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**Specialist Advice**

**Report on Geotechnical Investigation**

**Belmore Road, Belmore, Affordable  
Housing**

**270-278 Burwood Road and 54 Lakemba  
Street, Belmore NSW**

**Prepared for Homes NSW**

**Project 233414.01**

**29 October 2025**

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

### Signature

### Date

**Author**

29 October 2025

**Reviewer**

29 October 2025

## Executive Summary

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This geotechnical investigation report (specialist advice) has been prepared by Douglas Partners Pty Ltd (Douglas) on behalf of Homes NSW for a State Significant Development Application (SSD-83257708), for construction of a residential flat building for the purpose of affordable housing at 270-278 Belmore Road and 54 Lakemba Street, Belmore.

The purpose of this Geotechnical Investigation Report is to provide geotechnical due-diligence comments, and together with a separate Groundwater Impact Assessment, address the Secretary's Environmental Assessment Requirements (SEARs) for the project issued on 13 October 2025 which identified the specific assessment requirements given below.

Item	Description of requirement
12. Ground and Groundwater Conditions	Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.

The investigation included the drilling of three deep geotechnical boreholes, and nine shallow boreholes for contamination assessment purposes. The details of the field work are presented in this report, together with comments and recommendations on geotechnical issues including excavations, shoring, foundations, groundwater, and aggressivity.

From a geotechnical perspective the site conditions are generally considered suitable for the proposed development. Established methods of design and construction, in common use in the Sydney area are likely to be appropriate to manage any potential geotechnical impacts within and beyond the site – as outlined within this report.

Based on the results of the investigation, an Acid Sulfate Soils Management Plan (ASSMP) and Salinity Management Plan (SMP) are not considered necessary for the site.

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# Report on Geotechnical Investigation Belmore Road, Belmore, Affordable Housing 270-278 Burwood Road and 54 Lakemba Street, Belmore NSW

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## 1. Introduction

### 1.1 General

This geotechnical investigation report (specialist advice) has been prepared by Douglas Partners Pty Ltd (Douglas) on behalf of Homes NSW for a State Significant Development Application (SSD-83257708) for construction of a residential flat building for the purpose of affordable housing at 270-278 Belmore Road and 54 Lakemba Street, Belmore.

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Item	Description of requirement
12. Ground and Groundwater Conditions	Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.

Based on the results of the investigation, an Acid Sulfate Soils Management Plan (ASSMP) and Salinity Management Plan (SMP) are not considered necessary for the site.

The aim of the investigation was to provide information on subsurface soil and groundwater conditions across the site in order to support response to the geotechnical assessment element of the SEARS and provide due-diligence level geotechnical advice in relation to the proposed redevelopment, including the following:

- An assessment of the geotechnical suitability of the site for the proposed development; and
- Comment on geotechnical issues, including excavations, shoring, foundations, groundwater, and aggressivity.

The investigation included the drilling of three deep geotechnical boreholes, and nine shallow boreholes for contamination assessment purposes (reported separately). The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

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

## 1.2 Report context

The investigation works outlined in this report were undertaken in conjunction with an investigation for contamination assessment purposes. Selected, geotechnically relevant information from the contamination investigation (particularly borehole logs) have been integrated into this report. Reference should be made to the Detailed Site (Contamination) Investigation by Douglas for further details (report reference 233414.02.R.002).

The geotechnical investigation and reporting has been informed by the following information provided by Homes NSW:

- Survey Drawings by Norton Survey Partners dated 9 April 2024; and
- Architectural drawings by DKO dated 29 September 2025.

## 2. Site description

### 2.1 General

The site is located at 270-278 Belmore Road and 54 Lakemba Street, Belmore, within the Canterbury-Bankstown Local Government Area (LGA). It has a total site area of 4,280 square metres (sqm) and benefits from two street frontages; Burwood Road to the north-east and Lakemba Street to the north-west, refer to Figure 1.

The existing site comprises of seven two-storey red brick walk-up residential flat buildings, containing a total of 24 dwellings. A number of existing trees are also present on the site.

The location is highly accessible, positioned on the edge of the Belmore local centre and within 350 m walking distance of Belmore Station. A bus stop directly in front of the site on Burwood Road offers regular services to Campsie, Burwood, Abbotsford and Chiswick.



**Figure 1: Aerial image of site location**

## 2.2 Topography

Reference to the provided survey drawings indicates that ground surface levels generally slope gently down from approximately RL 19.7 (reduced level, in metres, to Australian Height Datum, AHD) at the southern site boundary to RL 16.8 at the northern site boundary.

Reference to the regional 2 m contours (NSW Department of Lands, 2009) suggest that the site is at the base of a hillside, with the adjoining Lakemba Street forming part of the local natural drainage corridor, which drains towards the north-east through open culverts to Cooks River.

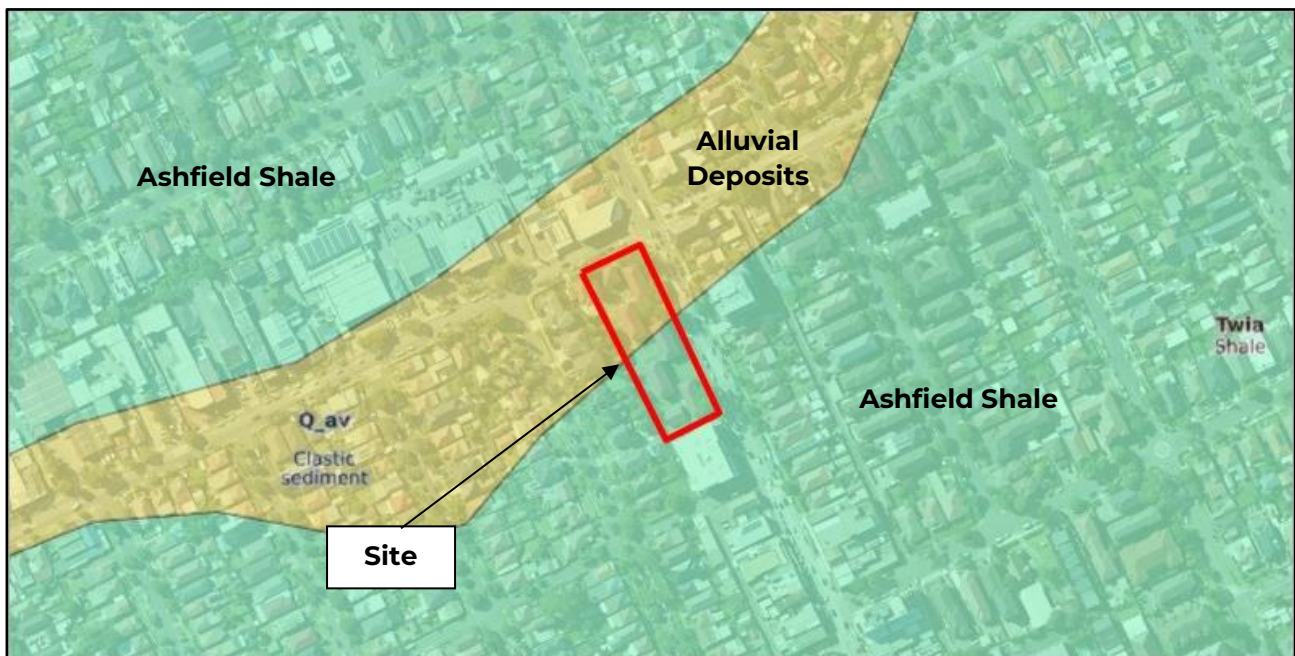
## 3. Published data

### 3.1 Geology

Reference to NSW Seamless geology mapping indicates the southern portion of the site (higher ground) is underlain by Ashfield Shale of the middle Triassic period, which belongs to the Wianamatta Group. Ashfield Shale typically comprises black to light grey shale and laminite.

The mapping indicates the northern portion of the site (lower ground) may be underlain by alluvial valley deposits, likely corresponding to the natural drainage channel along Lakemba Street.

An extract of the NSW Seamless geology mapping is shown in Figure 2.



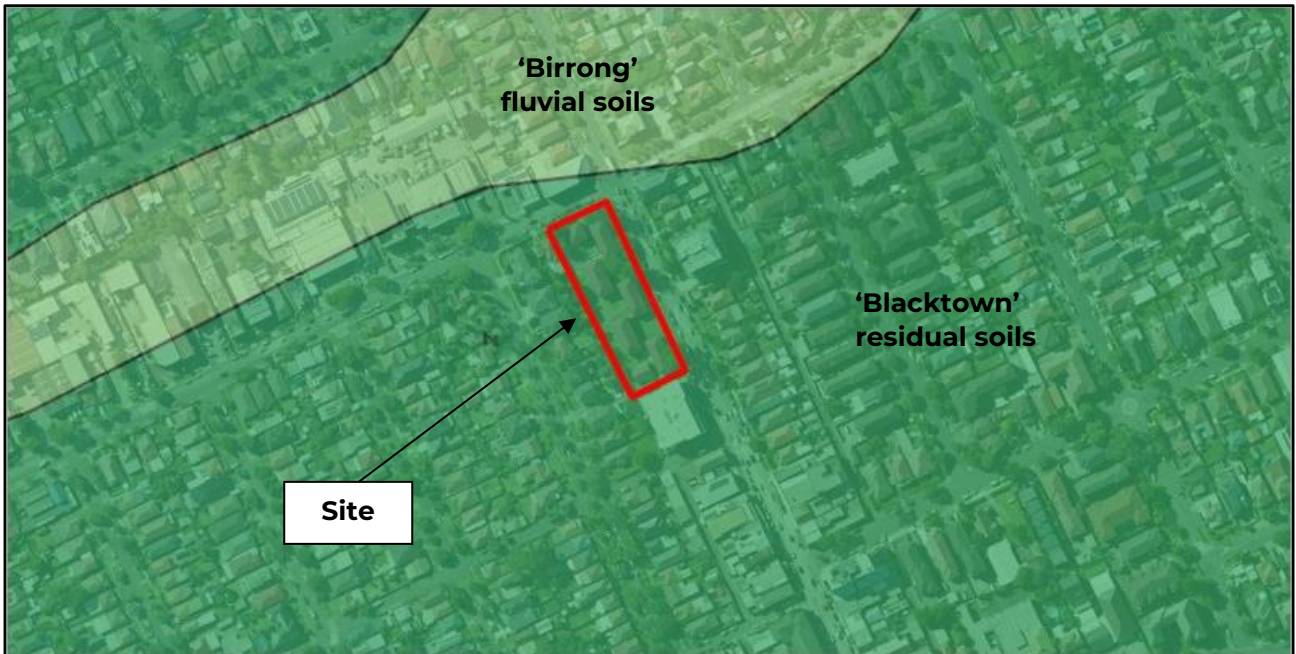
**Figure 2: NSW Seamless Geology map with approximate site location**

### 3.2 Soil landscape

Reference to the Sydney 1:100 000 Soils Landscape sheet indicates the site is underlain by the residual 'Blacktown' soil landscape (residual soils). The 'Blacktown' soil landscapes typically

include red and brown podzolic soils in well drained areas, and yellow podzolic soils and soloths on lower slopes and in areas of poor drainage.

The area directly north of the site is mapped as the fluvial ‘Birrong’ soil landscape. The ‘Birrong’ soil landscapes typically include yellow podzolic and solodic soils on older alluvial terraces, with deep solodic soils and yellow solonetz on current floodplains, as shown in Figure 3.



**Figure 3: Soil landscape mapping with approximate site location**

In practice, the ‘Birrong’ landscape is expected to correspond to the base of the natural drainage channel (i.e. Lakemba Street), noting that the mapping is at the regional level.

### 3.3 Acid sulfate soils

The site is located outside of areas of known acid sulfate soil risk mapping (NSWDECC, 1994-1998). While partly within the “Class 5” area of the acid sulfate soil planning maps – Environmental Planning Instrument – Acid Sulfate Soils (NSW DPHI, 2025), it is noted that this Class refers to a 500 m buffer area around areas at risk of acid sulfate soils and does not indicate a specific risk within the site. An extract of the acid sulfate soil planning map is shown in Figure 4.



**Figure 4: Acid sulfate soil planning map with approximate site location**

No signs of acid sulfate soils were observed during the investigation, hence an ASSMP is not considered necessary for the site.

### 3.4 Salinity

The site is located outside of the salinity potential areas identified in the Environmental Planning Instrument – Salinity (State Government of NSW and NSW DPPI, 2017) and outside of the Western Sydney Salinity Risk Mapping (DPIE, 2002).

It is noted, however, that some strata within the mapped soil landscapes can be associated with salinity.

### 3.5 Surface water and groundwater

As noted in Section 2.2, the site is located at the base of a hillside, near a natural drainage channel extending along Lakemba Street. This gully appears to transition to an open culvert downgradient (north-east) of the site that, in turn, drains towards Cooks River to the north-east.

The feasibility reports note that the northern parts of the site may be subject to flooding, based on the planning maps.

A search of the publicly available, WaterNSW groundwater bore database indicated that there are five registered groundwater bores (monitoring bores) within 500 m of the site, apparently corresponding to locations within the multi-storey residential site to the south. No standing water levels are included in the records.

Reference to the Greater Metropolitan Region Groundwater Sharing Plan (2023) indicates that underlying aquifers are of the Sydney Basin Central Groundwater Source.

## 4. Field work

### 4.1 Field work methods

The field work for the geotechnical investigation included three (3) deep boreholes across the site drilled using a DT250 geotechnical drilling rig operated by Ground Test. The field work was undertaken from 23 to 28 April 2025. A further nine (9) shallow boreholes were drilled across the site for the purpose of contamination assessment, between 23 and 29 April 2025. Supervision of the drilling and logging of the boreholes (geotechnical) was completed by an experienced geotechnical engineer from Douglas.

The geotechnical boreholes (BH02, BH04 and BH09) were initially drilled using 110 mm diameter solid flight auger and rotary drilling methods to advance to 4.0 m depth. Regular standard penetration tests (SPTs) were undertaken within the soils in order to provide information on the engineering properties of the soils and to obtain soil samples for visual and tactile assessment and for subsequent laboratory testing. The boreholes were then continued into the underlying bedrock using diamond core drilling techniques to final depths of between 14.4 m and 15.91 m. The strength of the recovered rock core was assessed by examination of the recovered rock cores and subsequent correlations with Point Load Strength Index ( $I_{s(50)}$ ) tests.

The contamination boreholes (BH01, BH03, BH05, BH06, BH07, BH08, BH10, BH11 and BH12) were augered to depths of between 0.7 m to 1.7 m using a DT250 drill rig operated by Ground Test or hand auger, depending on access and time constraints. Regular disturbed samples were taken while augering, for visual and tactile assessment and for subsequent laboratory testing.

Coordinates and surface levels for all borehole locations were recorded using a differential Global Positioning System (dGPS) receiver, which typically has an accuracy of 0.1 m but can vary due to satellite coverage and other factors. Coordinates are in GDA2020 / MGA Zone 56 format (Geocentric Datum of Australia 2020 base with Map Grid of Australia projection) and levels are relative to AHD.

A summary of the spatial and termination depth information is given in Table 1. Borehole locations are shown on Drawing 1 in Appendix B.

**Table 1: Summary of Boreholes**

Borehole	Purpose <sup>2</sup>	Surface RL (m AHD)	Easting (m) <sup>1</sup>	Northing (m) <sup>1</sup>	Final depth (m)
BH01	Contamination	17.1	323053.0	6245702.3	0.70
BH02	Geotechnical & Well	16.9	323079.0	6245713.3	14.40
BH02A	Well	17.0	323078.7	6245714.0	4.00
BH03	Contamination	17.1	323064.5	6245698.1	1.00
BH04	Geotechnical & Well	17.5	323061.8	6245684.3	15.82
BH05	Contamination	16.4	323075.8	6245690.8	1.70
BH06	Contamination	17.4	323096.1	6245679.4	1.00
BH07	Contamination	17.4	323081.6	6245664.6	0.70

BH08	Contamination	18.3	323082.2	6245644.3	0.60
BH09	Geotechnical & Well	18.3	323101.7	6245646.8	15.91
BH09A	Well	18.3	323102.2	6245647.3	4.00
BH10	Contamination	18.8	323097.7	6245634.9	0.50
BH11	Contamination	19.5	323100.2	6245616.4	0.60
BH12	Contamination	18.7	323111.6	6245647.5	1.00

Note: 1 - MGA2020 Zone 56

2 - Purpose reflects whether the borehole was drilled and located for primarily geotechnical purposes, or contamination assessment purposes. The purpose influenced the drilling method, testing, sampling and depth of investigation.

Following the completion of drilling of the geotechnical boreholes, piezometer standpipes were installed in the bores to obtain information on hydrogeological conditions and allow sampling of groundwater. Two additional shallow standpipes (BH02A, BH09A) were installed adjacent to boreholes BH02 and BH09 for groundwater contamination assessment. The standpipes were generally installed using the following methodology:

- Bores were reamed to HQ-size (96 mm diameter) for the length of the proposed standpipe to facilitate installation;
- 'Blank' and 'slotted' PVC pipe was installed in the bore, with a gravel pack backfilled around the 'slotted' PVC pipe at the target depth;
- The 'slotted length' and gravel pack was isolated from the overlying and (where relevant) underlying backfill by bentonite plugs;
- The surface was finished by a shallow bentonite plug, with a gatic cover concreted in at ground surface.

A summary of the standpipe installation details is provided in Table 2.

**Table 2: Summary of standpipe installation details**

Borehole	Screened interval <sup>1</sup> (m)	Screened Material <sup>2</sup>
BH02	8.00-14.40	Siltstone
BH02A	1.20-4.00	Silty clay
BH04	4.20-5.70	Silty clay and Weathered Siltstone
BH09	7.50-15.91	Siltstone
BH09A	1.20-4.00	Silty clay

Notes: 1 – refers to depth interval of both slotted screen and surrounding gravel pack

2 – refers to lithology in which the standpipe is screened

## 4.2 Field work results

### 4.2.1 Geotechnical conditions

The subsurface conditions encountered in the boreholes are presented on the engineering logs in Appendix C, along with standard notes defining the descriptive terms and the classification

methods used. The typical subsurface strata encountered at test locations may be broadly summarised as follows:

- **Fill:** Moderately compacted silty clay and silty sand fill with varying proportions of sand, igneous and ironstone gravel, organic matter, charcoal / ash and building rubble (brick fragments), to depths of 0.1 m to 0.8 m; underlain by,
- **Alluvial soil:** firm and stiff, typically low and medium plasticity, grey and pale grey mottled orange brown silty clay with varying proportions of organic matter, present in the northern parts of the site but absent at the southern end of the site; underlain by,
- **Residual soil (and extremely weathered siltstone):** Generally stiff to hard, medium and high plasticity, brown or red brown mottled yellow or orange brown, silty clay with siltstone and ironstone gravel; underlain by,
- **Siltstone bedrock:** Grey and dark grey siltstone with fine grained sandstone laminations from depths of between 4.30 m and 4.68 m. Typically very low to low strength with clay strength seams, then medium strength with some low to medium strength beds, and a very high strength band at BH04.

#### 4.2.2 Hydrogeological conditions

Groundwater seepage was initially observed at 1.6 m and 3.3 m depth while augering at boreholes BH02 and BH09, respectively. The shallow termination depth (at contamination boreholes) or necessary introduction of water to the borehole while wash boring or rock coring precluded further groundwater observations during drilling.

Some significant losses of drilling fluid were, however, observed whilst drilling, including losses of 50% to 70% of drilling fluid at BH04 as drilling advanced beyond 12.75 m depth suggesting a more permeable rock zone. Further details are recorded in the remarks on the relevant borehole logs.

Supplementary groundwater observations made at the site during the geotechnical investigation works are summarised in Table 3.

**Table 3: Summary of Groundwater Observations**

Bore	Ground Level (m AHD)	Measured Depth to Groundwater (m) [Groundwater Level (mAHD)]			
		6/5/25	11/6/25	30/7/25	5/8/25
BH02	16.9	-	2.4 [14.5]	2.6 [14.4]	2.4 [14.5]
BH02A	17.0	1.3 [15.7]	1.5 [15.5]	1.7 [15.3]	0.8 [16.2]
BH04	17.5	2.6 [14.9]	2.5 [15.0]	2.6 [14.9]	2.6 [14.9]
BH09	18.3	-	4.9 [13.4]	4.1 [14.2]	4.0 [14.3]

BH09A	18.3	1.5 [16.8]	1.6 [16.7]	1.7 [16.6]	1.6 [16.7]
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Dataloggers were installed in the geotechnical standpipes on 29 April 2025, immediately following development of the wells, to allow continuous groundwater level monitoring.

The above groundwater levels correspond to groundwater levels within the alluvial and residual soils.

## 5. Laboratory testing

Soil aggressivity laboratory testing was performed on four selected soil samples at a NATA registered laboratory in Sydney. Selected additional samples were issued for electrical conductivity testing. The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Table 4.

**Table 4: Summary of soil aggressivity test results**

Bore	Depth (m)	Material	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Electrical conductivity (µS/cm)
BH02	0.6-0.7	Silty CLAY	6.1	24	38	52
BH02	1.0-1.45	Silty CLAY	-	-	-	560
BH02	1.8-2.0	Silty CLAY	-	-	-	330
BH02	2.5-2.95	Silty CLAY	8.1	47	52	150
BH04	0.5-0.6	Silty CLAY	-	-	-	43
BH04	1.8-2.0	Silty CLAY	-	-	-	510
BH04	4.0-4.45	Silty CLAY	8.0	120	650	520
BH09	1.8-2.0	Silty CLAY	5.6	130	550	460

Groundwater laboratory testing was undertaken to support contamination assessment at the site, including some testing relevant to aggressivity. The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and selected results are summarised in Table 5.

**Table 5: Summary of groundwater test results**

Bore	pH	Sulfate (mg/kg)	Chloride (mg/kg)	Electrical conductivity (µS/cm)
BH02A	6.6	190	540	3500
BH04	6.3	490	4000	14000
BH09A	4.5	750	2300	7700

Comparison of the above results to Tables 6.4.2(C) and Table 6.5.2(C) of AS2159 indicate that conditions are:

- Generally consistent with a ‘mild’ exposure classification, for concrete piles; and,
- Generally consistent with a ‘moderate’ exposure classification for steel piles in soil; however, more severe aggressivity may apply if the piles are in free groundwater (e.g. as part of the drainage system).

Adopting conversion factors of 6 to 8.5 for light to heavy clays, these results suggest that while surficial soils are non-saline to depths of 0.5 m to 0.7 m, slightly to moderately saline subsurface soils are present at the site.

## 6. Proposed development

The proposed development comprises the construction of a new residential flat building for the purposes of affordable housing, a communal room and basement car parking including excavation, tree removal and associated servicing, landscaping and public domain works.

Based on the architectural plan produced by DKO (drawing reference DA200 revision A, dated 29 September 2025) it is understood that Basement Level O2 will have a finished floor level at RL 12.44. Hence, it is assumed that bulk excavation level will be at RL 11.9.

## 7. Comments

### 7.1 Geotechnical and hydrogeological model

Based on the results of the geotechnical investigation, and initial information on groundwater levels at the site, a geotechnical model has been developed for the site, summarised in Table 6.

**Table 6: Summary of the Geotechnical Model**

Unit	Summary	Typical Description
1	Fill	Uncontrolled silty clay and silty sand fill with varying proportions of sand, igneous and ironstone gravel, organic matter, charcoal / ash and building rubble (brick fragments), to depths of up to 1.0 m, but potentially deeper and more variable due to local backfill in the vicinity of structure and services.
2	Alluvial	Firm to stiff and stiff, low and medium plasticity, light grey and orange-brown, silty clay. Greater variability in composition may be present in these alluvial soils, due to their origin. Expected in the northern part of the site only.
3	Residual	Residual and extremely weathered (soil strength) material, very stiff and hard, medium and high plasticity, grey mottled orange-brown silty clay, with ironstone and siltstone gravel.
4a	Siltstone – variable strength	Variably weathered, very low and low to medium strength brown, orange brown and dark grey siltstone, fine grained

Unit	Summary	Typical Description
		sandstone laminations and clay seams, often highly fractured.
4b	Siltstone – low and medium strength	Fresh siltstone, with fine grained sandstone laminations, low and medium strength, including some significant medium strength bands, typically fractured.
4c	Siltstone – medium strength	Fresh siltstone, with fine grained sandstone laminations, typically medium strength, some very high strength bands (e.g. at BH04); typically slightly fractured, and encountered below approximately RL 9.5 to RL 10.5 at geotechnical test locations.

The above units are shown in relation to the boreholes and site levels on the interpreted geotechnical cross-section, presented on Drawing 2, in Appendix B. It should be noted that the subsurface profile is accurate only at the borehole locations and that substantial variation can occur in between and away from the boreholes. The interpreted geotechnical boundaries are for illustrative purposes only and should not be relied upon, and it should be noted that BH04 is offset from the subject section. The approximate groundwater level, based on initial readings at standpipes only, is shown for illustrative purposes.

The hydrogeology at the site is considered to be defined by typically unconfined aquifer conditions within the alluvial and residual soils, extending into the underlying siltstone. The groundwater observations to date are broadly consistent with a groundwater flow direction towards the north. It is likely that groundwater levels typically approximately follow the site topography, although some local recharge may also occur from groundwater levels below Lakemba Street, particularly following rainy weather, due to its gully location and larger tributary area. Ephemeral seepage or 'perched' groundwater may also occur within the fill, along the top of higher permeability layers within the natural soils and along the top of rock.

Groundwater seepage is likely to largely occur through the soil mass and along fractures within the underlying siltstones. While the hydraulic conductivity of the residual soils may be relatively low, higher permeability is anticipated within the more variable alluvial soils, although may vary within the strata. The hydraulic conductivity of the siltstone will depend on the nature of the fractures in the bedrock, including the continuity of fractures, open-ness of fractures, and the influence of veneers or weathering on defects (e.g. presence of clay).

## 7.2 Geotechnical suitability

Noting the ground conditions outlined above, from a geotechnical perspective the site conditions are generally considered suitable for the proposed development outlined in Section 6, including variations thereof.

Established methods of design and construction, in common use in the Sydney area, are likely to be appropriate to manage any potential geotechnical impacts within and beyond the site – as outlined within this report.

From a hydrogeological perspective, decisions around the basement geometry and temporary and long-term management of potential groundwater inflows into the basement are likely to be

important influences on design development and project costs. These issues are discussed in Section 7.3.

### 7.3 Groundwater and dewatering

#### 7.3.1 General

The results of the investigation and estimated bulk excavation level indicate that groundwater will be intercepted by the proposed basement excavation, and therefore that groundwater must be managed during the proposed works.

Generally speaking, the impacts of basement dewatering may include settlement of adjoining land, movement of contaminated plumes towards or into the site, potential groundwater 'mounding', and changes to existing availability of groundwater, including at existing groundwater wells, cultural needs and groundwater dependant ecological systems. At this site, given the relatively shallow depth to rock, over-consolidated nature of the soils, urban site environment and expected relatively low permeability of these materials, the impacts of a two level basement are expected to be limited and manageable on this site. Further details are outlined in Section 7.3.2, and the regulatory responsibilities are outlined in Section 7.3.13.

#### 7.3.2 Groundwater Management

Given the existing ground conditions, it is likely that groundwater inflows can be readily managed during construction by sump-and-pump management methods. The results of groundwater inflow analysis (refer Douglas report 233414.01.R.003) suggest that a tanked or partially tanked basement will be required for long-term groundwater management for the proposed development. Key design decisions for the selection of a tanked or partially tanked basement should consider the following:

- The use of a **tanked basement** would limit groundwater management requirements to the construction stage – but would require design of the basement for uplift and hydrostatic forces, generally adding significant costs at construction stage. A fully tanked basement would generally require tanking to ground surface, and to design flood levels where relevant.
- A **partially-tanked** basement, may allow for the basement to be designed for lower uplift and hydrostatic pressures than a fully-tanked basement (by adopting relief valves in the slab or side walls, or using a cut off wall with a drained floor). The design should include drainage to prevent uplift pressures exceeding the design levels. Accordingly, some long-term or periodic groundwater inflows may still occur to the basement - depending on the adopted design tanking level and variability in groundwater. Long-term groundwater management measures, including reporting of inflow events, would still need to be implemented to manage these potential inflows.

The disposal of groundwater inflows to the proposed basement would generally require groundwater treatment, to ensure that the quality at disposal is consistent with the requirements of the relevant disposal authority (e.g. Council or Sydney Water). Where groundwater treatment costs or requirements are considered prohibitive, then a tanked basement may be the preferred approach for long-term management.

In selecting a management approach, the potential for flooding at the northern part of the site should be considered, as well as potential contamination sources associated with nearby land-

uses (e.g. the petrol station opposite, on Lakemba Road – also refer Douglas Detailed Site (Contamination) Investigation). In these conditions, the construction of an effective “cut-off” wall in the northern parts of the site, below the design flood line may limit the risks associated with offsite contamination sources, as well as the potential for increased groundwater inflows and changed water quality that may be associated with flood events. The extent and depth of the cut-off wall could be varied to suit the risk appetite of the Client. As the wall is intended for longer-term inflow management, the cut-off wall could be constructed as part of the shoring wall or as part of the building structure within a construction-stage drained excavation.

Both during construction and in the long-term (should a partially drained basement be adopted), appropriate management is generally required to ensure that groundwater inflow volumes (“take”) and impacts remain consistent with the expected impacts and approval conditions, and for groundwater treatment to a quality consistent with disposal requirements.

### 7.3.3 Regulatory context

For SSDA projects, most regulation of groundwater impacts, inflow and disposal is generally managed through the SSDA process, including the SSDA conditions. A Groundwater Impact Assessment (GIA) including a preliminary Dewatering Management Plan (DMP) specific to the development, including the proposed design and construction approaches and groundwater management measures, is generally appropriate for submission for SSDA. After approval, further development of the DMP and/or associated monitoring plans is generally required to incorporate the conditions arising from SSDA, and to allow ready implementation during construction.

Separate approvals (e.g. for Water Supply Works or Water Use) are not generally required for works under SSDA, provided that inflow volumes remain within, and the impacts and disposal of groundwater is consistent with, the SEARs submissions and SSD approval conditions.

A Water Access Licence (WAL) and appropriate entitlements are generally required if groundwater inflows may exceed 3ML/year during a water year from July to June, noting that there is currently a WAL exemption in place for construction dewatering. If a partially tanked basement is adopted, ongoing monitoring and reporting of groundwater inflows would be required to claim the <3ML/year exemption and/or meet licence conditions.

Written authorisation for (temporary, or long-term) disposal of groundwater to stormwater or sewer is required from the relevant authority, with appropriate treatment and testing to ensure that water quality requirements are being met, both during construction and for any long-term dewatering. Allowance should be made in design for the spatial requirements of any long-term groundwater inflow storage and/or treatment equipment.

Should a partially tanked basement be adopted a completion report including the results of ongoing inflow volumes, monitoring, treatment and quality testing would generally need to be provided to the regulator at the completion of construction to support an occupancy certificate. An operational dewatering management plan would then be implemented to manage ongoing dewatering, unless a tanked basement has been constructed. For a tanked basement, dewatering may only be of concern if temporary penetrations of the tanking are required for maintenance and upgrades.

## 7.4 Excavation stability and shoring

### 7.4.1 General

Based on an estimated bulk excavation level of RL 11.9, excavation depths of 5 m to 7 m are anticipated. The basement excavation is expected to be largely through fill, alluvial and residual soils (Units 1 to 3), with siltstone (Unit 4) encountered towards the base of the excavation across the footprint of the building.

The opportunity for use of batters at this site is limited given the ground conditions, relatively shallow groundwater levels, fairly extensive basement footprint indicated by the preliminary drawings, and presence of an existing Sydney Water sewer within the western part of the site. The shallow groundwater is likely to limit batters to a maximum depth of 2 m, and will be subject to acceptance of potential increased risks of movements. Shoring support will generally be required to facilitate the basement excavation.

Decisions around groundwater management may also influence the preferred approach to shoring at the site, potentially influencing construction and design.

### 7.4.2 Batters and excavation stability

The potential use of batters as part of the development and/or as part of temporary excavation works would need to be reviewed in light of the specific proposed works.

For batters within the alluvial soils (Unit 2), temporary slope protection (e.g. shotcrete) may be required to protect against erosion of the batter face, particularly where material of higher silt content is encountered.

In the long-term, batters no steeper than 3H:1V are recommended whilst landscaping, to allow for slope maintenance. Reference should also be made to Section 7.7.

### 7.4.3 Shoring

Shoring will generally be required around the proposed basement excavation.

Soldier piles socketed into siltstone below the bulk and local excavation level (preferably into Unit 4b or 4c), are expected to be suitable at this site, with infill shotcrete panels constructed between the piles as excavation proceeds. The higher hydrostatic loads due to basement tanking may need to be borne by secant pile walls or by more closely spaced piles (e.g. contiguous piles) with infill panels designed to withstand the loads. Relatively rapid construction of the infill panels may be required within Unit 2 soils, due to the risk of soils with higher silt content, and higher susceptibility to erosion, being present within this Unit.

Alternatively, a temporary drained soldier pile wall could be installed for the construction phase, with an appropriately designed, permanent tanked structure constructed within the drained basement excavation.

Bored, concrete piles may be suitable for the construction of piles at this site, although casing may be required for drilling through Unit 2, and possibly some Unit 1 materials, to prevent side wall material falling into the (open) pile excavation, and tremie methods will likely be required for

the placement of concrete below the groundwater table. Alternatively, continuous flight auger (CFA) piles may be used, to eliminate the need for casing and effectively manage concreting in the presence of groundwater.

Working platforms will generally be required to support piling works at the site. The existing clay soils, and particularly the existing alluvial (Unit 2) soils may soften relatively rapidly in wet conditions, under traffic.

Inspections are recommended during bored pile excavation to allow for geotechnical assessment of the foundation material, deepening of the piles where necessary, and advance notice of areas where poorer ground conditions may be present. CFA piles are a 'blind' piling technique, and geotechnical inspections are generally not practical, although some geotechnical oversight is considered beneficial. The foundation condition of CFA piles should be confirmed by the piling contractor.

Inspections of the exposed rock face between soldier piles (should this option be chosen) during excavation is also recommended at 1.5 m drops, prior to placement of mesh and shotcrete, to allow assessment of possible steep joints or defects which might require additional support.

During excavation, if the adopted pile spacing is found to be unsuitable to ensure soil stability between piles (particularly in Unit 1 and Unit 2, and particularly if silt or sand soils are encountered), then it may be necessary to backfill and add additional piles and/or use jet grouting methods to stabilise the soil overburden for the installation of infill panels. Test pits could be used to assess stability of soils, particularly the Unit 2 soils, in advance of detailed design.

Given the depth of excavation, 'tie-back' ground anchors would generally be required to provide temporary lateral support to the shoring wall, with final support provided by the basement structure.

It is likely that one or two levels of anchors will generally be required for the proposed basement, depending on the offset from site boundaries, the presence of deflection-sensitive services, and location and depth of foundations and structures behind the wall, such as the residential building (and basement(s)) south of the site.

All shoring piles should be taken down to bear below the bulk excavation, and below local and potential accidental over-excavation depths, due to the potential presence of seams and adverse jointing within all Unit 4 bedrock – noting that the loads on the anchors and shoring would be influenced by settlements or unstable bearing of the piles. This may also be influenced by the cleanliness of the pile excavation and the approach to concrete placement, which should be carefully managed by the contractor.

The following comments are provided in relation to preliminary shoring design, only:

- For a shoring wall supported by multiple rows of anchors or props, preliminary design may be based on a uniform rectangular earth pressure distribution of  $4H$  (where  $H$  is the wall height in metres, and pressure is in kPa), provided that deflections are not a concern. Where walls are constructed close to existing deflection-sensitive structures or utilities, a (uniform) lateral pressure of between  $6H$  and  $8H$  should be considered, depending on the sensitivity of the utilities and the soil profile to be retained. Higher pressures would be appropriate where batters (i.e. sloping ground) are present above the wall, or where concentrated loads are

proposed behind the wall, either during construction (e.g. plant) or in the permanent case (e.g. elevated garden beds or roads).

- For a shoring wall supported by a single row of anchors or props, triangular earth pressure distributions may be considered for preliminary design. Such parameters would need to be evaluated in light of the revised basement design.

Hydrostatic loading would be additional to the preliminary design inputs given above.

Should deeper basements be proposed, exposing a larger rock face, then the potential for adverse jointing within the shale may need to be explicitly considered in design. It is suggested that design include allowance for a large scale, 45 degree wedge failure plane within the rock behind the shoring wall, adversely oriented in the ultimate case. These wedges are known to occur within Ashfield Shale in Sydney and may be present on this site, potentially causing higher loads than those imposed by a traditional earth-pressure assessment.

If anchors are required to provide support against uplift, then anchor design should consider potential cone failure modes, allowing for an apex angle of no greater than 60 degrees for anchors socketed into the Unit 4b and 4c siltstones underlying the proposed basement excavation, based on the regular presence of steep defects in the logs – unless a larger cone (e.g. up to 90 degrees) is justified by further investigation.

#### 7.4.1 **Movements associated with excavation**

Typical horizontal movements in the order of 0.15% of the wall height would be expected for a well-constructed and designed, high stiffness shoring wall (i.e. with two rows of anchors), but depending on the excavation and support sequence and support provided. For a 5 m to 7 m high shoring wall, this corresponds to approximately 8 mm to 11 mm movement.

The sensitivity of adjacent structures and services should be considered in the shoring wall design.

Survey monitoring of the excavation and retaining walls would generally be appropriate to assess movement of any shoring walls during excavation, particularly where any deflection-sensitive structures or services are present behind the walls.

#### 7.4.2 **Design regulation**

The advice included within this report should be considered specialist advice and does not comprise design.

Noting the residential use of the proposed building, the detailed design of the shoring walls and anchors for the basement will need to be prepared in accordance with the Design and Building Practitioners Act, including meeting the regulated design requirements for shoring and ground anchors given in the Ministerial Order (Government Gazette 78, 2022). This includes the need for 'reasonable steps' to be taken to assess the footings of structures within the zone of influence of the designed excavation, which may include investigation.

Broadly speaking, a preliminary 'zone of influence' for basement shoring wall design could be taken as the zone of soil above a line drawn from the base of excavation depth, at 1(Horizontal):1(Vertical) above the horizontal to the top of rock, then at 2(H):1(V) in soils to the

ground surface. This 'zone' should be evaluated by the designers once the shoring and excavation geometry is known.

The detailed design of shoring/retaining walls is normally undertaken using software that can account for the soil-structure interaction during the progressive excavation and support installation sequence, as well as the loads acting behind the wall, and provide estimates of wall movements (e.g. Wallap, FLAC, Plaxis.).

Appropriate permissions from adjacent landowners will be required where support measures (e.g. anchors) are proposed across site boundaries. Anchors should also be de-stressed following the provision of permanent lateral support, usually by the basement structure.

Maximum allowable wall movements and/or movements beyond the wall, arising from structural requirements of neighbouring buildings and services, may be a key performance requirement influencing the design of shoring walls and anchors at this site.

## 7.5 Excavation conditions

### 7.5.1 Excavatability

Based on a possible bulk excavation level of approximately RL 11.9, excavation is expected to be largely through fill, alluvial and residual soils (Units 1 to 3), with siltstone (Unit 4a and 4b) encountered towards the base of excavation.

Units 1 to 3 and 4a are likely to be readily excavated using conventional earthmoving equipment. Some local rock hammering may be required in Unit 4a, with rock hammering becoming more typically required within Unit 4b, particularly within the medium strength materials – where excavatability may be governed by the defects within the rock mass.

The existing alluvial soils (Unit 2) are likely to soften readily upon exposure, particularly when exposed to water (e.g. near onsite perimeter drainage, sumps, or generally following wet weather). The potential for poor trafficability within the site should be considered particularly during excavation within Unit 2. Unit 3 and Unit 4a may also be influenced in wet conditions, although likely to a lesser extent.

It is recommended that tenderers review the detailed logs and photographs to assess conditions based on their plant and experience.

### 7.5.2 Vibrations

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s vector sum peak particle velocity (VSPPV). This is generally much lower than the vibration levels required to cause structural damage to buildings. The Australian Standard AS2631.2-2014 "Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)" indicates an acceptable day time limit of 8 mm/s VSPPV for human comfort.

Based on the experience of DP and with reference to AS2631.2, it is suggested that an initial VSPPV limit of 8 mm/s applicable at the foundation level of existing adjacent buildings be provisionally adopted for this site for both architectural and human comfort considerations. Appropriate

enquiries should be made to neighbouring property (and utility) owners to check if the presence of sensitive equipment or structures may require a lower vibration limit.

The limit, and locations of vibration monitors, may need to be adjusted to reflect asset requirements, response of neighbouring structures during excavation and vibration dosage for neighbouring occupants. It is noted that lower vibration limits may slow works and result in a longer duration of vibrations.

A vibration trial may be required to size equipment at the commencement of excavation into rock, particularly once rock hammering is required. The trial may indicate that minimum offset distances are required from vibration-sensitive assets for the preferred plant, or that alternative excavation methods or equipment are required (e.g. line drilling or pre-sawing along excavation faces).

Where a vibration trial indicates that the equipment may potentially exceed vibration levels, or where buildings or occupants are otherwise sensitive to vibration levels, consideration could be given to continuous vibration monitoring during the works. These monitors may be set up to activate a flashing 'alarm' light, or send text messages, if pre-set vibration levels are exceeded during the work.

### 7.5.3 Waste classification

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (EPA, 2014). This includes fill and natural materials that may be removed from the site. Reference should be made to the Detailed Site (contamination) Investigation for further information (report reference 233414.02.R.002).

Where material is classed as Virgin Excavated Natural Material (VENM), the salinity of the material should be considered before exporting to any receiving site.

## 7.6 Foundations

Based on the conditions encountered during the investigation, it is likely that the proposed excavation will generally extend into Unit 4b material, with Unit 4a present below the northern part of the building footprint. In this case, pad footings bearing onto Unit 4b, or pile footings bearing on Unit 4c may be considered appropriate. Noting the drilling fluid losses at depth, particularly at BH04, the risk of groundwater inflows into pile footings creating unfavourable conditions for concreting should be considered.

The performance of the footings will depend on a combination of rock strength and defects, both at the base of the footing excavation and below – and may not neatly match the geotechnical model units in all locations. In general terms, below the bulk excavation level, the units are expected to correspond to the Shale Classes based on the Pells et al (1998) classification system, and corresponding foundation design parameters, given in Table 7.

**Table 7: Foundation Design Parameters (below RL 12.0)**

Unit	Shale Class	Allowable Bearing Pressure <sup>1,2</sup> (MPa)	Ultimate Bearing Pressure <sup>2,3</sup> (MPa)	Typical Youngs Modulus (MPa)	Minimum Additional Testing / Requirements <sup>4</sup>
Unit 4b	III	3.5	20	500	-
Unit 4c	II	6	40	900	Spoon testing of 33% of footings

Note: 1. Allowable pressures assume a confined state, and allowable settlements of less than 1% of the minimum footing plan dimension. Alternatively, settlements can be estimated for the proposed load based on the typical Youngs Modulus.  
 2. All bearing pressures may be limited by defects, or lack of confinement, subject to inspection of the excavation and possible spoon testing, which may require the bearing pressure to be downgraded. Bearing pressures assume that the bedrock is in a confined state, and that no nearby current or future excavations are present below an imaginary 'influence' line drawn at 1H:1V down from the edge of the footing. Such excavations would require inspection to confirm that adverse jointing is not present, and reduced values may apply.  
 3. Ultimate values assume settlement of more than 5% to 10% of the minimum footing plan dimension.  
 4. Geotechnical inspection of all footing excavations is recommended to confirm that the material is consistent with the design requirements; the minimum testing is to provide additional information on defects to confirm that foundation performance is as expected. Additional or lesser testing may be warranted, subject to the results of initial foundation testing and depending on the design bearing pressures.

The higher bearing pressures given in Table 7 require the additional testing outlined in that table and may be associated with a higher risk of inspection 'failures'. For example, spoon testing should be carried out in at least one third of all footings that are designed for an allowable end bearing capacity of more than 3.5 MPa. Spoon testing involves drilling a 50 mm diameter hole below the base of the footing, to a depth of at least 1.5 times the footing width, with the hole left full of water for 24 hours prior to testing to check for the presence of weak/clay bands. If excessive weak seams are detected then the foundation capacity may need to be downgraded, or the footings taken deeper to reach suitable foundation material. The rate of testing would then also need to be increased in the area of spoon test failures.

All foundations should be inspected by a geotechnical professional following excavation and cleaning, to confirm that the foundation material is consistent with the design requirements. As shales are susceptible to softening upon exposure, allowance should be made for blinding or for concrete pours to be made on the same day as excavation.

### 7.7 Salinity Management

The results of laboratory testing, together with the typical soils at the site, indicate that while the surface soils (to 0.6 m to 0.7 depth) appear to be typically non-saline, the subsoils are generally slightly saline, and borderline slightly to moderately saline.

A SMP is not considered appropriate at this site in light of the proposed development type, borderline slightly to moderately saline conditions, and location outside of the salinity areas identified by the EPI.

Consideration should be given to the results of soil and groundwater laboratory testing in the management and selection of selection of concrete and steel structures and services at the site. These management strategies should be complementary to standard good building practices

recommended within the Australian Standards and National Construction Code, including cover to reinforcement within concrete.

Noting the results of testing, however, it would be considered prudent to implement the following additional measures at the site:

- VENM soils excavated from the basement footprint should generally be considered slightly to moderately saline, unless proven otherwise by testing. The receiving party should be informed if salinity is identified within the VENM materials, to allow appropriate management to be implemented at the receiving site. This may limit the locations where VENM may be received to sites with similar or more severe salinity characteristics.
- Saline groundwater may flow into a partially tanked basement, and appropriate drainage management measures should be in place to manage inflows so as to limit evaporation (and so potential concentration or crystallisation of salts, which may result in a more aggressive environment). All drainage systems should include maintenance measures to allow for periodic flushing of the system to clear salts and other deposits from groundwater from the system.
- Saline groundwater should be stored and treated for disposal, only. Works methods should exclude re-use of groundwater for dust suppression or similar during excavation and construction works, unless the water has been treated to (and tested to confirm) a freshwater standard.
- Landscaping should be designed to avoid excessive concentrations of runoff or ponding of water that would lead to waterlogging of the soil or (onsite or adjacent) pavements; or additional recharge to the groundwater through any more permeable zones in the underlying fill.
- Salt tolerant grasses and vegetation should be considered for landscaping. Reference should be made to an experienced landscape planner or agronomist.

## 7.8 Further Assessment

A Sydney water sewer line is located within the property and may either be replaced or retained as part of the works. Further Sydney Water assets are also located outside of the site boundaries. It is likely that these assets may require specialist engineering assessment (SEA) by Sydney Water, in advance of construction, to assess whether their assets may be adversely affected by the works. This may include assets that are replaced as part of the works, but then subject to construction loading (e.g. from construction plant) or affected by excavations.

Sydney Water will generally nominate their services of concern once the proposed works are known. Geotechnical investigation and assessment, in conjunction with a broader SEA consulting team, is generally required as part of the SEA submission. The subsequent evaluation by Sydney Water can be slow, and it is generally recommended that this process be started as early as practicable. It is noted, however, that subsequent changes to design or construction may require the SEA process to be repeated.

Once the proposed works and geometry have been confirmed, further geotechnical reporting to support preliminary and/or detailed design may be appropriate. This may include review of the investigation results (and advice within this report) and consideration of potential additional investigation requirements, if appropriate.

Geotechnical design work for the proposed building would need to be undertaken in accordance with the Design and Building Practitioners Act.

## 8. Conclusion

A geotechnical investigation was undertaken at the site in April 2025. The investigation included the drilling of three deep geotechnical boreholes, and nine shallow boreholes for contamination assessment purposes. The results of the investigation indicate the site is underlain by fill, alluvial and residual soils over Ashfield Shale bedrock.

The results of the investigation and estimated bulk excavation level at RL 11.9 suggest that groundwater will be intercepted by the proposed basement excavation, and therefore that groundwater must be managed during the proposed works.

From a geotechnical perspective the site conditions are generally considered suitable for the proposed development. Established methods of design and construction commonly used in the Sydney area are likely to be appropriate to manage any potential geotechnical impacts within and beyond the site – as outlined within this report.

Based on the results of the investigation, an Acid Sulfate Soils Management Plan (ASSMP) and Salinity Management Plan (SMP) are not considered necessary for the site.

Further geotechnical investigation and assessment will likely be required to

- Assess the impact of the proposed basement on any Sydney Water assets nearby; and
- Support any additional assessments and detailed design.

## 9. References

Pells, P. J., Mostyn, G., & Walker, B. F. (1998). Foundations on Sandstone and Shale in the Sydney Region. *Australian Geomechanics, No 33 Part 3*, 17-29.

## 10. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 270-278 Burwood Road and 54 Lakemba Street, Belmore NSW in line with Douglas' proposal dated 21 March 2025 based on the award of Contract LAHC 2024/622 Geotechnical Services Due Diligence – HAFF by Homes NSW; and including the approved variation dated 3 April 2025. This report is provided for the exclusive use of Homes NSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

This report provides specialist advice only and no part of it is considered a Regulated Design under the Design and Building Practitioner Act 2020 (NSW).

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## **Appendix A**

About this Report

## Introduction

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

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

## Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

## Borehole and Test Pit Logs

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

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

## Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather

changes. They may not be the same at the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

## Reports

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

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

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

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

## About this Report

### Site Anomalies

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

### Information for Contractual Purposes

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

### Site Inspection

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

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## Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

### Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style **XW**. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

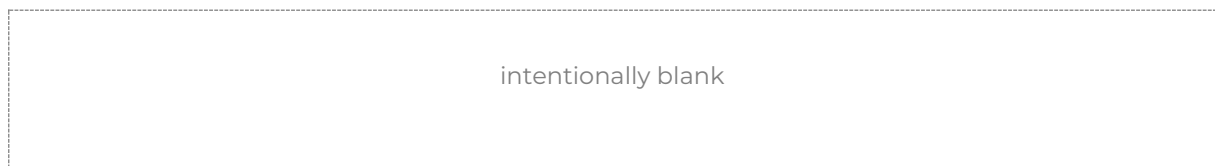
### Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

### Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.





## Introduction

All materials which are not considered to be “in-situ rock” are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The “classification” comprises a two character “group symbol” providing a general summary of dominant soil characteristics. The “name” summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

### Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either “fine grained” (also known as “cohesive” behaviour) or “coarse grained” (“non cohesive” behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as “oversize”	
Cobble	63 - 200		
Gravel <sup>1</sup>	2.36 - 63	Coarse	>65%
Sand <sup>1</sup>	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

<sup>1</sup> – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer “component proportions” below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a “Sandy CLAY”, this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

### Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a “primary”, “secondary”, or “minor” component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition <sup>1</sup>	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor <sup>2</sup>	Present in the soil, but not significant to its engineering properties	All other components	All other components

<sup>1</sup> As defined in AS1726-2017 6.1.4.4

<sup>2</sup> In the detailed material description, minor components are split into two further sub-categories. Refer “identification of minor components” below.

### Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, “INTERBEDDED Silty CLAY AND SAND”.

## Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

## Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component <sup>1</sup>	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

<sup>1</sup> – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

## Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

## Soil Composition

### Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

### Grain Size

Type	Particle size (mm)	
	Gravel	Coarse
	Medium	6.7 - 19
	Fine	2.36 - 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

### Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

## Soil Condition

### Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code **NDF**, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

### Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example **(VS)**.

#### Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

#### Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

## Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

## Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

## Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as “extremely weathered material” in reports and by the abbreviation code **XWM** on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

## Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than ‘very low’ as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

## Cobbles and Boulders

The presence of particles considered to be “oversize” may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with “MIXTURE OF”.





## Rock Strength

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

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

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

<sup>1</sup> Rock strength classification is based on UCS. The UCS to  $I_{s(50)}$  ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material “within rock” but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the “Description of Strata” and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

## Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil <sup>1</sup>	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered <sup>1</sup>	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

<sup>1</sup> The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

## Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

## Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

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

## Rock Quality Designation

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

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

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

## Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

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

# Rock Descriptions

Terminology  
Symbols  
Abbreviations

## Defect Descriptions

### Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

### Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

### Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

### Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

### Rock Defect Shape/Planarity

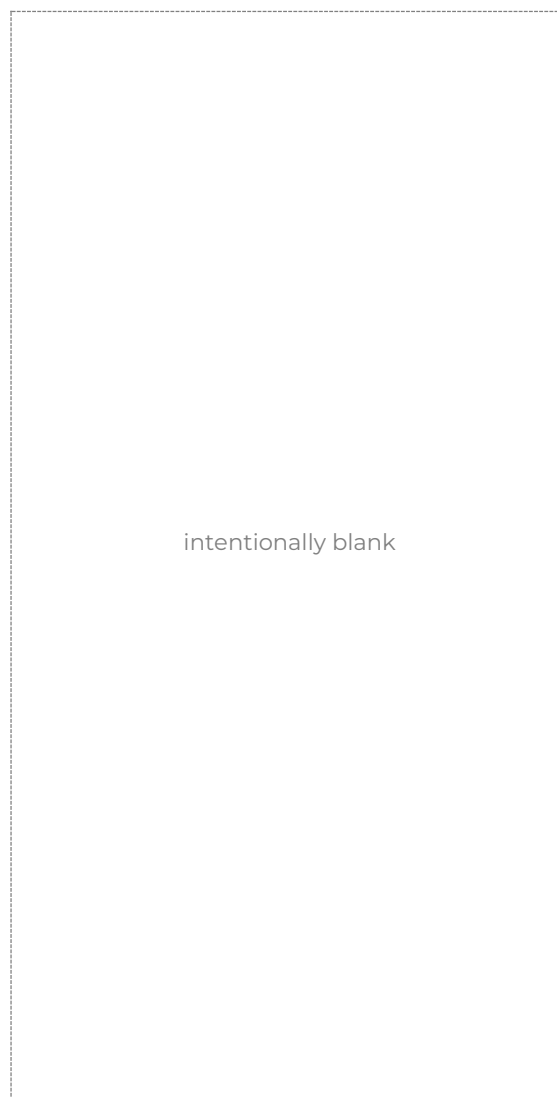
Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

### Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Smooth	SM
Slickensided	SL
Very rough	VR

### Defect Orientation

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





## Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing appearing to the right of the scale, as illustrated below:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

### Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Driven Tube sample	DT
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U <sup>1</sup>
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

<sup>1</sup> – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

### Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y = x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V

Unconfined compressive strength, (MPa)	UCS
--	-----

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(L)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

### Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

### Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD <sup>1</sup>
Air Track	AT
Diatube	DT <sup>1</sup>
Hand auger	HA <sup>1</sup>
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA <sup>1</sup>
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT <sup>1</sup>
Ripping tyne/ripper	R
Rock roller	RR <sup>1</sup>
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON <sup>1</sup>
Mud/blade bucket	MB <sup>1</sup>
Toothed bucket	TB <sup>1</sup>
Vibrocore	VC <sup>1</sup>
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB <sup>1</sup>

<sup>1</sup> – numeric suffixes indicate tool diameter/width in mm

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## **Appendix B**

Drawings



**LEGEND**

- Approximate Site Boundary
- Proposed Basement Outline
- A Interpreted Geotechnical Cross Section
- + Geotechnical Borehole Location

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	24.10.2025	EC

SCALE: 1:600 @ A3

**Douglas**  
PARTNERS  
OFFICE: SYDNEY  
96-98 Hermitage Rd, West Ryde NSW 2114  
(02)9809 0666

CLIENT:  
**Homes NSW**

NOTE:  
1: Basemap from Metromap (Dated 13.03.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:  
**Belmore Road, Belmore, Affordable Housing**

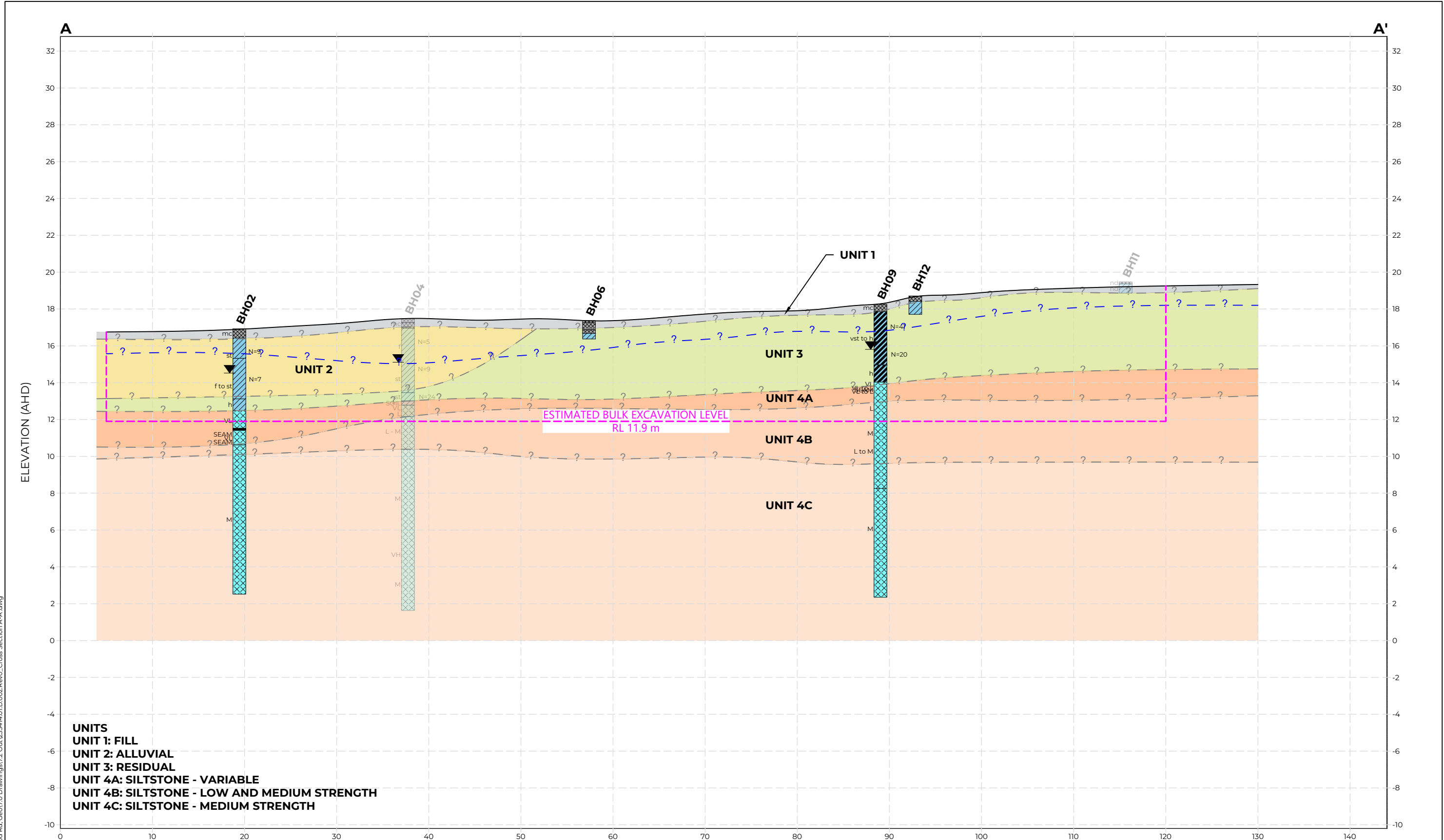
PROJECT ADDRESS:  
**278 Burwood Road, Belmore**

DRAWING TITLE:  
**Test Location Plan**

PROJECT NO:  
**233414.01**

DRAWING NO:  
**1**

REVISION:  
**0**



**UNITS**  
**UNIT 1: FILL**  
**UNIT 2: ALLUVIAL**  
**UNIT 3: RESIDUAL**  
**UNIT 4A: SILTSTONE - VARIABLE**  
**UNIT 4B: SILTSTONE - LOW AND MEDIUM STRENGTH**  
**UNIT 4C: SILTSTONE - MEDIUM STRENGTH**

**LEGEND**  
 CLAY  
 SILTSTONE  
 NO CORE  
 Groundwater Level  
 FILL

**TESTS / OTHER**  
 N - Standard penetration test value  
 - ? - - - Interpreted geotechnical boundary

<b>ROCK STRENGTH</b>	<b>CONSISTENCY (COHESIVE SOILS)</b>	<b>COMPACTION (anthropogenically modified soil)</b>
VL- Very Low	vs - Very Soft	na - Not applicable
L - Low	s - Soft	nd - No data
M - Medium	f - Firm	pc - Poorly compacted
H - High	st - Stiff	mc - Mostly compacted
VH - Very High	vst - Very Stiff	wc - Well compacted
	h - Hard	vc - Variably compacted

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	24.10.2025	EC/MN

SCALE: 0 2 4 6 8 10 15 20  
 1:400 @ A3  
 Vertical Exaggeration = 2.0

OFFICE: SYDNEY  
 96-98 Hermitage Rd, West Ryde NSW 2114  
 (02) 9809 0666

CLIENT:  
**Homes NSW**

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

PROJECT NAME:  
**Belmore Road, Belmore, Affordable Housing**  
 PROJECT ADDRESS:  
**278 Burwood Road, Belmore**

DRAWING TITLE:  
**INTERPRETED GEOTECHNICAL CROSS SECTION A-A'**

PROJECT No: **233414.01**  
 DRAWING No: **2**  
 REVISION: **0**

\\dfspsas02\Projects\233414\01 - BELMORE, 278 Burwood Rd, Geo\170 Drawings\172 Out\233414\01.D002.Rev0\_Cross Section A-A.dwg

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## **Appendix C**

Results of Field Work

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 16.9 AHD  
**COORDINATE:** E:323079.0, N:6245713.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02  
**PROJECT No:** 233414.01  
**DATE:** 23/04/25  
**SHEET:** 1 of 3

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS									
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSISTENCY, (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE				
	0.20	FILL / Silty CLAY trace gravel: dark brown, then orange-brown; low to medium plasticity; fine to medium, ironstone gravel; trace organic matter.	[Pattern]	FILL	(MC)	w>PL		ES	0.20									
	0.50							A/ES	0.50									
	0.50	Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; trace organic matter. 1.00m: tree root	[Pattern]	ALV	St	w<PL		A/ES	0.70									
	0.70							A	0.70									
	1.00							SPT	1.00									
	1.45										PP	360-420kPa						
	1.80	Silty CLAY (CL): pale grey mottled orange-brown and green-brown; low plasticity.	[Pattern]	ALV	St	w=PL		A/ES	1.80									
	2.00																	
	2.50							SPT	2.50			3,36 N=9						
	2.80							ES	2.80			2,25 N=7						
	3.00							ES	3.00			180-250kPa						
	3.20	From 3.20m: becoming orange-brown mottled pale grey																
	3.80	Silty CLAY (CI) trace gravel: grey mottled orange-brown; medium plasticity; fine to medium, ironstone and siltstone gravel.	[Pattern]	XWM	H	w<PL		ES	3.80									
	4.00							SPT	4.00								10,17,26/130 (HB)	
	4.43	Continued as rock log																
	5.00																	
	6.00																	
	7.00																	
	8.00																	
	9.00																	
	10.00																	

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Bobcat  
**METHOD:** HA to 0.7m, AD/T to 4.43m, NMLC to 14.4m  
**REMARKS:** 20% drilling fluid loss below 8.40m, hole reamed to HQ size for well installation

**OPERATOR:** Ground Test (JJ)  
**LOGGED:** C.S. YIP  
**CASING:** HWT to 4m

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 16.9 AHD  
**COORDINATE:** E:323079.0, N:6245713.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02  
**PROJECT No:** 233414.01  
**DATE:** 23/04/25  
**SHEET:** 2 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)	16													1				
	15													2				
	14													3				
	13													4				
	12	Continued from soil log SILTSTONE: grey and brown; bedded at 0-10°, with <5% grey, fine grained sandstone laminations and beds. Ashfield Shale.		HW	4.43	VL	100	0		4.43m: Unless stated otherwise, rock is fractured along B, 0-5°, PR, RF, Fe SN or CN 4.51m: CS, 5°, 10mm 4.81m: CS, 15°, 15mm 4.90-4.96m: B x2, 5°, IR, VNR Clay, SM, and Fe SN 5.05m: JT, 40°, IR, SN Fe, RF 5.14m: JT, 85-90°, IR, SN Fe, RF, (5.11-5.17m)				5				
	5.40				5.40									5.40				
	5.52				5.52									5.52				
	6			XW		SEAM				5.52-5.90m: EW, 0°, 380mm				6				
	5.90			HW		VL												
	6.00			XW		SEAM				6.00-6.30m: EW, 5°, 300mm				6				
	6.30	SILTSTONE: dark grey; distinctly bedded at 0-5°, with <5% grey, fine grained sandstone laminations and beds. Ashfield Shale.			6.30					6.30m: B, 0°, PR, INF Clay 2mm, SM				6.30	PLT	PL(A)=0.62MPa		
	10						96	49		6.91m: JT, 85°, PR, CN, VR, (6.82-7m)				7	PLT	PL(A)=0.33MPa		
	7									7.03-7.71m: B x8, 0-5°, IR, CN, VR				7	PLT	PL(A)=0.63MPa		
	8									7.75m: JT, 15°, IR, CN, VR 7.86m: JT, 85°, PR, CN, VR				8	PLT	PL(A)=0.53MPa		
	9			FR		M				8.49m: B, 5°, IR, CN, VR				8	PLT	PL(A)=0.65MPa		
	8									8.83m: B, 0°, PR, INF Clay 3mm, SM 8.90m: JT, 85°, ST, CN, RF, (8.87-8.92m)				9	PLT	PL(A)=0.46MPa		
	9						100	93		8.95m: CS, 85°, 20mm 9.18m: B, 0°, PR, INF Clay 2mm, SM				9	PLT	PL(A)=0.67MPa		
	7									9.7m: JT, 60°, PR, CN 20mm, RF								

NOTES: #Soil origin is "probable" unless otherwise stated.

**PLANT:** Bobcat **OPERATOR:** Ground Test (JJ)  
**METHOD:** HA to 0.7m, AD/T to 4.43m, NMLC to 14.4m  
**REMARKS:** 20% drilling fluid loss below 8.40m, hole reamed to HQ size for well installation

**LOGGED:** C.S. YIP  
**CASING:** HWT to 4m

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 16.9 AHD  
**COORDINATE:** E:323079.0, N:6245713.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02  
**PROJECT No:** 233414.01  
**DATE:** 23/04/25  
**SHEET:** 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING									
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.			DEPTH (m)	STRENGTH			RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
				LR	SR	FR		VL	LM	VM												
	11	[CONT] SILTSTONE: dark grey; distinctly bedded at 0-5°, with <5% grey, fine grained sandstone laminations and beds. Ashfield Shale.								100	93	10.16m B, 0°, PR, VNR Clay, SM						PLT	PL(A)=0.51MPa			
	11.5											10.91-11.28m JT x2, 80°, PR, CN, VR						PLT	PL(A)=0.36MPa			
	12											11.35m JT, 70°, PR, CN, VR										
	12.5											12.10m: JT, 85°, IR, CN, VR, (12.05-1216m)						PLT	PL(A)=0.41MPa			
	13									100	91	12.65-12.67m JT x3, 25°, PR, CN, VR										
	13.5											12.76m JT, 70°, ST, CN, RF										
	14											13.60m: B, 5°, IR, CN, VR						PLT	PL(A)=0.50MPa			
	14.4											13.72m: CS, 15°, 10mm										
	14.4											13.80m: JT, 25°, IR, CN, VR						PLT	PL(A)=0.36MPa			
	14.4											13.86m: CS, 0°, 40mm										
	14.4	Borehole discontinued at 14.40m depth. Target depth reached.																				
	15																					
	16																					
	17																					
	18																					
	19																					
	20																					

NOTES: #Soil origin is "probable" unless otherwise stated.

**PLANT:** Bobcat **OPERATOR:** Ground Test (JJ)  
**METHOD:** HA to 0.7m, AD/T to 4.43m, NMLC to 14.4m  
**REMARKS:** 20% drilling fluid loss below 8.40m, hole reamed to HQ size for well installation

**LOGGED:** C.S. YIP  
**CASING:** HWT to 4m



Refer to explanatory notes for symbol and abbreviation definitions

# CORE PHOTO LOG

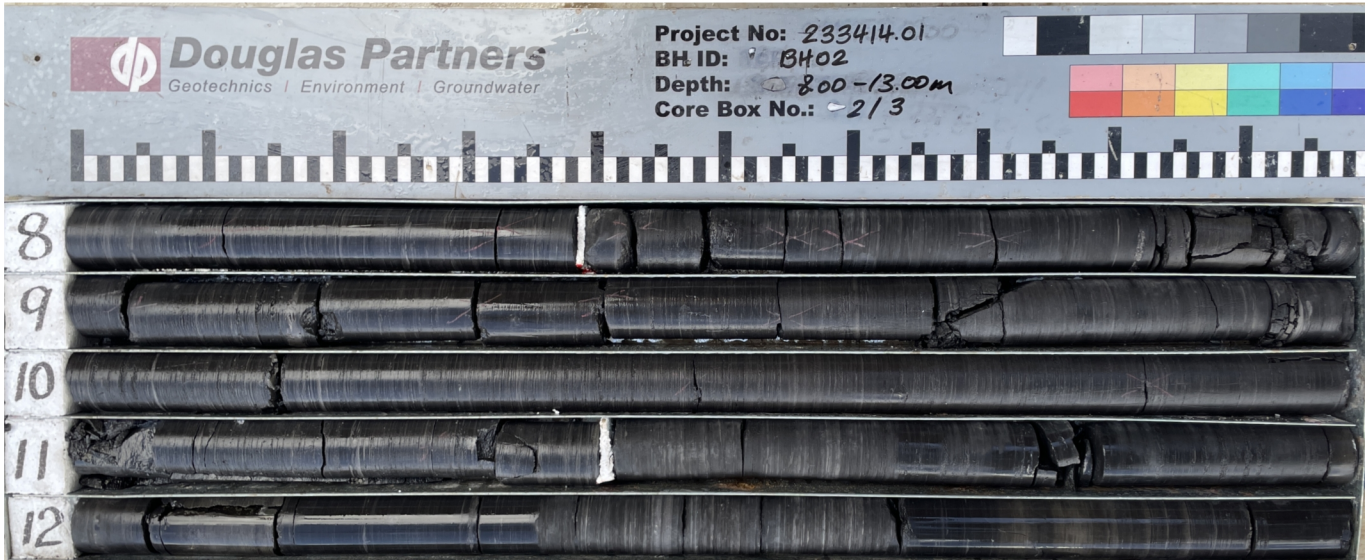
**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 16.9 AHD  
**COORDINATE:** E:323079.0, N:6245713.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02  
**PROJECT No:** 233414.01  
**DATE:** 23/04/25  
**SHEET:** 1 of 2



4.43-8.00 m depth



8.00-13.00 m depth

# CORE PHOTO LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 16.9 AHD  
**COORDINATE:** E:323079.0, N:6245713.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02  
**PROJECT No:** 233414.01  
**DATE:** 23/04/25  
**SHEET:** 2 of 2



13.00-14.40 m depth





# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 17.5 AHD  
**COORDINATE:** E:323061.8, N:6245684.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH04  
**PROJECT No:** 233414.01  
**DATE:** 28/04/25  
**SHEET:** 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING								
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE			
																			RS	XS	XS
	7	[CONT] SILTSTONE: dark grey; distinctly bedded at 0-5°, with <5% grey, fine grained sandstone laminations. Ashfield Shale.		FR																	
	11								M	100	95		10.27m: B, 0°, PR, INF Clay 2mm, SM 10.29m: B, 3°, PR, INF Clay 3mm, SM 10.35m: JT, 70°, PR, CN, VR				PLT	PL(A)=0.35MPa			
	12												11.85m: JT, 30°, PR, CN, VR 12.02m: JT, 65°, PR, CN, VR 12.18m: JT, 70°, IR, CN, VR 12.22m: CS, 10°, 20mm 12.33m: JT, 45°, PR, CN, RF 12.36m: B, 0°, PR, INF Clay 2mm, SM 12.50m: JT, 85°, IR, CN, VR, (12.47-12.63m)				PLT	PL(A)=0.50MPa			
	13							12.60	VH									PLT	PL(A)=5.6MPa		
	14							13.00					13.40m: JT, 85°, IR, CN, VR, (13.38-13.43m) 13.78m: JT, 65°, PR, CN, VR					PLT	PL(A)=0.50MPa		
	15								M	100	100		15.02m: JT, 70°, IR, CN, VR, (14.95-15.10m) 15.23m: JT, 65°, IR, CN, VR 15.40m: JT, 70°, PR, CN, RF, (15.34-15.49m)					PLT	PL(A)=0.66MPa		
	16				Borehole discontinued at 15.82m depth. Target depth reached.																
	17																				
	18																				
	19																				
	20																				

NOTES: #Soil origin is "probable" unless otherwise stated.

**PLANT:** Bobcat  
**METHOD:** HA to 0.8m, AD/T to 2.5m, WB to 4.45m, NMLC to 15.82m  
**REMARKS:** 50% drilling fluid loss below 12.75m, 70% drilling fluid loss below 14.0m, hole opened to HQ size for well installation

**OPERATOR:** Ground Test (JJ)  
**LOGGED:** C.S. YIP  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# CORE PHOTO LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 17.5 AHD  
**COORDINATE:** E:323061.8, N:6245684.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH04  
**PROJECT No:** 233414.01  
**DATE:** 28/04/25  
**SHEET:** 1 of 2



4.45-8.00 m depth



8.00-13.00 m depth

# CORE PHOTO LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 17.5 AHD  
**COORDINATE:** E:323061.8, N:6245684.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH04  
**PROJECT No:** 233414.01  
**DATE:** 28/04/25  
**SHEET:** 2 of 2



13.00-15.82 m depth

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323101.7, N:6245646.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH09  
**PROJECT No:** 233414.01  
**DATE:** 24/04/25  
**SHEET:** 1 of 3

CONDITIONS ENCOUNTERED				SAMPLE				TESTING AND REMARKS						
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°) DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
18.3	0.40	FILL / Silty CLAY trace gravel: dark brown, then pale grey; medium plasticity; fine to medium, ironstone gravel; trace organic matter and brick fragments.		FILL	(MC)	w>PL		A/ES	0.20	PID	0.1ppm			
	0.40	Silty CLAY (CH) trace gravel: brown mottled red-brown; high plasticity; fine, ironstone gravel.				w=PL		A/ES	0.30	PID	0.0ppm			
	0.40							A/ES	0.50	PID	0.0ppm			
	1.00							A/ES	0.80	PID	0.0ppm			
	1.00							SPT	1.00	SPT	3,16,25 N=41			
	1.45								1.45					
	1.80							A/ES	1.80					
	2.00								2.00					
	2.50							SPT	2.50	SPT	5,8,12 N=20			
	2.95								2.95					
	3.30	Silty CLAY (CH): grey to dark grey; high plasticity.												
	4.23			XWM	H			SPT	4.00	SPT	20,25/80 (HB) 4-4.23m			
	4.23	Continued as rock log												
	5.00													
	6.00													
	7.00													
	8.00													
	9.00													

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Bobcat  
**METHOD:** HA to 0.5m, AD/T to 4.23m, NMLC to 15.91m  
**REMARKS:** 0-10% drilling fluid loss below 4m, hole opened to HQ size for well installation

**OPERATOR:** Ground Test (JJ)  
**LOGGED:** C.S. YIP  
**CASING:** HWT to 4m

Refer to explanatory notes for symbol and abbreviation definitions





# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
 Belmore

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323101.7, N:6245646.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH09  
**PROJECT No:** 233414.01  
**DATE:** 24/04/25  
**SHEET:** 3 of 3

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)	10.00	SILTSTONE: dark grey; distinctly bedded at 0-5°, with <5% grey, fine grained sandstone laminations and beds. Ashfield Shale.		FR	M	M	100	95	10.77m: CS, 5°, 35mm 10.85m: JT, 85°, IR, CN, VR, (10.79-10.91m)					8	PLT	PL(A)=0.49MPa		
7	11													PLT	PL(A)=0.53MPa			
6	12													PLT	PL(A)=0.31MPa			
5	13																	
4	14													PLT	PL(A)=0.38MPa			
3	15													PLT	PL(A)=0.35MPa			
2	16	Borehole discontinued at 15.91m depth. Target depth reached.						15.23m: B, 5°, IR, VNR, VR 15.40-15.43m: JT x3, 85°, PR, CN, RF					16	PLT	PL(A)=0.68MPa			
1	17												17					
0	18												18					
-1	19												19					

NOTES: #Soil origin is "probable" unless otherwise stated.

**PLANT:** Bobcat **OPERATOR:** Ground Test (JJ)  
**METHOD:** HA to 0.5m, AD/T to 4.23m, NMLC to 15.91m  
**REMARKS:** 0-10% drilling fluid loss below 4m, hole opened to HQ size for well installation

**LOGGED:** C.S. YIP  
**CASING:** HWT to 4m

Refer to explanatory notes for symbol and abbreviation definitions



# CORE PHOTO LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323101.7, N:6245646.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH09  
**PROJECT No:** 233414.01  
**DATE:** 24/04/25  
**SHEET:** 1 of 2



4.23-8.00 m depth



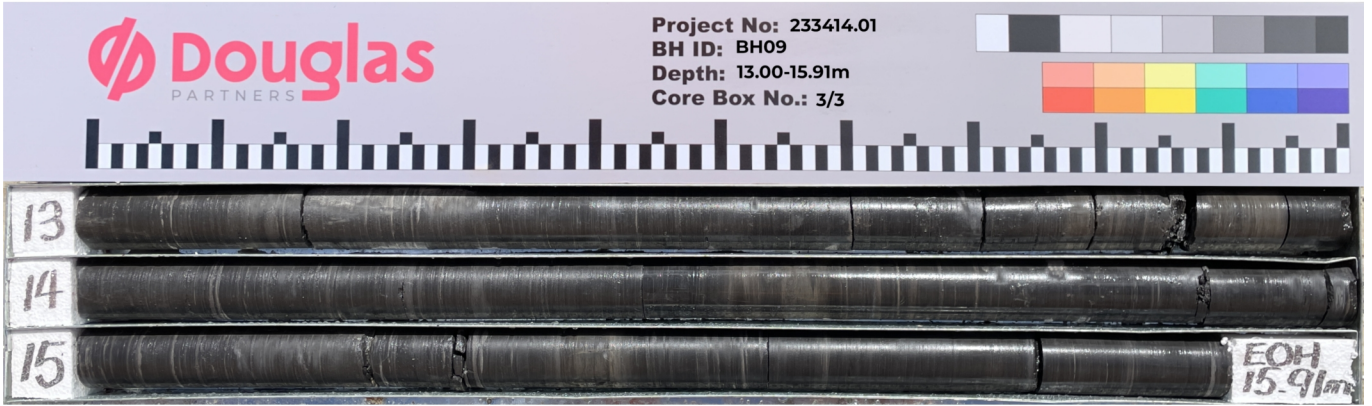
8.00-13.00 m depth

# CORE PHOTO LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192  
Belmore

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323101.7, N:6245646.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH09  
**PROJECT No:** 233414.01  
**DATE:** 24/04/25  
**SHEET:** 2 of 2



13.00-15.91 m depth

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 17.1 AHD  
**COORDINATE:** E:323053.0, N:6245702.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH01  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed	17	0.10	FILL / Silty SAND trace gravel: dark brown; fine to medium; low plasticity silt; with rootlets, trace brick.		FILL	ND		M		ES		0.10		
			FILL / Silty CLAY trace gravel: brown-grey; low plasticity; trace roots.		FILL	ND		w=PL		*	ES	0.40 - 0.50		
		0.60	Silty CLAY (CL): grey; low plasticity.		ALV	ND		w=PL			ES	0.60 - 0.70		
		Borehole discontinued at 0.70m depth. Refusal at 0.7m.												
	1													

NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng

**METHOD:** HA to 0.7m

**CASING:** Uncased

**REMARKS:** \*Blind replicate sample BD1/20250429 taken from 0.4-0.5m

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 17.0 AHD  
**COORDINATE:** E:323078.8, N:6245714.0  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH02A  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. <sup>(1)</sup> DENSITY. <sup>(2)</sup>	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	0.50	FILL / Silty CLAY trace gravel: dark brown then orange-brown; low to medium plasticity; fine to medium, ironstone gravel; trace organic matter.		FILL	(MC)	w>PL w=PL							Concrete	
	1.00	Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; trace organic matter.  1.00m: tree root		ALV		w<PL w=PL				1			Bentonite	
	1.60	Silty CLAY (CL): grey mottled orange-brown and green-brown; low plasticity.												
	2.00									2				
	3.20	3.20m: becoming orange-brown mottled pale grey		ALV		w>PL				3				
	3.80	Silty CLAY (CL) trace gravel: grey mottled orange-brown; medium to high plasticity; fine to medium, ironstone and siltstone gravel.		XWM	H	w<PL								
	4.00	Borehole discontinued at 4.00m depth. Continued as geotechnical rock log.												

NOTES: <sup>#</sup>Soil origin is "probable" unless otherwise stated. <sup>1</sup>Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Bobcat  
**METHOD:** SFA to 4.0m  
**REMARKS:** Strength obtained from adjacent geotechnical borehole

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 17.1 AHD  
**COORDINATE:** E:323064.5, N:6245698.1  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH03  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. <sup>(*)</sup> DENSITY. <sup>(*)</sup>	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed	17		FILL / Silty CLAY trace sand trace gravel: dark brown; low to medium plasticity; sandstone and igneous gravel; trace roots.		FILL	ND	w=PL			ES	0.10		
		0.40	FILL / Silty CLAY trace gravel: brown to orange-brown; medium to high plasticity.		FILL	ND	w=PL			ES	0.40		
		0.60	Silty CLAY (CL): grey; low plasticity.		ALV	(St)	w=PL			ES	0.60		
		0.80	Silty CLAY (CI-CH): grey mottled orange-brown; medium to high plasticity.		ALV	(F) to (St)	w=PL			ES	0.80		
	1	Borehole discontinued at 1.00m depth. Target Depth Reached.											
	16												

NOTES: <sup>(\*)</sup>Soil origin is "probable" unless otherwise stated. <sup>(\*)</sup>Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools  
**METHOD:** HA to 1m  
**REMARKS:**

**OPERATOR:** Douglas Partners (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased



Refer to explanatory notes for symbol and abbreviation definitions

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 16.4 AHD  
**COORDINATE:** E:323075.8, N:6245690.8  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH05  
**PROJECT No:** 233414.02  
**DATE:** 23/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. <sup>(*)</sup> DENSITY. <sup>(*)</sup>	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
23/04/25 No Free Groundwater Observed			FILL / Silty SAND trace gravel: dark brown; fine to coarse; low to medium plasticity silt; igneous gravel; with roots and rootlets.		FILL	ND	w<PL		ES		0.20		
		0.30	FILL / Silty CLAY trace gravel: yellow-brown, red-brown and grey; medium to high plasticity; igneous gravel; trace rootlets.		FILL	ND	w<PL		ES		0.30		
		0.50	FILL / Silty CLAY: dark grey to dark brown with yellow-brown; medium to high plasticity; trace roots and rootlets, possibly reworked natural.		FILL	ND	w=PL		ES		0.50		
		0.70	Silty CLAY (CI-CH): yellow-brown with red-brown; medium to high plasticity; trace rootlets.						ES		0.70		
	1			ALV	ND	w<PL					1		
	1.5										1.50		
									*	ES			
											1.70		
		Borehole discontinued at 1.70m depth. Target Depth Reached.											

NOTES: <sup>(\*)</sup>Soil origin is "probable" unless otherwise stated. <sup>(\*\*)</sup>Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools  
**METHOD:** HA to 1.7m  
**REMARKS:** \*Blind replicate sample BD3/20350423 taken from 1.5-1.7m

**OPERATOR:** Douglas Partners (N. Woodward)

**LOGGED:** N. Woodward  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 17.4 AHD  
**COORDINATE:** E:323096.1, N:6245679.4  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH06  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY (g/cm³)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed			FILL / Silty CLAY: dark brown; low to medium plasticity; trace roots.		FILL	ND		w=PL		ES	0.00 - 0.10	0.10	PID	<1ppm
		0.10	FILL / Silty CLAY trace gravel: orange-brown and brown; medium plasticity; sandstone gravel.		FILL	ND		w=PL		ES	0.10 - 0.40	0.40	PID	<1ppm
		0.50	FILL / Silty CLAY trace gravel: grey; low plasticity; possible reworked natural.		FILL	ND		w=PL		ES	0.40 - 0.60	0.60	PID	<1ppm
		0.70	Silty CLAY (CI-CH): red-brown mottled orange-brown; medium to high plasticity.		RS	ND		w=PL		ES	0.60 - 0.80	0.80	PID	<1ppm
	1.00	Borehole discontinued at 1.00m depth. Target Depth Reached.												

NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng

**METHOD:** HA to 1m

**CASING:** Uncased

**REMARKS:** \*Blind replicate sample BD2/20250429 taken from 0.8-1.0m



Refer to explanatory notes for symbol and abbreviation definitions

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 17.4 AHD  
**COORDINATE:** E:323081.7, N:6245664.6  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH07  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS		
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°) DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)
29/04/25 No Free Groundwater Observed	0.10	FILL / Silty CLAY: dark brown; low plasticity; with roots.		FILL	ND	w=PL			ES	0.10		
	0.20	FILL / Silty CLAY with gravel: grey; low to medium plasticity.		FILL	ND	w=PL						
	0.70	Silty CLAY (CI-CH): red-brown mottled yellow-brown; medium to high plasticity; trace ash and charcoal.		RS	ND	w=PL						
Borehole discontinued at 0.70m depth. Target Depth Reached.												

NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng

**METHOD:** HA to 0.7m

**CASING:** Uncased

**REMARKS:** \*Blind replicate sample BD3/20250429 taken from 0.6-0.7m

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323082.2, N:6245644.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH08  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. <sup>(*)</sup> DENSITY. <sup>(*)</sup>	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed	18	0.10	FILL / Silty CLAY with gravel: dark brown; low plasticity; with roots, trace charcoal and ash.		FILL	ND	w=PL		ES	0.10			
	0.30	0.40	FILL / Silty CLAY with gravel: grey; low plasticity; possible reworked natural.		FILL	ND	w=PL		ES	0.30-0.40			
	0.45	0.60	Silty CLAY (CI-CH) trace gravel: red-brown mottled orange-brown; medium to high plasticity; ironstone gravel.		RS	ND	w=PL		ES	0.45-0.60			
Borehole discontinued at 0.60m depth. Target Depth Reached.													
1													
7													

NOTES: <sup>(\*)</sup>Soil origin is "probable" unless otherwise stated. <sup>(\*)</sup>Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools  
**METHOD:** HA to 0.6m  
**REMARKS:**

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 18.3 AHD  
**COORDINATE:** E:323102.2, N:6245647.3  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH09A  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS					
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSISTENCY (°) DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL
	18	0.30	FILL / Silty CLAY trace gravel: dark brown; medium plasticity; fine to medium, ironstone gravel; trace organic matter and brick fragments.		FILL	(MC)	w>PL								
		0.40	FILL / Silty CLAY with gravel: pale grey; medium to high plasticity; fine to medium, ironstone gravel.		FILL										
			Silty CLAY (CH) trace gravel: brown mottled red-brown; high plasticity; ironstone gravel.				w=PL								
		1	1.00m: Pale grey, mottled red-brown with fine to medium ironstone gravel												
	17														
		2			RS	VSt to H									
	16						w<PL								
		3													
	15	3.30	Silty CLAY (CH): grey to dark grey; high plasticity.												
		4			RS	H									
		4	Borehole discontinued at 4.00m depth. Continued as geotechnical rock log.												
	14														

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Bobcat **OPERATOR:** Groundtest (J. Jeffcoat) **LOGGED:** L. Teng  
**METHOD:** SFA to 4.0m **CASING:** Uncased

**REMARKS:** Strength obtained from adjacent geotechnical borehole



Refer to explanatory notes for symbol and abbreviation definitions

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 18.8 AHD  
**COORDINATE:** E:323097.7, N:6245634.9  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH10  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed	0.10	FILL / Silty CLAY trace sand: dark brown; low plasticity; fine to coarse sand; trace roots and brick fragments.		FILL	ND	w=PL			ES	0.10			
		Silty CLAY (CI-CH): orange-brown mottled red-brown; medium to high plasticity.		RS	ND	w=PL			ES	0.40			
Borehole discontinued at 0.50m depth. Target Depth Reached.													
<div style="display: flex; justify-content: space-between; width: 100%;"> <span>18</span> <span>1</span> <span>17</span> </div>													
<small>NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.</small>													

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**PLANT:** Hand Tools  
**METHOD:** HA to 0.5  
**REMARKS:**

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased

Refer to explanatory notes for symbol and abbreviation definitions



# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 19.5 AHD  
**COORDINATE:** E:323100.2, N:6245616.4  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH11  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed	0.10	FILL / Silty CLAY trace sand: dark brown; low plasticity; fine to coarse sand; trace roots.		FILL	ND	w=PL			ES	0.10			
		Silty CLAY (CI-CH): red-brown mottled orange-brown; medium to high plasticity.		RS	ND	w=PL			ES	0.40 0.50			
Borehole discontinued at 0.60m depth. Target Depth Reached.													

NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools  
**METHOD:** HA to 0.6m  
**REMARKS:**

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased

# BOREHOLE LOG

**CLIENT:** Homes NSW  
**PROJECT:** HAFF Project  
**LOCATION:** 278 Burwood Road, Belmore, NSW 2192

**SURFACE LEVEL:** 18.7 AHD  
**COORDINATE:** E:323111.6, N:6245647.5  
**DATUM/GRID:** MGA2020 Zone 56  
**DIP/AZIMUTH:** 90°/---°

**LOCATION ID:** BH12  
**PROJECT No:** 233414.02  
**DATE:** 29/04/25  
**SHEET:** 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS				
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
29/04/25 No Free Groundwater Observed			FILL / Silty SAND: dark brown; fine to coarse.		FILL	ND		M		ES		0.20	PID	<1ppm
	0.30		Silty CLAY (CI-CH) trace gravel: orange-brown mottled brown; medium to high plasticity; ironstone gravel.							ES		0.40	PID	<1ppm
			From 0.80m: grey mottled red-brown		RS	ND		w=PL		ES		0.80	PID	<1ppm
	1	Borehole discontinued at 1.00m depth. Target Depth Reached.												

NOTES: #Soil origin is "probable" unless otherwise stated. !Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

**PLANT:** Hand Tools  
**METHOD:** HA to 1m  
**REMARKS:**

**OPERATOR:** Groundtest (J. Jeffcoat)

**LOGGED:** L. Teng  
**CASING:** Uncased

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Refer to explanatory notes for symbol and abbreviation definitions



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## **Appendix D**

Results of Laboratory Testing

## CERTIFICATE OF ANALYSIS 379401

### Client Details

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Lachlan Straney
<b>Address</b>	96 Hermitage Rd, West Ryde, NSW, 2114

### Sample Details

<b>Your Reference</b>	<u>233414.01 Belmore</u>
<b>Number of Samples</b>	8 Soil
<b>Date samples received</b>	01/05/2025
<b>Date completed instructions received</b>	01/05/2025

### Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.  
 Samples were analysed as received from the client. Results relate specifically to the samples as received.  
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.  
**Please refer to the last page of this report for any comments relating to the results.**

### Report Details

<b>Date results requested by</b>	08/05/2025
<b>Date of Issue</b>	08/05/2025
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

**Results Approved By**

Diego Bigolin, Inorganics Supervisor

**Authorised By**

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		379401-1	379401-2	379401-3	379401-4	379401-5
Your Reference	UNITS	BH02	BH02	BH04	BH09	BH02
Depth		0.6-0.7	2.5-2.95	4.0-4.45	1.8-2	1-1.45
Date Sampled		23/04/2025	23/04/2025	28/04/2025	24/04/2025	23/04/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/05/2025	05/05/2025	05/05/2025	05/05/2025	05/05/2025
Date analysed	-	05/05/2025	05/05/2025	05/05/2025	05/05/2025	05/05/2025
pH 1:5 soil:water	pH Units	6.1	8.1	8.0	5.6	[NA]
Electrical Conductivity 1:5 soil:water	µS/cm	52	150	520	460	560
Chloride, Cl 1:5 soil:water	mg/kg	38	52	650	550	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	24	47	120	130	[NA]

Misc Inorg - Soil				
Our Reference		379401-6	379401-7	379401-8
Your Reference	UNITS	BH02	BH04	BH04
Depth		1.8-2	0.5-0.6	1.8-2
Date Sampled		23/04/2025	28/04/2025	28/04/2025
Type of sample		Soil	Soil	Soil
Date prepared	-	05/05/2025	05/05/2025	05/05/2025
Date analysed	-	05/05/2025	05/05/2025	08/05/2025
Electrical Conductivity 1:5 soil:water	µS/cm	330	43	510

Method ID	Methodology Summary
<b>Inorg-001</b>	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
<b>Inorg-002</b>	Conductivity and Salinity - measured using a conductivity cell.
<b>Inorg-081</b>	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

Client Reference: 233414.01 Belmore

QUALITY CONTROL: Misc Inorg - Soil				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			05/05/2025	1	05/05/2025	05/05/2025		05/05/2025	[NT]
Date analysed	-			05/05/2025	1	05/05/2025	05/05/2025		05/05/2025	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	6.1	5.9	3	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	52	52	0	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	38	37	3	119	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	24	24	0	118	[NT]

## Result Definitions

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

## Quality Control Definitions

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

## Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

## Report Comments

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



## **CERTIFICATE OF ANALYSIS 379841**

### **Client Details**

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Lisa Teng
<b>Address</b>	96 Hermitage Rd, West Ryde, NSW, 2114

### **Sample Details**

<b>Your Reference</b>	<b><u>233414.02, Belmore</u></b>
<b>Number of Samples</b>	6 Water
<b>Date samples received</b>	06/05/2025
<b>Date completed instructions received</b>	07/05/2025

### **Analysis Details**

Please refer to the following pages for results, methodology summary and quality control data.  
Samples were analysed as received from the client. Results relate specifically to the samples as received.  
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.  
**Please refer to the last page of this report for any comments relating to the results.**

### **Report Details**

<b>Date results requested by</b>	14/05/2025
<b>Date of Issue</b>	14/05/2025
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#### **Results Approved By**

Diego Bigolin, Inorganics Supervisor  
Dragana Tomas, Senior Chemist  
Giovanni Agosti, Group Technical Manager  
Jack Wallis, Senior Chemist  
Stuart Chen, Asbestos Approved Identifier/Report coordinator

#### **Authorised By**

Nancy Zhang, Laboratory Manager

VOCs in water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date Extracted	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025
Date Analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Dichlorodifluoromethane	µg/L	<10	<10	<10	<10
Chloromethane	µg/L	<10	<10	<10	<10
Vinyl Chloride	µg/L	<10	<10	<10	<10
Bromomethane	µg/L	<10	<10	<10	<10
Chloroethane	µg/L	<10	<10	<10	<10
Trichlorofluoromethane	µg/L	<10	<10	<10	<10
1,1-Dichloroethene	µg/L	<1	<1	<1	<1
Trans-1,2-dichloroethene	µg/L	<1	<1	<1	<1
1,1-dichloroethane	µg/L	<1	<1	<1	<1
Cis-1,2-dichloroethene	µg/L	<1	<1	<1	<1
Bromochloromethane	µg/L	<1	<1	<1	<1
Chloroform	µg/L	<1	1	<1	<1
2,2-dichloropropane	µg/L	<1	<1	<1	<1
1,2-dichloroethane	µg/L	<1	<1	<1	<1
1,1,1-trichloroethane	µg/L	<1	<1	<1	<1
1,1-dichloropropene	µg/L	<1	<1	<1	<1
Cyclohexane	µg/L	<1	<1	<1	<1
Carbon tetrachloride	µg/L	<1	<1	<1	<1
Benzene	µg/L	<1	<1	<1	<1
Dibromomethane	µg/L	<1	<1	<1	<1
1,2-dichloropropane	µg/L	<1	<1	<1	<1
Trichloroethene	µg/L	<1	<1	<1	<1
Bromodichloromethane	µg/L	<1	<1	<1	<1
trans-1,3-dichloropropene	µg/L	<1	<1	<1	<1
cis-1,3-dichloropropene	µg/L	<1	<1	<1	<1
1,1,2-trichloroethane	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
1,3-dichloropropane	µg/L	<1	<1	<1	<1
Dibromochloromethane	µg/L	<1	<1	<1	<1
1,2-dibromoethane	µg/L	<1	<1	<1	<1
Tetrachloroethene	µg/L	<1	<1	<1	<1
1,1,1,2-tetrachloroethane	µg/L	<1	<1	<1	<1
Chlorobenzene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1

VOCs in water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Bromoform	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
Styrene	µg/L	<1	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	<1	<1	<1	<1
o-xylene	µg/L	<1	<1	<1	<1
1,2,3-trichloropropane	µg/L	<1	<1	<1	<1
Isopropylbenzene	µg/L	<1	<1	<1	<1
Bromobenzene	µg/L	<1	<1	<1	<1
n-propyl benzene	µg/L	<1	<1	<1	<1
2-chlorotoluene	µg/L	<1	<1	<1	<1
4-chlorotoluene	µg/L	<1	<1	<1	<1
1,3,5-trimethyl benzene	µg/L	<1	<1	<1	<1
Tert-butyl benzene	µg/L	<1	<1	<1	<1
1,2,4-trimethyl benzene	µg/L	<1	<1	<1	<1
1,3-dichlorobenzene	µg/L	<1	<1	<1	<1
Sec-butyl benzene	µg/L	<1	<1	<1	<1
1,4-dichlorobenzene	µg/L	<1	<1	<1	<1
4-isopropyl toluene	µg/L	<1	<1	<1	<1
1,2-dichlorobenzene	µg/L	<1	<1	<1	<1
n-butyl benzene	µg/L	<1	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	<1	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	<1	<1	<1	<1
Hexachlorobutadiene	µg/L	<1	<1	<1	<1
1,2,3-trichlorobenzene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	101	102	102	100
Surrogate Toluene-d8	%	100	99	100	99
Surrogate 4-Bromofluorobenzene	%	96	94	95	94

vTRH(C6-C10)/BTEXN in Water						
Our Reference		379841-1	379841-2	379841-3	379841-4	379841-5
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506	TS
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025	07/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025	08/05/2025
TRH C <sub>6</sub> - C <sub>9</sub>	µg/L	<10	<10	<10	<10	[NA]
TRH C <sub>6</sub> - C <sub>10</sub>	µg/L	<10	<10	<10	<10	[NA]
TRH C <sub>6</sub> - C <sub>10</sub> less BTEX (F1)	µg/L	<10	<10	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	97%
Toluene	µg/L	<1	<1	<1	<1	101%
Ethylbenzene	µg/L	<1	<1	<1	<1	105%
m+p-xylene	µg/L	<2	<2	<2	<2	103%
o-xylene	µg/L	<1	<1	<1	<1	103%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	101	102	102	100	100
Surrogate Toluene-d8	%	100	99	100	99	100
Surrogate 4-Bromofluorobenzene	%	96	94	95	94	97

vTRH(C6-C10)/BTEXN in Water		
Our Reference		379841-6
Your Reference	UNITS	TB
Date Sampled		6/05/2025
Type of sample		Water
Date extracted	-	07/05/2025
Date analysed	-	08/05/2025
TRH C <sub>6</sub> - C <sub>9</sub>	µg/L	<10
TRH C <sub>6</sub> - C <sub>10</sub>	µg/L	<10
TRH C <sub>6</sub> - C <sub>10</sub> less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	101
Surrogate Toluene-d8	%	99
Surrogate 4-Bromofluorobenzene	%	94

svTRH (C10-C40) in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	09/05/2025	09/05/2025	09/05/2025	09/05/2025
TRH C <sub>10</sub> - C <sub>14</sub>	µg/L	<50	<50	<50	<50
TRH C <sub>15</sub> - C <sub>28</sub>	µg/L	<100	<100	<100	<100
TRH C <sub>29</sub> - C <sub>36</sub>	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50	<50
TRH >C <sub>10</sub> - C <sub>16</sub>	µg/L	<50	<50	<50	<50
TRH >C <sub>10</sub> - C <sub>16</sub> less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C <sub>16</sub> - C <sub>34</sub>	µg/L	<100	<100	<100	<100
TRH >C <sub>34</sub> - C <sub>40</sub>	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50	<50	<50
Surrogate o-Terphenyl	%	114	115	115	111

PAHs in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Naphthalene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	105	109	101	102

Organochlorine Pesticides in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
alpha-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
HCB	µg/L	<0.2	<0.2	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2	<0.2	<0.2
pp-DDT	µg/L	<0.2	<0.2	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2	<0.2	<0.2
Mirex	ug/L	<0.2	<0.2	<0.2	<0.2
Surrogate 4-Chloro-3-NBTF	%	110	108	98	96

OP Pesticides in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Dichlorvos	µg/L	<0.2	<0.2	<0.2	<0.2
Mevinphos	µg/L	<0.2	<0.2	<0.2	<0.2
Phorate	µg/L	<0.2	<0.2	<0.2	<0.2
Dimethoate	µg/L	<0.2	<0.2	<0.2	<0.2
Diazinon	µg/L	<0.2	<0.2	<0.2	<0.2
Disulfoton	µg/L	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos-methyl	µg/L	<0.2	<0.2	<0.2	<0.2
Parathion-Methyl	µg/L	<0.2	<0.2	<0.2	<0.2
Ronnel	µg/L	<0.2	<0.2	<0.2	<0.2
Fenitrothion	µg/L	<0.2	<0.2	<0.2	<0.2
Malathion	µg/L	<0.2	<0.2	<0.2	<0.2
Chlorpyrifos	µg/L	<0.2	<0.2	<0.2	<0.2
Fenthion	µg/L	<0.2	<0.2	<0.2	<0.2
Parathion	µg/L	<0.2	<0.2	<0.2	<0.2
Bromophos ethyl	µg/L	<0.2	<0.2	<0.2	<0.2
Methidathion	µg/L	<0.2	<0.2	<0.2	<0.2
Fenamiphos	µg/L	<0.2	<0.2	<0.2	<0.2
Ethion	µg/L	<0.2	<0.2	<0.2	<0.2
Phosalone	µg/L	<0.2	<0.2	<0.2	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.2	<0.2	<0.2	<0.2
Coumaphos	µg/L	<0.2	<0.2	<0.2	<0.2
Surrogate 4-Chloro-3-NBTF	%	110	108	98	96

PCBs in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Aroclor 1016	µg/L	<2	<2	<2	<2
Aroclor 1221	µg/L	<2	<2	<2	<2
Aroclor 1232	µg/L	<2	<2	<2	<2
Aroclor 1242	µg/L	<2	<2	<2	<2
Aroclor 1248	µg/L	<2	<2	<2	<2
Aroclor 1254	µg/L	<2	<2	<2	<2
Aroclor 1260	µg/L	<2	<2	<2	<2
Surrogate 2-Fluorobiphenyl	%	103	100	99	100

Total Phenolics in Water					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05	<0.05

HM in water - dissolved					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	1.2	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	10	2	39	11
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	15	19	77	14
Zinc-Dissolved	µg/L	47	78	330	57

Metals in Waters - Acid extractable				
Our Reference		379841-1	379841-2	379841-3
Your Reference	UNITS	BH021A	BH04	BH09A
Date Sampled		6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water
Date prepared	-	08/05/2025	08/05/2025	08/05/2025
Date analysed	-	09/05/2025	09/05/2025	09/05/2025
Phosphorus - Total	mg/L	<0.05	1.1	0.1

Ion Balance					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025
Date analysed	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025
Calcium - Dissolved	mg/L	23	55	13	23
Potassium - Dissolved	mg/L	4	14	18	4
Sodium - Dissolved	mg/L	670	2,900	1,500	670
Magnesium - Dissolved	mg/L	38	250	100	38
Hardness (calc) equivalent CaCO <sub>3</sub>	mg/L	210	1,200	450	220
Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub>	mg/L	<5	<5	<5	<5
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	610	260	<5	610
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	<5	<5	<5	<5
Total Alkalinity as CaCO <sub>3</sub>	mg/L	610	260	<5	610
Sulphate, SO <sub>4</sub>	mg/L	190	490	750	190
Chloride, Cl	mg/L	540	4,000	2,300	530
Ionic Balance	%	3.0	8.0	-3.0	4.0

Miscellaneous Inorganics					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date prepared	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025
Date analysed	-	07/05/2025	07/05/2025	07/05/2025	07/05/2025
pH	pH Units	6.6	6.3	4.5	[NA]
Electrical Conductivity	µS/cm	3,500	14,000	7,700	[NA]
Total Suspended Solids	mg/L	38	570	470	[NA]
Total Dissolved Solids (grav)	mg/L	2,200	9,300	5,100	[NA]
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Nitrate as N in water	mg/L	0.11	0.01	<0.005	[NA]
Nitrite as N in water	mg/L	0.007	<0.005	<0.005	[NA]
NOx as N in water	mg/L	0.12	0.01	0.007	[NA]
Ammonia as N in water	mg/L	0.04	0.16	0.28	[NA]
Organic Nitrogen as N	mg/L	<0.2	<0.2	0.3	[NA]
TKN in water	mg/L	0.2	0.3	0.6	[NA]
Total Nitrogen in water	mg/L	0.3	0.4	0.6	[NA]
Phosphate as P in water	mg/L	0.02	0.059	0.009	[NA]

Microbiological Testing					
Our Reference		379841-1	379841-2	379841-3	379841-4
Your Reference	UNITS	BH021A	BH04	BH09A	BD1/20250506
Date Sampled		6/05/2025	6/05/2025	6/05/2025	6/05/2025
Type of sample		Water	Water	Water	Water
Date of testing	-	08/05/2025	08/05/2025	08/05/2025	08/05/2025
E. coli	cfu/100mL	<1000	3500 MPN/100mL	20	<1000
Faecal Coliforms	cfu/100mL	<1000	3500 MPN/100mL	20	<1000

Method ID	Methodology Summary
<b>Ext-008</b>	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
<b>Inorg-001</b>	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
<b>Inorg-002</b>	Conductivity and Salinity - measured using a conductivity cell.
<b>Inorg-006</b>	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
<b>Inorg-014</b>	Cyanide - free, total, weak acid dissociable by segmented flow analyser (in line dialysis with colourimetric finish).  Solids/Filters and sorbents are extracted in a caustic media prior to analysis. Impingers are pH adjusted as required prior to analysis.  Cyanides amenable to Chlorination - samples are analysed untreated and treated with hypochlorite to assess the potential for chlorination of cyanide forms. Based on APHA latest edition, 4500-CN_G,H.
<b>Inorg-018</b>	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.  NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:-  TDS = EC * 0.6
<b>Inorg-019</b>	Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.
<b>Inorg-031</b>	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
<b>Inorg-040</b>	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
<b>Inorg-055</b>	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-055</b>	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-055/062/127</b>	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
<b>Inorg-057</b>	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
<b>Inorg-060</b>	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-062</b>	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).

Method ID	Methodology Summary
<b>Inorg-081</b>	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
<b>Metals-020</b>	Determination of various metals by ICP-AES.  Total Phosphate determined stoichiometrically from Phosphorus (assumed to be present as Phosphate).  Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
<b>Metals-021</b>	Determination of Mercury by Cold Vapour AAS.
<b>Metals-022</b>	Determination of various metals by ICP-MS.  Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.  Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
<b>Org-020</b>	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
<b>Org-021/022/025</b>	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PCBs" is simply a sum of the positive individual PCBs.
<b>Org-022/025</b>	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
<b>Org-022/025</b>	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
<b>Org-023</b>	Water samples are analysed directly by purge and trap GC-MS.
<b>Org-023</b>	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: VOCs in water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date Extracted	-			07/05/2025	2	07/05/2025	08/05/2025		07/05/2025	[NT]
Date Analysed	-			08/05/2025	2	08/05/2025	09/05/2025		08/05/2025	[NT]
Dichlorodifluoromethane	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-023	<10	2	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	102	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-023	<1	2	1	2	67	102	[NT]
2,2-dichloropropane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	102	[NT]
1,1,1-trichloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
1,1-dichloropropene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-023	<1	2	<1	<1	0	101	[NT]
Dibromomethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-023	<1	2	<1	<1	0	94	[NT]
Bromodichloromethane	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-023	<1	2	<1	<1	0	102	[NT]
1,3-dichloropropane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-023	<1	2	<1	<1	0	105	[NT]
1,2-dibromoethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
Bromoform	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-023	<2	2	<2	<2	0	104	[NT]
Styrene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
o-xylene	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
1,2,3-trichloropropane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
<i>Surrogate</i> Dibromofluoromethane	%		Org-023	100	2	102	100	2	99	[NT]
<i>Surrogate</i> Toluene-d8	%		Org-023	99	2	99	100	1	100	[NT]
<i>Surrogate</i> 4-Bromofluorobenzene	%		Org-023	93	2	94	97	3	102	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			07/05/2025	2	07/05/2025	08/05/2025		07/05/2025	[NT]
Date analysed	-			08/05/2025	2	08/05/2025	09/05/2025		08/05/2025	[NT]
TRH C <sub>6</sub> - C <sub>9</sub>	µg/L	10	Org-023	<10	2	<10	<10	0	103	[NT]
TRH C <sub>6</sub> - C <sub>10</sub>	µg/L	10	Org-023	<10	2	<10	<10	0	103	[NT]
Benzene	µg/L	1	Org-023	<1	2	<1	<1	0	101	[NT]
Toluene	µg/L	1	Org-023	<1	2	<1	<1	0	102	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
m+p-xylene	µg/L	2	Org-023	<2	2	<2	<2	0	104	[NT]
o-xylene	µg/L	1	Org-023	<1	2	<1	<1	0	104	[NT]
Naphthalene	µg/L	1	Org-023	<1	2	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	100	2	102	100	2	99	[NT]
Surrogate Toluene-d8	%		Org-023	99	2	99	100	1	100	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	93	2	94	97	3	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	[NT]
Date analysed	-			08/05/2025	1	09/05/2025	09/05/2025		08/05/2025	[NT]
TRH C <sub>10</sub> - C <sub>14</sub>	µg/L	50	Org-020	<50	1	<50	<50	0	116	[NT]
TRH C <sub>15</sub> - C <sub>28</sub>	µg/L	100	Org-020	<100	1	<100	<100	0	116	[NT]
TRH C <sub>29</sub> - C <sub>36</sub>	µg/L	100	Org-020	<100	1	<100	<100	0	114	[NT]
TRH >C <sub>10</sub> - C <sub>16</sub>	µg/L	50	Org-020	<50	1	<50	<50	0	116	[NT]
TRH >C <sub>16</sub> - C <sub>34</sub>	µg/L	100	Org-020	<100	1	<100	<100	0	116	[NT]
TRH >C <sub>34</sub> - C <sub>40</sub>	µg/L	100	Org-020	<100	1	<100	<100	0	114	[NT]
Surrogate o-Terphenyl	%		Org-020	74	1	114	114	0	99	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	379841-2
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Naphthalene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	73	73
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	78	76
Fluorene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	75	76
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	84	83
Anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	82	83
Pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	81	81
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	84
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	72	66
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	104	1	105	102	3	104	103

QUALITY CONTROL: Organochlorine Pesticides in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	379841-2
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	86	85
HCB	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
beta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	81	81
gamma-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Heptachlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	69	70
delta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Aldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	87	87
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	88	90
gamma-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
alpha-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan I	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDE	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	77	77
Dieldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	88	83
Endrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	74	73
Endosulfan II	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDD	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	87	84
Endrin Aldehyde	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDT	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	73	75
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Mirex	ug/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	107	1	110	107	3	106	110

Client Reference: 233414.02, Belmore

QUALITY CONTROL: OP Pesticides in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	379841-2
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Dichlorvos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	82	82
Mevinphos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Phorate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Dimethoate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Diazinon	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Disulfoton	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Parathion-Methyl	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Ronnel	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	76	75
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	86	83
Malathion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	68	67
Chlorpyriphos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	83	81
Fenthion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Parathion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	84	81
Bromophos ethyl	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Methidathion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Fenamiphos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Ethion	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	82	78
Phosalone	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Azinphos-methyl (Guthion)	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Coumaphos	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	107	1	110	107	3	106	110

QUALITY CONTROL: PCBs in Water				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	379841-2
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Aroclor 1016	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1221	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1232	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1242	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1248	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Aroclor 1254	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	86	86
Aroclor 1260	µg/L	2	Org-021/022/025	<2	1	<2	<2	0	[NT]	[NT]
Surrogate 2-Fluorobiphenyl	%		Org-021/022/025	96	1	103	97	6	100	99

Client Reference: 233414.02, Belmore

QUALITY CONTROL: Total Phenolics in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	379841-2
Date extracted	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	108	98

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	379841-2
Date prepared	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Date analysed	-			08/05/2025	1	08/05/2025	08/05/2025		08/05/2025	08/05/2025
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	92	90
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	89	91
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	87	102
Copper-Dissolved	µg/L	1	Metals-022	<1	1	10	9	11	88	94
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	95	84
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	[NT]		99	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	15	15	0	88	98
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	47	48	2	89	100

QUALITY CONTROL: HM in water - dissolved				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	379841-3
Date prepared	-			[NT]	2	08/05/2025	08/05/2025		[NT]	08/05/2025
Date analysed	-			[NT]	2	08/05/2025	08/05/2025		[NT]	08/05/2025
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	2	<0.1	[NT]		[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	2	2	[NT]		[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	2	<0.05	<0.05	0	[NT]	74
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	2	19	[NT]		[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	2	78	[NT]		[NT]	[NT]

Client Reference: 233414.02, Belmore

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate		Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			08/05/2025	2	08/05/2025	08/05/2025		08/05/2025	[NT]
Date analysed	-			09/05/2025	2	09/05/2025	09/05/2025		09/05/2025	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	2	1.1	1.1	0	106	[NT]

QUALITY CONTROL: Ion Balance				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			07/05/2025	1	07/05/2025	07/05/2025		07/05/2025	[NT]
Date analysed	-			07/05/2025	1	07/05/2025	07/05/2025		07/05/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	23	[NT]		99	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	4	[NT]		92	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	670	[NT]		103	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	38	[NT]		99	[NT]
Hardness (calc) equivalent CaCO <sub>3</sub>	mg/L	3	Metals-020	[NT]	1	210	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	1	610	[NT]		[NT]	[NT]
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	1	<5	[NT]		[NT]	[NT]
Total Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	1	610	[NT]		113	[NT]
Sulphate, SO <sub>4</sub>	mg/L	1	Inorg-081	<1	1	190	190	0	95	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	1	540	540	0	97	[NT]
Ionic Balance	%		Inorg-040	[NT]	1	3.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	379841-2
Date prepared	-			07/05/2025	1	07/05/2025	07/05/2025		07/05/2025	07/05/2025
Date analysed	-			07/05/2025	1	07/05/2025	07/05/2025		07/05/2025	07/05/2025
pH	pH Units		Inorg-001	[NT]	1	6.6	[NT]		99	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	3500	[NT]		100	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	38	[NT]		98	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	2200	[NT]		111	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	<0.004	1	<0.004	<0.004	0	116	75
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.11	0.096	14	103	100
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.007	0.007	0	95	112
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.12	0.10	18	101	102
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.04	0.04	0	97	95
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	0.2	0.2	0	[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.3	0.3	0	96	83
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.02	0.02	0	95	83

QUALITY CONTROL: Miscellaneous Inorganics				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	07/05/2025	07/05/2025		[NT]	[NT]
Date analysed	-			[NT]	2	07/05/2025	07/05/2025		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	2	6.3	[NT]		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	2	14000	[NT]		[NT]	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	2	570	530	7	[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	2	9300	[NT]		[NT]	[NT]
Total Cyanide	mg/L	0.004	Inorg-014	[NT]	2	<0.004	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	2	0.01	[NT]		[NT]	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	[NT]	2	<0.005	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	2	0.01	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	2	0.16	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	[NT]	2	<0.2	[NT]		[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	[NT]	2	0.3	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	2	0.4	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	2	0.059	[NT]		[NT]	[NT]

## Result Definitions

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

## Quality Control Definitions

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

## Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

## Report Comments

Microbiology analysed by Sonic Food & Water Testing. Report no. W2510391.

The time between collection and the commencement of testing should not exceed 24 hours. Samples tested outside this time may have their results compromised.