



**SITE HYDROGEOLOGY REPORT**  
**465-469 PRINCES HIGHWAY & 5-7 GEEVES**  
**AVENUE, ROCKDALE NSW**

Prepared for:

**EMAG APARTMENTS PTY LTD**

**Reference: P3324\_03**

**14 January 2025**

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# 1 INTRODUCTION

## 1.1 Overview

Morrow Geotechnics Pty Ltd has carried out a Groundwater Study and prepared a Site Hydrogeology Report for the proposed development at 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW (the site) also known as Lot A & B in DP 315664, Lot A in DP 306355, Lot 1 in DP 131822 and Lot A & B in DP 402977.

The following geotechnical report has been prepared for the site:

- Morrow Geotechnics Pty Ltd, Geotechnical Investigation Report, *465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW*, referenced P3324\_01, and dated 24 September 2024 (MG 2024).

The previous geotechnical report presents the results of site investigations for the proposed development and geotechnical recommendations for design and construction.

## 1.2 Proposed Development

Architectural drawings have been provided by Axel Richter Architects, *Co-Living 465-469 Princes Highway & 5-7 Geeves Avenue Rockdale NSW 2216*, Rev A, dated 30 April 2024, including:

- A100 Site Plan;
- A101 Basement 2;
- A102 Basement 1;
- A200 East Elevation; and
- A201 North Elevation.

From the documentation provided, Morrow Geotechnics understands that the proposed development involves the construction of a six storey multi-dwelling structure over a two level basement. Excavation for the proposed basement is expected to extend to a maximum depth of up to 6.0 m below existing ground level (mBGL) to a depth of RL 9.1 mAHD.

## 1.3 Proposed Dewatering Schedule

Given the moderate to high permeability of the alluvium profile encountered in the geotechnical investigation it is proposed to construct the basement using a cut-off wall socketed into bedrock to minimise groundwater flows. Minor groundwater seepage around the cut-off wall will be allowed to drain through sub-slab drainage and collected by sump pits within the basement.

The excavation program for the proposed basement is expected to take up to 4 months. Temporary construction dewatering is expected to occur for construction seepage inflows during this 4 month period.

## 1.4 Objectives

The objective of this Site Hydrogeology Report is to provide results on the presence of water at the site and comment on whether there is an aquifer present at the site in accordance with the definition of aquifer as laid out in the NSW DPI Office of Water *Aquifer Interference Policy*. Section 1.2 of the policy defines an aquifer as

“the term ‘aquifer’ is commonly understood to mean a groundwater system that is sufficiently permeable to allow water to move within it, and which can yield productive volumes of groundwater”

Further, this report provides analysis of the permeability of soils encountered within boreholes at the site and geotechnical advice and recommendations on the management of groundwater in the design and construction of the proposed development.

## **2 GEOLOGICAL MODEL**

### **2.1 Published Geological Mapping**

Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130) indicates that the site is underlain by (Rh) Hawkesbury Sandstone, which is typically comprised of medium to coarse-grained quartz sandstone, with very minor shale and laminite lenses.

### **2.2 Published Soil Landscapes**

The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 (2nd Edition) indicates that the site overlies the Newport Landscape. This landscape type typically includes gently undulating plains of Holocene sands to rolling rises over other soils or bedrock. Soils are generally shallow (< 0.5 m) siliceous sands overlaying moderately deep buried sands (< 1.5m) yellow podzolic soil with sandy topsoil on crests and deep (> 2.0m) podzols in depressions earthy sands. These soils are noted present high soil erosion hazards, localized steep slopes, very low soil fertility and non-cohesive topsoil.

### **2.3 Site Description**

During the Geotechnical and Hydrogeological Investigations, the site was occupied by single and two storey commercial properties. The site has no vegetation or trees. The site is bounded to the north by a single storey commercial building, to the east by the Princes Highway, to the south by Geeves Avenue and commercial properties and to the east by the Rockdale Train Station Carpark and Train Station. The site covers approximately 927.3 m<sup>2</sup>. The site topography slopes gently towards the south east, with elevations on the site ranging from RL 15.65 mAHD in the north west corner of the site to RL 14.95 mAHD in the south east corner of the site.



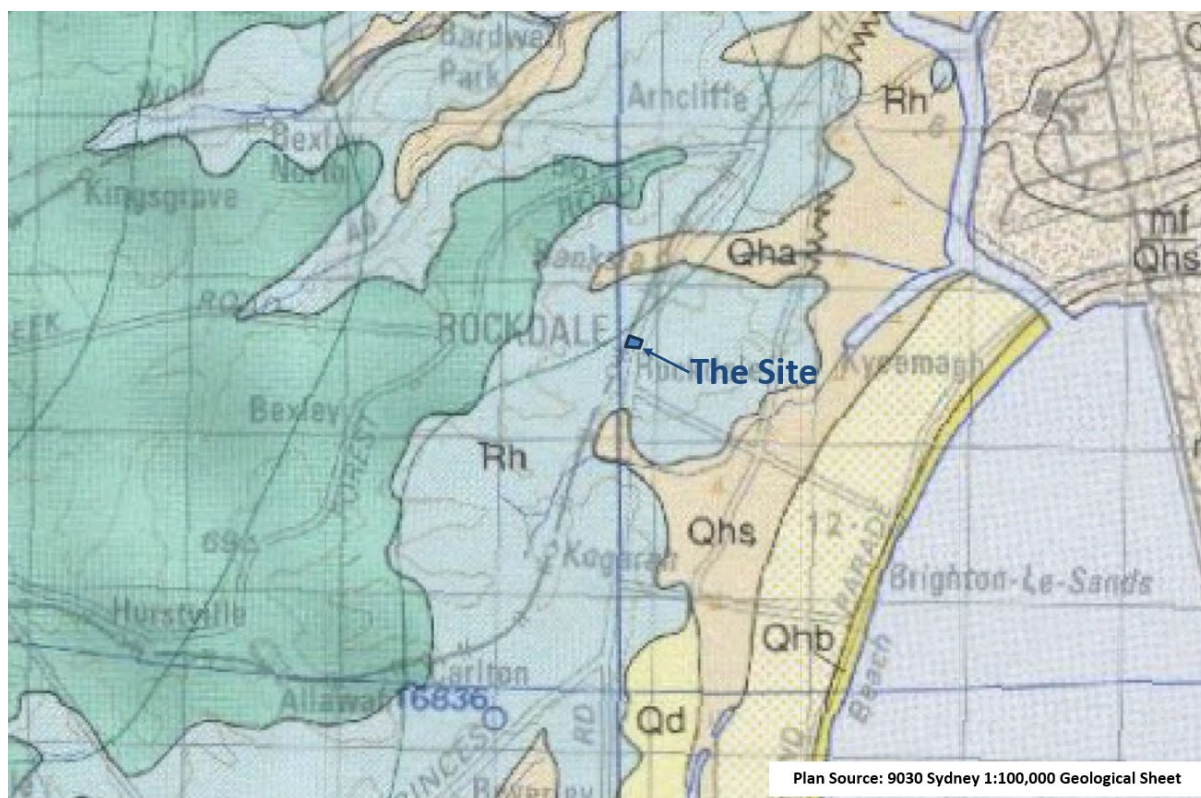


Figure 1: Regional Geology taken from Sydney 1:100,000 Geological Sheet

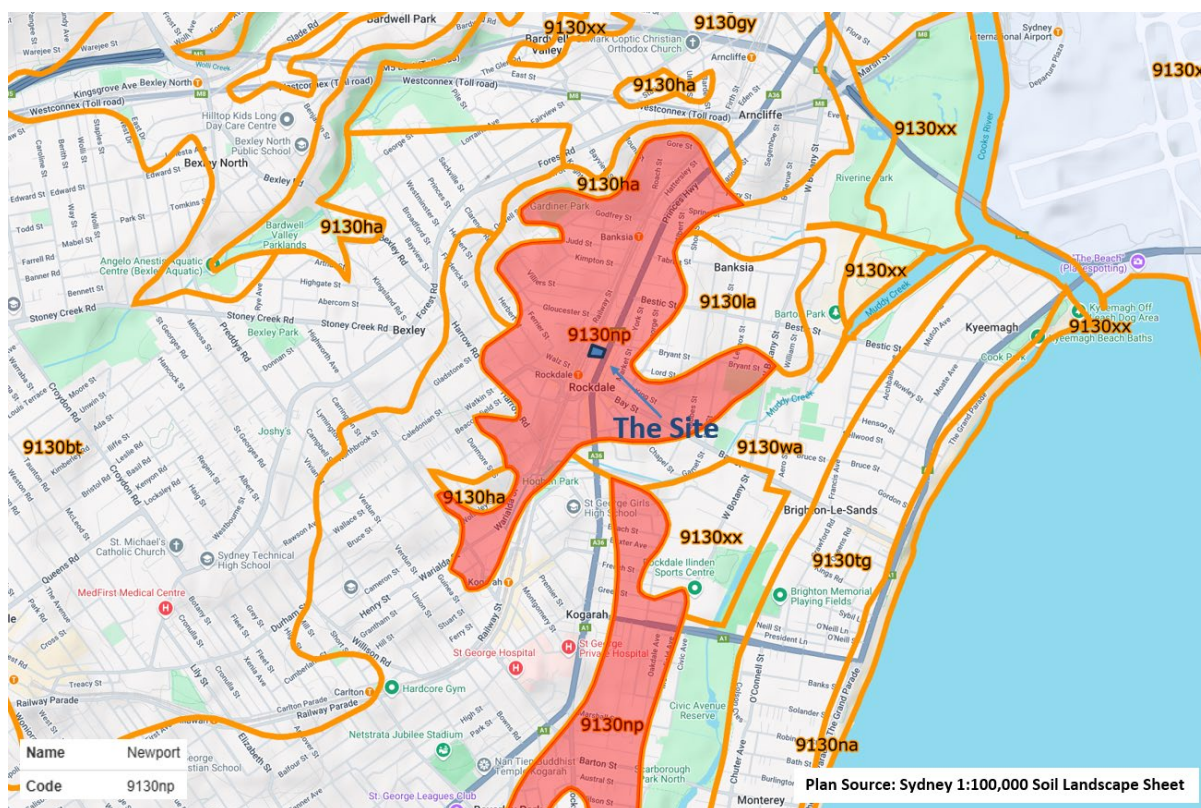
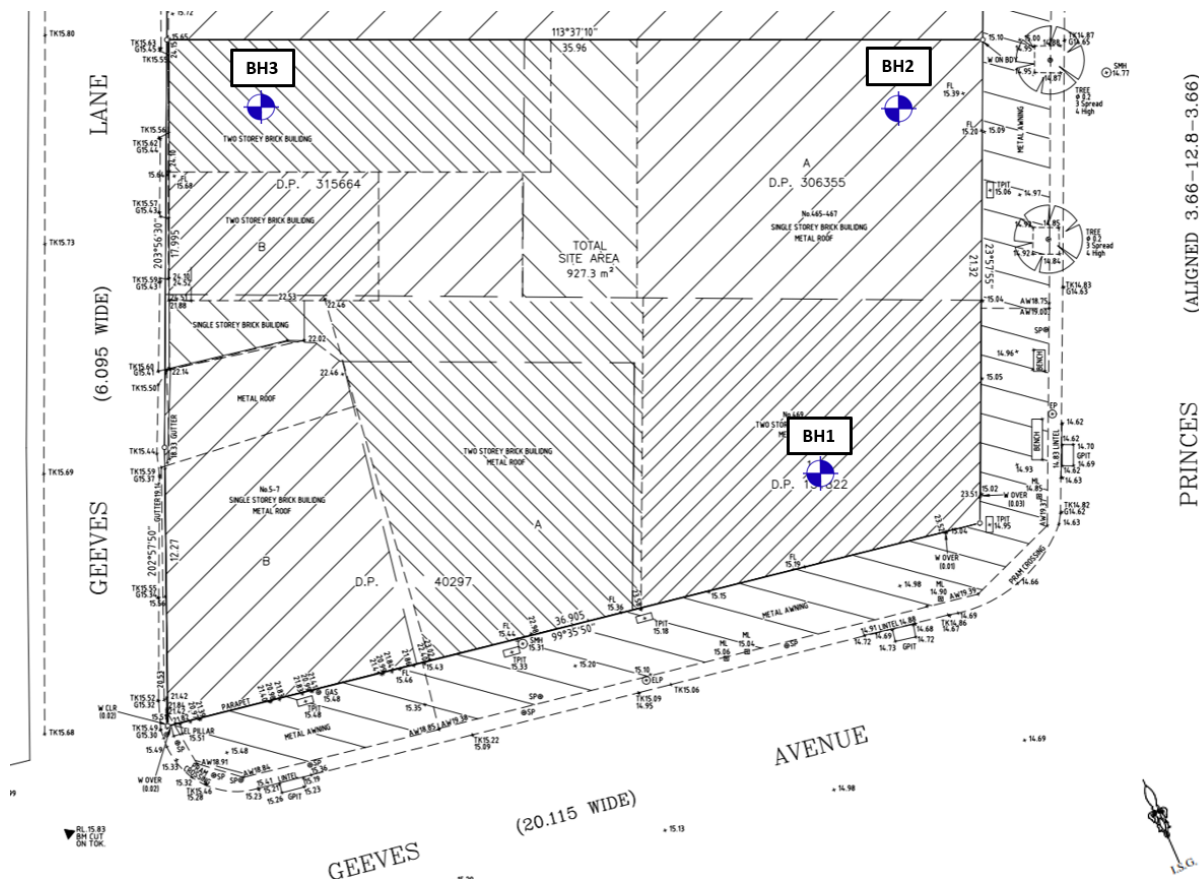


Figure 2: Soil Landscapes taken from Sydney 1:100,000 Soil Landscape Sheet

## 2.4 Stratigraphic Model

Three boreholes were drilled in total (BH1 to BH3). The boreholes were drilled using a man-portable drilling rig using NMLC coring techniques to depths of 18.41, 18.90 and 16.30 mBGL (metres below ground level) respectively. Borehole locations are shown on **Figure 3** below:



**Figure 3:** Borehole location plan

The subsurface conditions encountered during the previous investigations indicate that the site is underlain by fill and deep alluvial soils overlying sandstone bedrock. A summary of the subsurface conditions across the site, interpreted from the investigation results, is presented in **Table 1** and **Table 2**. Borehole Locations are shown on the plan attached to this report.

**TABLE 1 SUMMARY OF ENCOUNTERED SUBSURFACE CONDITIONS**

Unit	Material	Comments
1	Fill	Sandy gravelly FILL, generally loose to medium dense, fine to medium grained, moist with gravels and construction waste. Unit 1 is inferred to be uncontrolled and poorly compacted.
2	Alluvial Soil	Alluvial clayey SAND, low plasticity, dense, fine to medium grained grading to alluvial sandy CLAY with depth, very stiff to hard, high plasticity, fine grained, trace ironstone gravels.
3	Class V Sandstone	Extremely weathered SANDSTONE, extremely low strength, fine to medium grained, iron stained with sandy clay bands.
4	Class IV Sandstone	Moderately to distinctly weathered SANDSTONE, sub horizontal bedding, low to medium strength, fine to medium grained and iron stained. Defects within Unit 4 comprised sub-horizontal bed partings and trace infilled clay seams.
5	Class III Sandstone	Moderately weathered SANDSTONE, sub horizontal bedding, medium strength, fine to medium grained and iron stained. Defects within Unit 3 comprised sub-horizontal bed partings.



**TABLE 2** ENCOUNTERED GEOTECHNICAL CONDITIONS

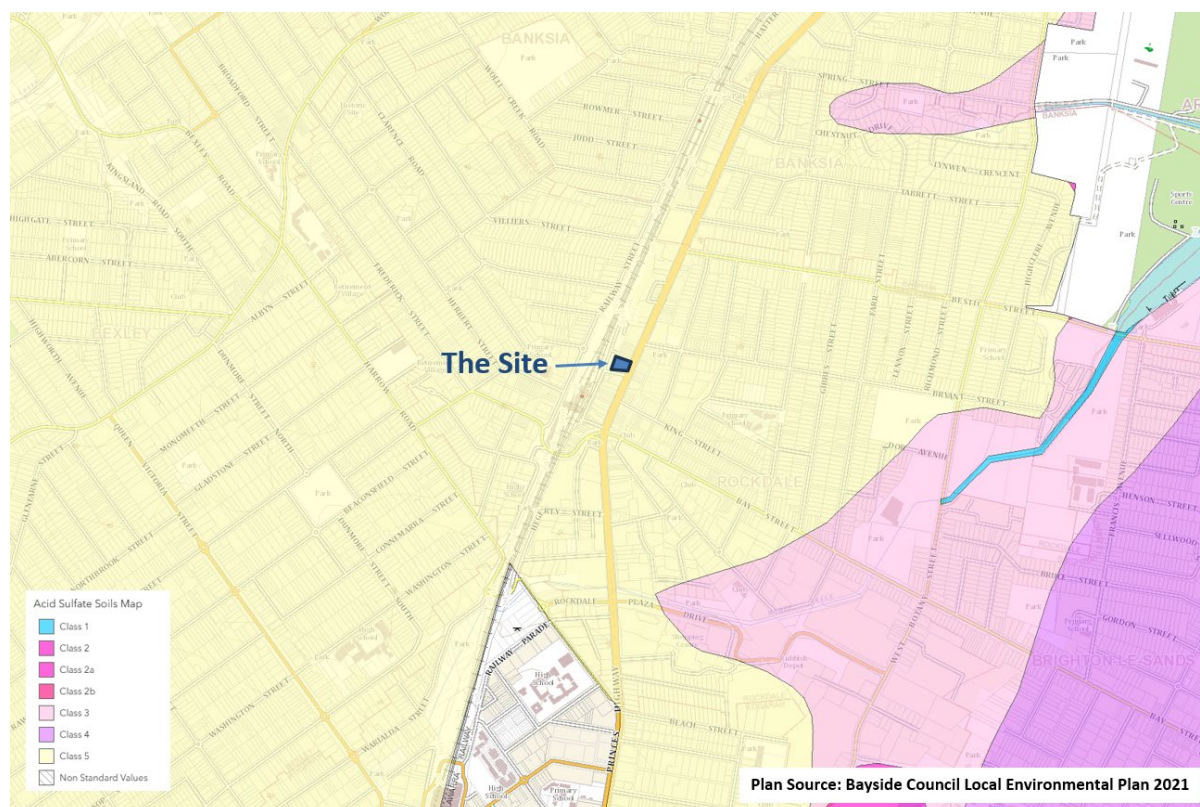
Unit	Approx. Depth Range of Unit <sup>1</sup> mBGL (RL mAHD)		
	BH1	BH2	BH3
<b>1</b> <b>Fill</b>	0.0 to 0.8 (15.2 to 14.4)	0.0 to 1.9 (15.3 to 13.4)	0.0 to 2.8 (15.6 to 12.8)
<b>2</b> <b>Alluvial Soil</b>	0.8 to 13.6 (14.4 to 1.6)	1.9 to 16.7 (13.4 to -1.4)	2.8 to 15.0 (12.8 to 0.6)
<b>3</b> <b>Class V Sandstone</b>	13.6 to 16.1 (1.6 to -0.9)	16.7 to 17.0 (-1.4 to -1.7)	15.0 to 15.4 (0.6 to 0.2)
<b>4</b> <b>Class IV Sandstone</b>	16.1 to 18.4 (-0.9 to -3.2)	17.0 to 17.9 (-1.7 to -2.6)	15.4 to 16.3 (0.2 to -0.7)
<b>5</b> <b>Class III Sandstone</b>	-	17.9 to 18.9 (-2.6 to -3.6)	-

**Notes:**

- 1 Depths shown are based on material observed within test locations and will vary across the site.
- 2 The top of Unit 3 is inferred during drilling and may vary across site.
- 3 Sandstone classed as per Pells (2004)

## 2.5 Acid Sulfate Soils

According to the Bayside Local Environmental Plan 2021 the site is located in a Class 5 area of Acid Sulfate Soils (see location in **Figure 4** below). Acid sulfate soils are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres on adjacent class 1,2,3 or 4 land.



**Figure 4:** Acid Sulfate Soils Map with site location

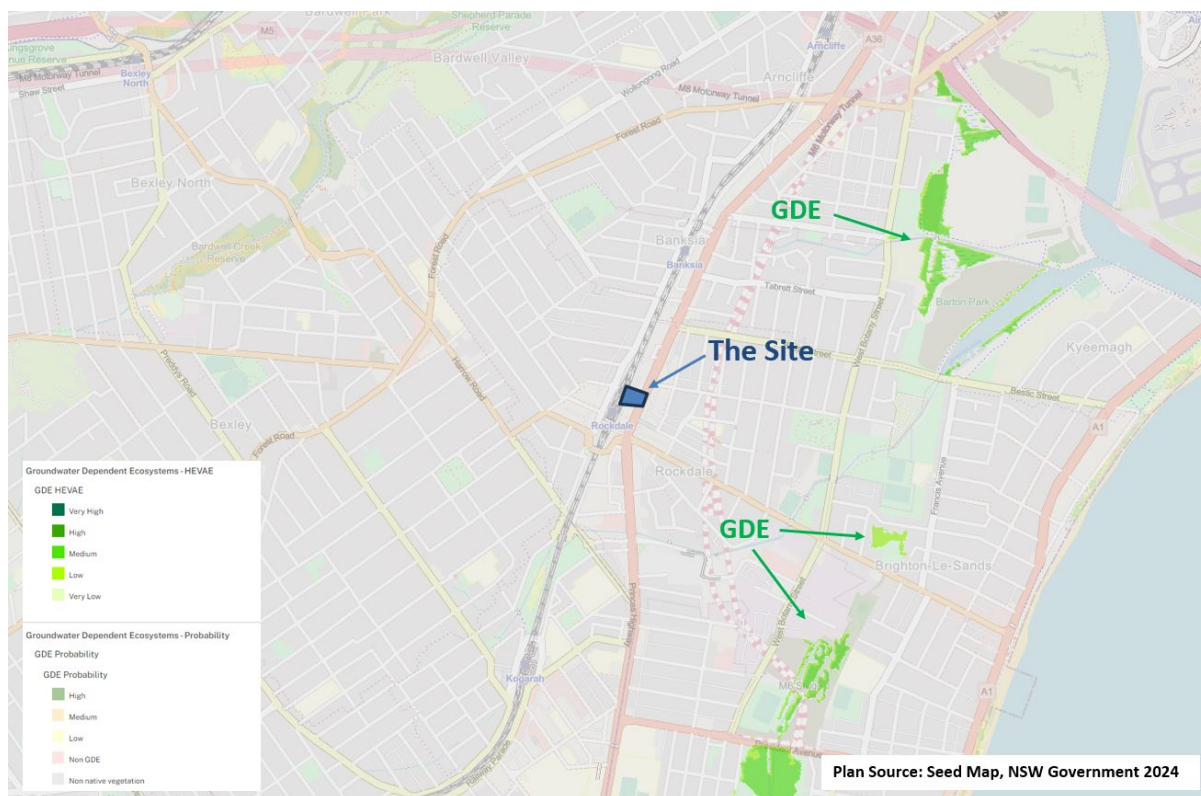
## 2.6 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecosystems that rely on groundwater to fulfill all or part of their water needs, ensuring the survival of their plant and animal communities, as well as their ecological processes and services (NSW DPE 2023). The reliance of GDEs on groundwater can be seasonal, continual, or episodic (Howe et al. 2007). These ecosystems vary widely in size, ranging from just a few meters to several square kilometres. GDEs can be categorized into three main types (Eamus et al. 2006; Richardson et al. 2011):

- **Groundwater Dependent Vegetation (Terrestrial GDEs):** These ecosystems depend on the subsurface presence of groundwater, often accessed through the capillary fringe or vadose zone (the unsaturated subsurface area just above the water table) (Naumburg et al. 2005; Eamus et al. 2006a). Within these communities, plant species may exhibit varying degrees of groundwater dependency, from complete reliance on groundwater to partial or infrequent dependency (Hatton and Evans 1998; Zencich et al. 2002; Eamus et al. 2006; Froend and Drake 2006).
- **Aquatic GDEs:** These environments occur where groundwater surfaces, such as in rivers, wetlands, and springs. Aquatic GDEs are considered dependent on groundwater if groundwater is essential to the biota and ecological processes at any stage of the ecosystem's life span (Howe et al. 2007).
- **Subterranean GDEs:** These ecosystems exist within the saturated zones of aquifers, including water-filled spaces in various geological matrices such as karst (caves), fractured rock, and alluvial systems. They also encompass hyporheic ecosystems, which occur within the sediments of surface waters, acting as a transitional zone between surface and groundwater ecosystems (Hose et al. 2022).

GDEs include a wide range of environments like aquifers, lakes, streams, springs, cave systems, swamps, and wetlands. They rely on groundwater to meet their water requirements, which is crucial for maintaining their flora and fauna. The level of groundwater dependence and the nature of this reliance affect how GDEs respond to changes in groundwater quality and quantity. Groundwater extraction can negatively impact these ecosystems.

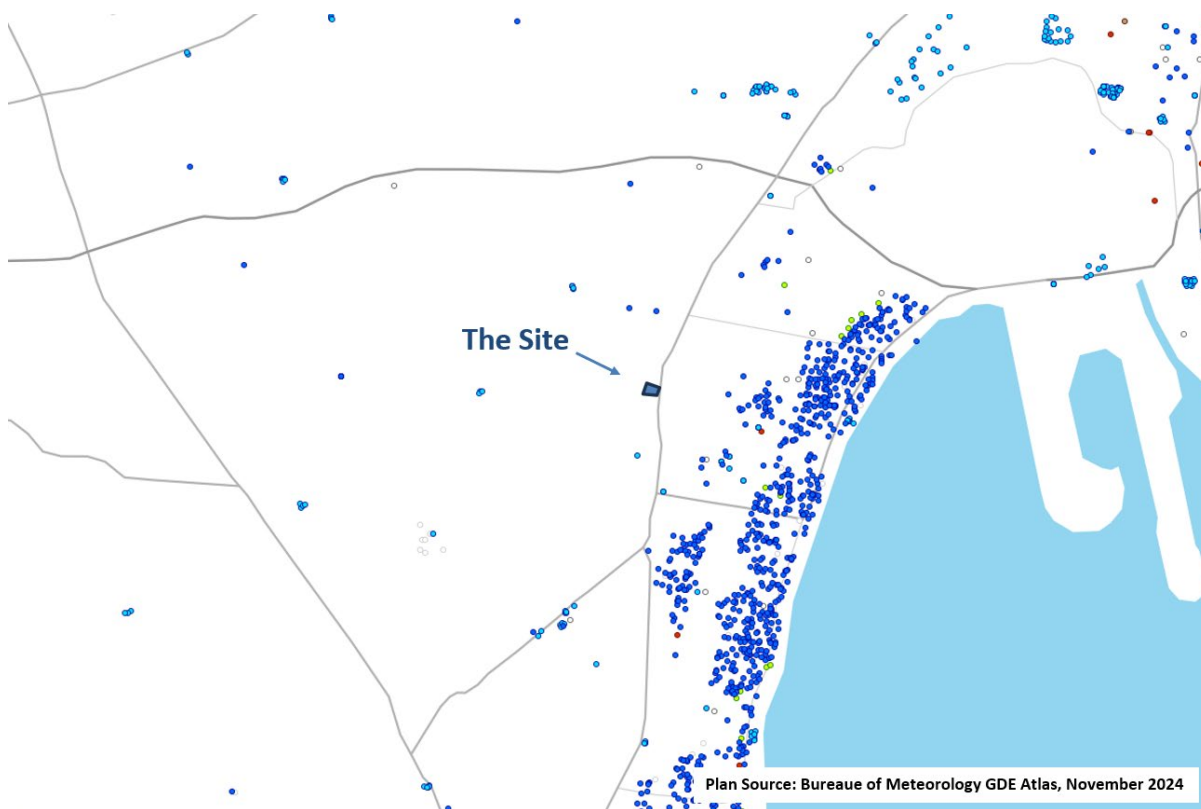
According to New South Wales Government mapping (see location in **Figure 5** below), the site is approximately 1,300 metres north west of a GDE located at Bruce St & Rockdale Bicentennial Park and 1,200 metres south west of a GDE located at Barton Park.



**Figure 5:** Groundwater Dependent Ecosystems with site location

## 2.7 Groundwater Monitoring Bores

According to the Bureau of Meteorology (BOM) Groundwater Dependent Ecosystems Atlas the locations of identified water supply bores are shown on **Figure 6** below.



**Figure 6:** Monitoring Bores with site location

### 3 HYDROGEOLOGICAL MODEL

#### 3.1 Groundwater Observations

Standpipe piezometer wells were installed the boreholes (BH1, BH2 and BH3) as part of the geotechnical investigations, monitoring well construction details are found in **Table 3** below. Before the installation of the piezometers, drill cuttings and water in the boreholes were flushed out. The monitoring wells were constructed using 50 mm diameter screw threaded PVC casing, sections of which were machine slotted. The annulus between the casing and boreholes was backfilled using 2 mm filter gravel pack to above the top of the screen. A bentonite plug with a minimum thickness of 0.5m was then installed above the gravel pack, the remaining annulus was backfilled with drill cuttings. The wells were each finished with a cement plug and a gatic cover.

Groundwater levels within the three piezometer wells have been monitored by Morrow Geotechnics between 18 September 2024 and 10 January 2025.

**TABLE 3**                    **PIEZOMETER DETAILS**

Piezometer	BH1	BH2	BH3
<b>Top of Piezometer approx. RL (mAHD)</b>	15.2	15.3	15.6
<b>Piezometer Depth mBGL</b>	18.4	18.9	7.0
<b>Bentonite Plug Depth mBGL</b>	1.0 to 1.4	4.0 to 5.8	1.5 to 3.0
<b>Screen Depth mBGL</b>	1.4 to 18.4	6.9 to 18.9	2.5 to 7.0
<b>Well Development Date</b>	13/09/2024	16/09/2024	17/09/2024

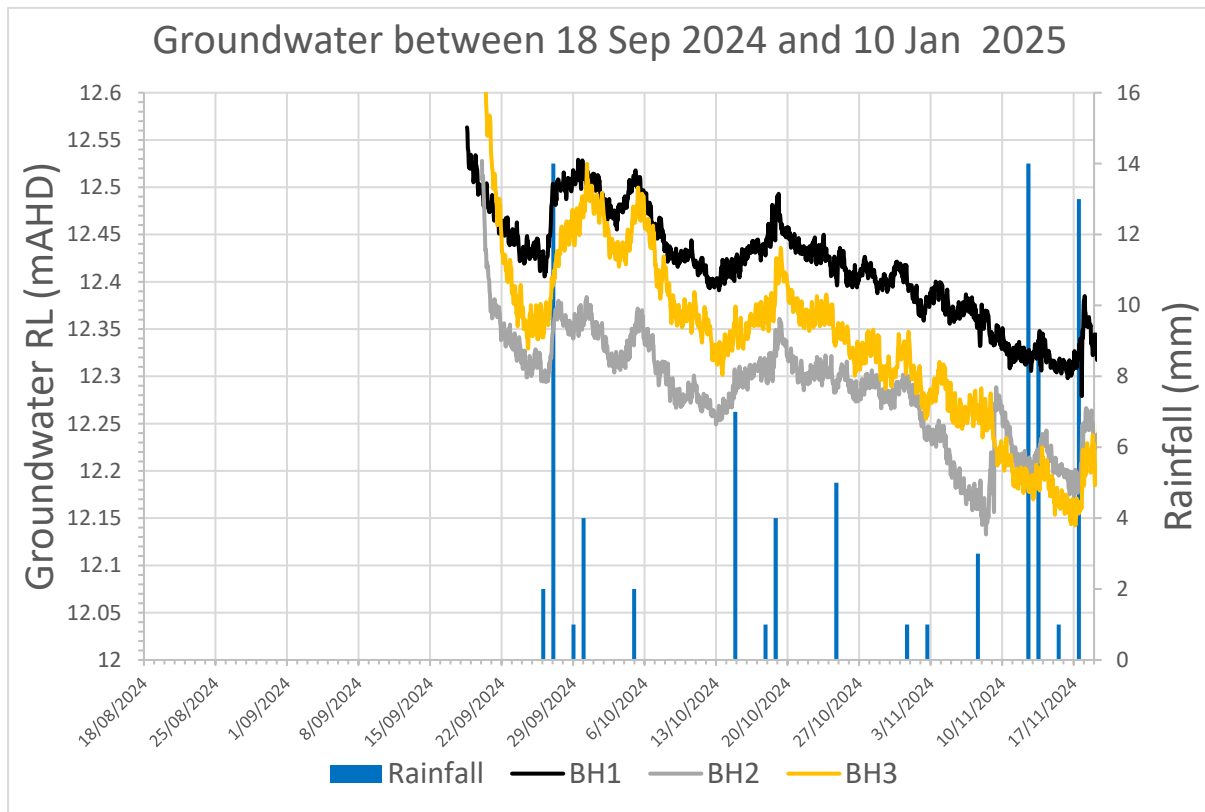
**TABLE 4**                    **WATER LEVELS FROM MANUAL READINGS**

Monitoring Date	Piezometer Groundwater Level mBGL (RL mAHD)		
	BH1	BH2	BH3
<b>18/9/2024</b>	2.66 mBGL (12.54 mAHD)	2.94 mBGL (12.36 mAHD)	1.27 mBGL (14.33 mAHD)
<b>19/11/2024</b>	2.89 mBGL (12.31 mAHD)	3.08 mBGL (12.22 mAHD)	3.4 mBGL (12.2 mAHD)
<b>10/01/2025</b>	2.64 mBGL (12.56 mAHD)	2.92 mBGL (12.38 mAHD)	2.87 mBGL (12.73 mAHD)

Automatic dataloggers were installed within BH1, BH2 and BH3 in order to provide long term groundwater measurements. Dataloggers were installed within the piezometers on 18 September 2024, the loggers were set to measure groundwater levels at one hour intervals. Groundwater measurements were recorded



between 18 September 2024 and 10 January 2025. Graphs of water level measurements taken by the automatic dataloggers are displayed in **Figure 7** to **Figure 10** below. Daily rainfall totals taken from Bureau of Meteorology Sans Souci 9Public School) AWS {station 66058} for the monitoring period are displayed alongside water level measurements.



**Figure 7:** Data Logger Measurements and Daily Rainfall

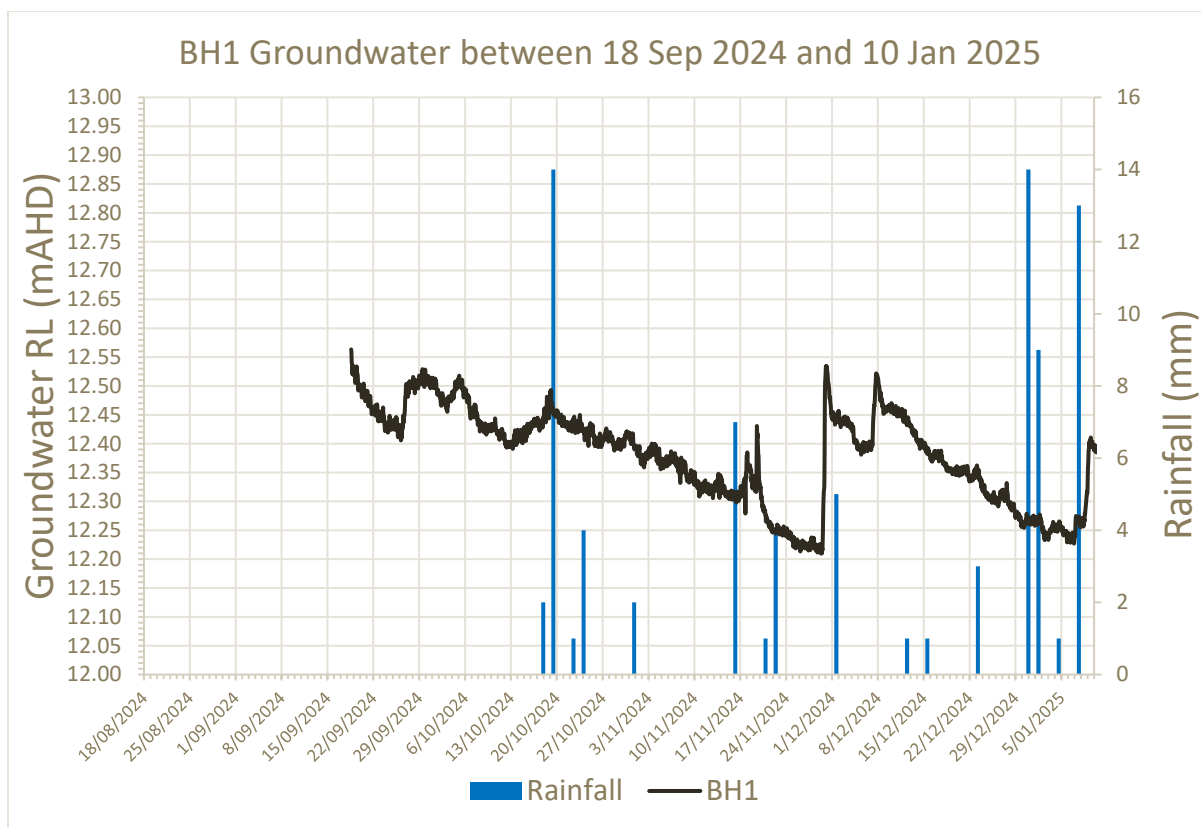


Figure 8: BH1 Data Logger Measurements and Daily Rainfall

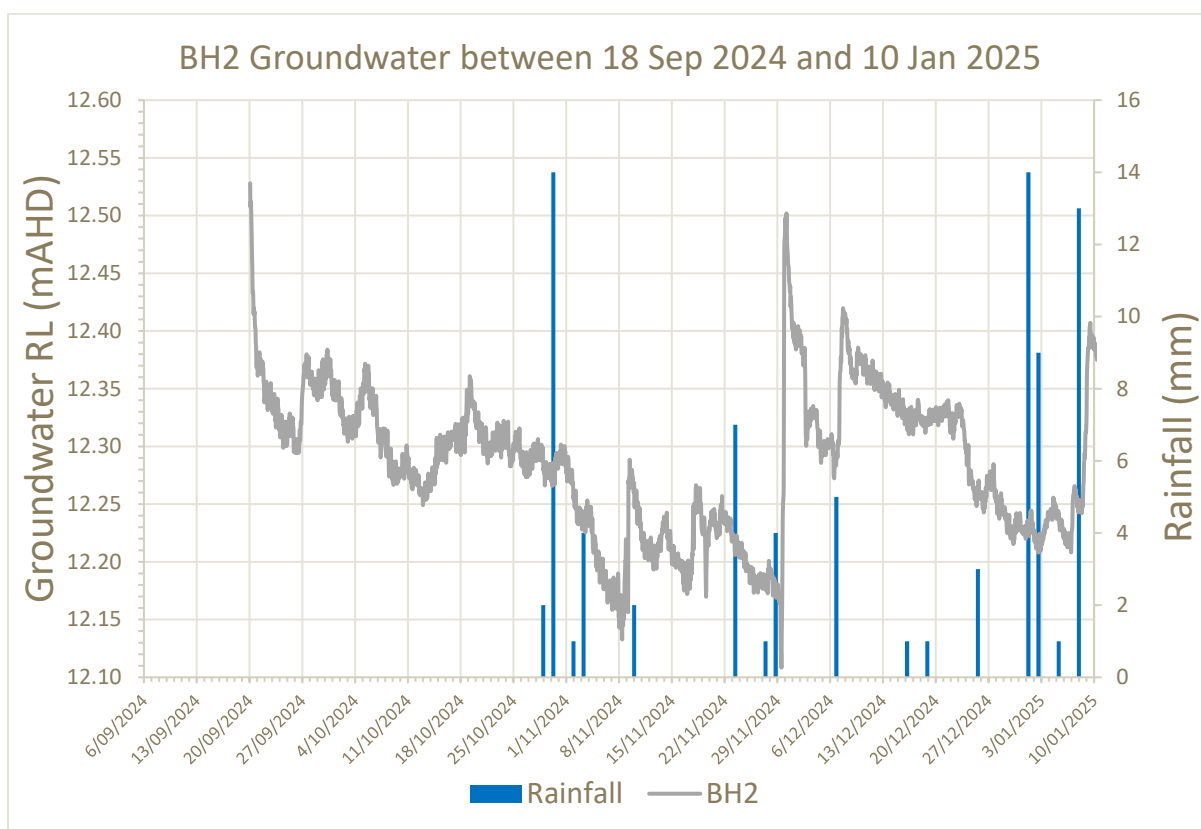
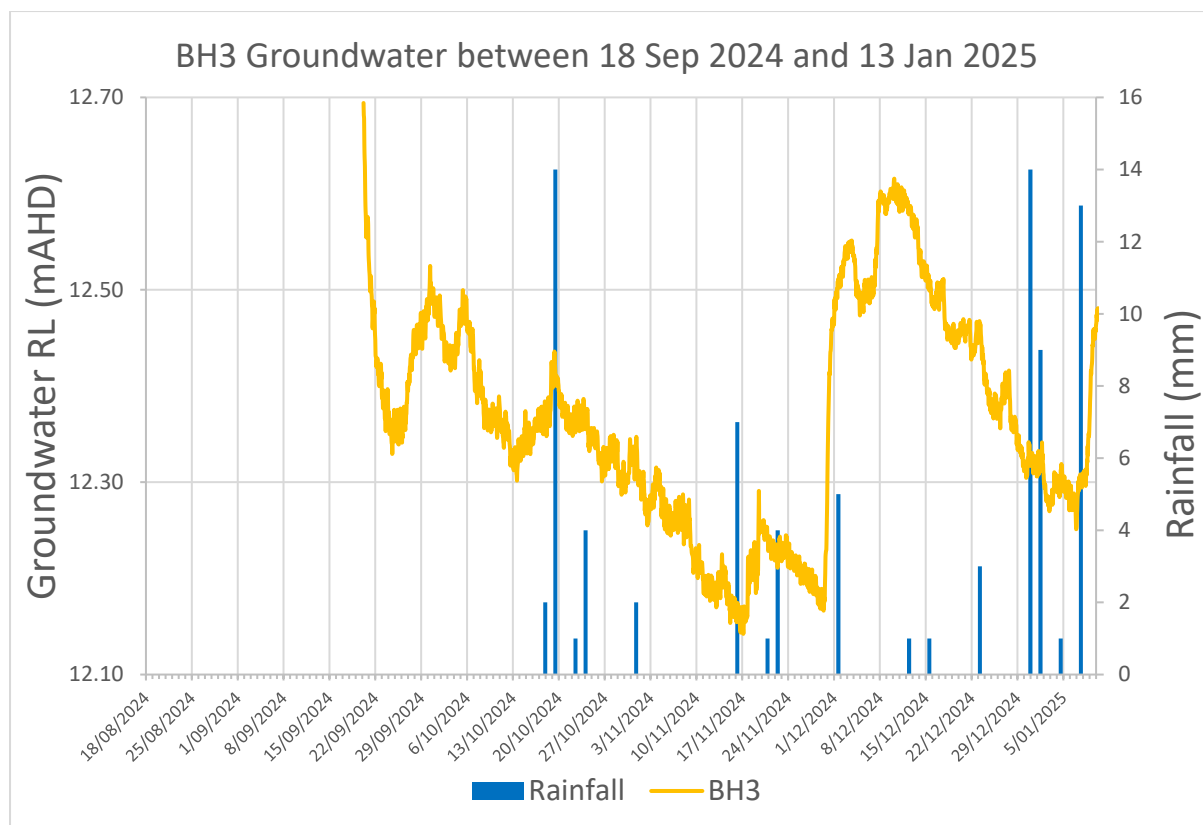


Figure 9: BH2 Data Logger Measurements and Daily Rainfall





**Figure 10:** BH3 Data Logger Measurements and Daily Rainfall

A summary of the groundwater observations within the three wells is provided below:

**TABLE 5** **GROUNDWATER OBSERVATION SUMMARY**

Monitoring Date	Piezometer Groundwater Level mBGL (RL mAHD)		
	BH1	BH2	BH3
<b>Maximum Water Level</b>	2.63 mBGL	2.77 mBGL	2.90 mBGL
	(12.56 mAHD)	(12.52 mAHD)	(12.69 mAHD)
<b>Minimum Water Level</b>	2.99 mBGL	3.19 mBGL	3.45 mBGL
	(12.21 mAHD)	(12.11 mAHD)	(12.14 mAHD)
<b>Average Water Level</b>	2.82 mBGL	3.01 mBGL	3.23 mBGL
	(12.38 mAHD)	(12.28 mAHD)	(12.36 mAHD)
<b>Median Water Level</b>	2.80 mBGL	3.00 mBGL	3.24 mBGL
	(12.39 mAHD)	(12.29 mAHD)	(12.35 mAHD)

Average groundwater levels at the three piezometers are within the Unit 2 – Alluvial Soil and range from RL 12.28 to 12.38 mAHD. The groundwater levels within the alluvial soil represent a stable hydraulic gradient approximately 2.8 to 3.2 mBGL.

Water levels within the boreholes were only slightly responsive to rainfall events during the three month monitoring period. This is inferred to result from surface water infiltration following rainfall recharging the groundwater.

The results of the water level monitoring show a stable hydraulic level across the site at approximately 12.3 mAHD. On the basis of ongoing groundwater monitoring at the site it is recommended that a design groundwater level for site is taken at 500 mm above the highest recorded groundwater level (i.e. RL 12.8 mAHD).

### 3.2 Hydraulic Conductivity Testing

Rising head and slug permeability tests were carried out on BH1, BH2 and BH3 to give an indication of in-situ permeability of the material at the site. Permeability values were calculated on the basis of the testing in accordance with the formulas provided in British Standard BS5930 -1999 Code of Practice for Site Investigations, Section 21.4.6. Calculation sheets for permeability testing are provided as an attachment to this letter as **Appendix C**. Permeability tests were repeated three times to ensure reliability of results.

Permeability values which were adopted from the testing for the assessment of groundwater seepage volumes are shown in **Table 6** below.

**TABLE 6 BOREHOLE PERMEABILITY VALUES**

Borehole	Permeability Based on In-situ Measurement	
	(m/s)	(m/day)
BH1 Test 1	$5.10 \times 10^{-4}$	44.06
BH1 Test 2	$3.51 \times 10^{-4}$	30.32
BH2 Test 1	$1.66 \times 10^{-5}$	1.43
BH2 Test 2	$2.21 \times 10^{-5}$	17.10
BH2 Test 3	$3.10 \times 10^{-4}$	26.78
BH2 Test 4	$4.33 \times 10^{-4}$	37.411
BH2 Test 5	$2.99 \times 10^{-4}$	25.83
BH2 Test 6	$1.36 \times 10^{-5}$	1.17
BH3 Test 1	$3.54 \times 10^{-4}$	30.58
BH3 Test 2	$3.10 \times 10^{-4}$	26.78

Borehole permeability results varied across the test locations by approximately 1 order of magnitude.

As indicated above, measured groundwater levels at the three piezometers are within the Unit 2 – Alluvial Soil. nBased on the geotechnical investigation and ongoing monitoring it is possible to conclude that the hydrogeological conditions at the site comprise a phreatic watertable within a moderate permeability soil aquifer.

Look's *Handbook of Geotechnical Investigation and Design Tables* (2007) notes that permeability of poorly graded sand typically ranges from less than  $1 \times 10^{-4}$  m/s to  $1 \times 10^{-2}$  m/s. The lower permeability values recorded at the site are inferred to result from the high clay content encountered within the investigations having relatively low pore space.

On the basis of average permeability testing at the site it is recommended that a design permeability of the alluvium of  $5.1 \times 10^{-4}$  m/s is adopted, representing worst-case permeability taken from BH1.

### 3.3 Local Groundwater Regime

On the basis of ongoing groundwater monitoring at the site it is recommended that a design groundwater level for site is taken at RL 12.8 mAHD.

On the basis of the geotechnical investigation and ongoing monitoring it is possible to conclude that the soils at the site are of moderate permeability and that groundwater will be encountered during basement excavation.

On the basis of permeability testing at the site it is recommended that a design permeability of the alluvium of  $5.1 \times 10^{-4}$  m/s is adopted.

### 3.4 Water Quality Observations

A sample of the water to be discharged was taken on 19 November 2024 and sent to a NATA accredited laboratory for testing against the Australia and New Zealand Environment Conservation Council ANZECC (2000) guidelines for 95% protection of marine ecosystems (in the absence of guidelines the criteria for fresh waters was used) and National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013). Relevant water quality results are presented in **Table 7** to **Table 11**, lab results are attached in **Appendix B**.

The groundwater samples were taken from BH1, BH2 and BH3 using an electric powered pump with a length of ¼ inch low-density polyethylene (LDPE) tubing. The groundwater sample was collected from the outflow tube and stored in containers proved by SGS laboratory. The containers were immediately placed in an esky with ice packs to maintain a cool temperature and delivered to SGS laboratory same day. Disposable nitrile gloves were used for sample collection to minimize potential contamination.

**TABLE 7 WATER QUALITY RESULTS – PHYSICAL PARAMETERS**

Analytes	Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
	BH1	BH2	BH3					
Bicarbonate Alkalinity as CaCO <sub>3</sub> (mg/L)	<5	<5	270	-	-	-	-	-
Carbonate Alkalinity as CaCO <sub>3</sub> (mg/L)	<1	<1	<1	-	-	-	-	-
Hydroxide Alkalinity as CaCO <sub>3</sub> (mg/L)	<5	<5	<5	-	-	-	-	-
Total Alkalinity as CaCO <sub>3</sub> (mg/L)	<5	<5	270	-	-	-	-	-
pH	4.3	4.5	7.1	-	-	-	-	-
Electrical Conductivity (µS/cm)	320	260	650	-	-	-	-	-

Analytes	Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
	BH1	BH2	BH3					
Redox Potential (Eh) (mV)	-	-	381	-	-	-	-	-
Total Dissolved Solids (TDS) (mg/L)	190	150	390	-	-	-	-	-
Total Hardness (mg/L)	-	-	270	-	-	-	-	-
Dissolved Oxygen (DO) (mg/L)	-	-	2.1	-	-	-	-	-
Turbidity (NTU)	-	-	130	-	-	-	-	-
Total Suspended Solids (TSS) (mg/L)	230	1400	120	-	-	-	-	-
Total Organic Carbon (TOC) (mg/L)	-	-	15	-	-	-	-	-
Sodium Absorption Ration (SAR)	-	-	1.1	-	-	-	-	-

**TABLE 8 WATER QUALITY RESULTS – MAJOR ANIONS & MAJOR CATIONS**

Analytes	Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
	BH1	BH2	BH3					
Major Anions	Sulfate, SO <sub>4</sub> (mg/L)	48	21	32	-	-	-	-
	Chloride (mg/L)	42	35	29	-	-	-	-
	Carbonates (CO <sub>3</sub> ) (meq/L)	<0.03	<0.03	<0.03	-	-	-	-
	Bromide (Br) (mg/L)	-	-	0.08	-	-	-	-
	Fluoride (F) (mg/L)	-	-	<0.10	-	-	-	-
Major Cations	Calcium (Ca) (mg/L)	8.6	3.1	92	-	-	-	-
	Magnesium (Mg) (mg/L)	10.0	6.7	9.1	-	-	-	-
	Sodium (Na) (mg/L)	22	24	40	-	-	-	-
	Potassium (K) (mg/L)	3.6	2.0	5.4	-	-	-	-
	Cation/Anion Balance (%)	-	-	2	-	-	-	-

**TABLE 9 WATER QUALITY RESULTS – DISSOLVED INORGANICS AND DISSOLVED HEAVY METALS**

Analytes	Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
	BH1	BH2	BH3					
Aluminum (Al) (µg/L)	-	-	<5	-	-	-	0.8 (pH<6.5) * 55 (pH>6.5) *	-
Antimony (Sb) (µg/L)	-	-	<1	-	-	-	91*	-
Arsenic (As) (µg/L)	<1	<1	<1	-	24	-	24	-
Barium (Ba)	-	-	38	-	-	-	-	-
Beryllium (Be)	-	-	<1	-	-	-	-	-
Boron (B) (µg/L)	-	-	60	-	-	-	940	-
Cadmium (Cd) (µg/L)	0.3	<0.1	<0.1	-	0.2	0.7	0.2	5.5
Chromium (Cr) (µg/L)	<1	<1	<1	-	1	4.4	-	-
Cobalt (Co) (µg/L)	-	-	5	-	-	-	1.4*	1
Copper (Cu) (µg/L)	2	1	<1	-	1.4	1.3	1.4	1.3
Iron (Fe)	-	-	<5	-	-	-	-	-
Lead (Pb) (µg/L)	2	<1	<1	-	3.4	4.4	3.4	4.4
Lithium (Li) (mg/L)	-	-	<0.005	-	-	-	-	-
Manganese (Mn) (µg/L)	10	6.7	9.1	-	-	-	1900	-
Mercury (Hg) (mg/L)	<0.0001	<0.0001	<0.0001	-	0.06	0.1	0.6	0.4
Molybdenum (Mo) (µg/L)	-	-	1	-	-	-	34*	-
Nickel (Ni) (µg/L)	2	2	1	-	11	7	11	70
Selenium (Se) (µg/L)	-	-	1	-	-	-	11	-
Silica (dissolved SiO2) (mg/L)	-	-	3.9	-	-	-	-	-
Silver (Ag) (µg/L)	-	-	3	-	-	-	0.05	1.4
Strontium (Sr) (µg/L)	-	-	500	-	-	-	-	-
Uranium (U) (µg/L)	-	-	<1	-	-	-	0.5*	-
Vanadium (V) (µg/L)	-	-	<1	-	-	-	6*	100
Zinc (Zn) (µg/L)	15	22	<5	-	8	15	8	8

**Notes:**

1 \*Indicates Default Value – not calculated for protection of 95% species

TABLE 10

## WATER QUALITY RESULTS – NUTRIENTS &amp; MICROBIOLOGICAL ORGANISMS

Analytes		Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
		BH1	BH2	BH3					
Nutrients	Ammonia (NH3) (µg/L)	-	-	0.12	-	-	-	900	910
	Nitrate (NO3) (mg/L)	-	-	0.093	-	-	-	-	-
	Total Nitrogen (N)	-	-	0.57	-	-	-	-	-
	Oxidised Nitrogen (N)	-	-	0.12	-	-	-	-	-
	Total Phosphorus (P) (mg/L)	-	-	0.27	-	-	-	-	-
	Reactive Phosphorus (P) (mg/L)	-	-	<0.005	-	-	-	-	-
Microbiological Organisms	Faecal Coliforms (CFU/100mL)	-	-	5	-	-	-	-	-
	Faecal Streptococci (CFU/100mL)	-	-	2	-	-	-	-	-
	Escherichia Coli (CFU/100mL)	-	-	5	-	-	-	-	-

**TABLE 11 WATER QUALITY RESULTS – ORGANICS**

Analytes	Measured Concentration in Water Sample			Bayside Council	ANZECC (2000) Fresh Water Threshold	ANZECC (2000) Marine Water Threshold	ANZG (2018) Fresh water (95% Species Protection)	ANZG (2018) Marine (95% Species Protection)
	BH1	BH2	BH3					
Benzene (µg/L)	<0.5	<0.5	37	-	950	500	950	700
Toluene (µg/L)	<0.5	<0.5	370	-	-	-	180	180
Ethylbenzene (µg/L)	<0.5	<0.5	200	-	-	-	80	80
O-Xylene (µg/L)	<0.5	<0.5	480	-	350	-	350	-
M/P-Xylene (µg/L)	<1	<1	1300	-	200	-	-	-
Naphthalene (VOC) (µg/L)	<0.5	<0.5	130	-	16	50	16	70
Benzene Toluene Ethylbenzene Xylene (BTEX) (µg/L)	<3	<3	2300	-	-	-	-	-
Total Recoverable Hydrocarbons (TRHs) C6-C10 (µg/L)	<50	<50	22000	-	-	-	-	-
Total Recoverable Hydrocarbons (TRHs) C6-C9 (µg/L)	<40	<40	14000	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAHs) (µg/L)	<1	<1	660	-	-	-	-	-

**A visible layer of hydrocarbons was noted while sampling BH3, the layer was filtered and excluded before inorganic/metals testing.**

Concentrations of **Copper** and **Zinc** are above the ANZG, ANZECC, and NEPM Marine guidelines for the water sample tested at the site.

## 4 STATEMENT OF LIMITATIONS

The advice and parameters presented in this Groundwater Management Plan are for assessment of the expected groundwater seepage based upon the proposed development and encountered site conditions at the investigation locations.

We draw your attention to the document “Important Information”, which is attached to this letter. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Morrow Geotechnics, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

## 5 CLOSURE

Please do not hesitate to contact the undersigned should you have any questions.

For and on behalf of Morrow Geotechnics Pty Ltd,

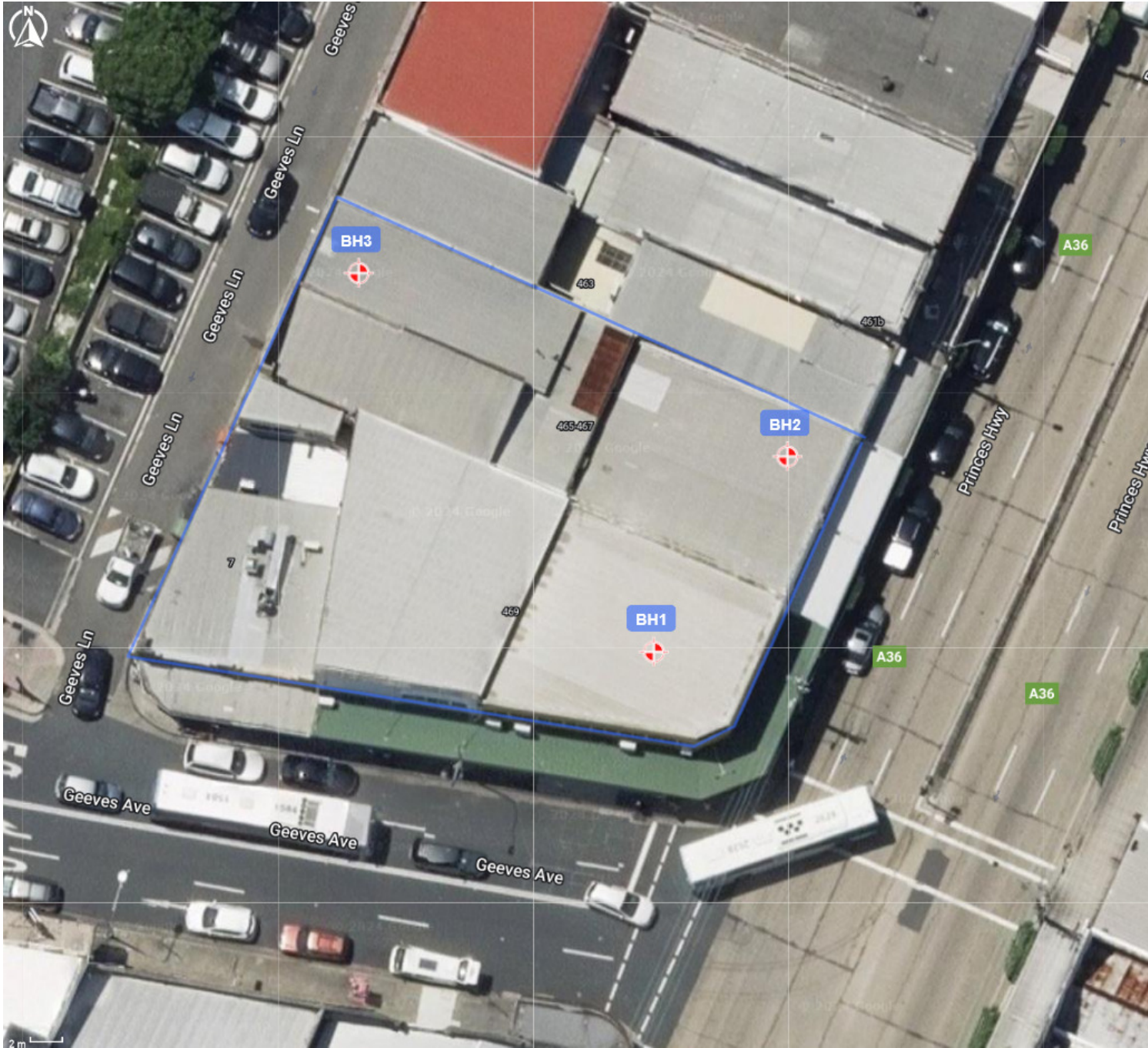







Andrew Butel  
Hydrogeologist/Senior Engineering Geologist  
BSc (Geology), GradCertEngSc, RPGeo, MAIG

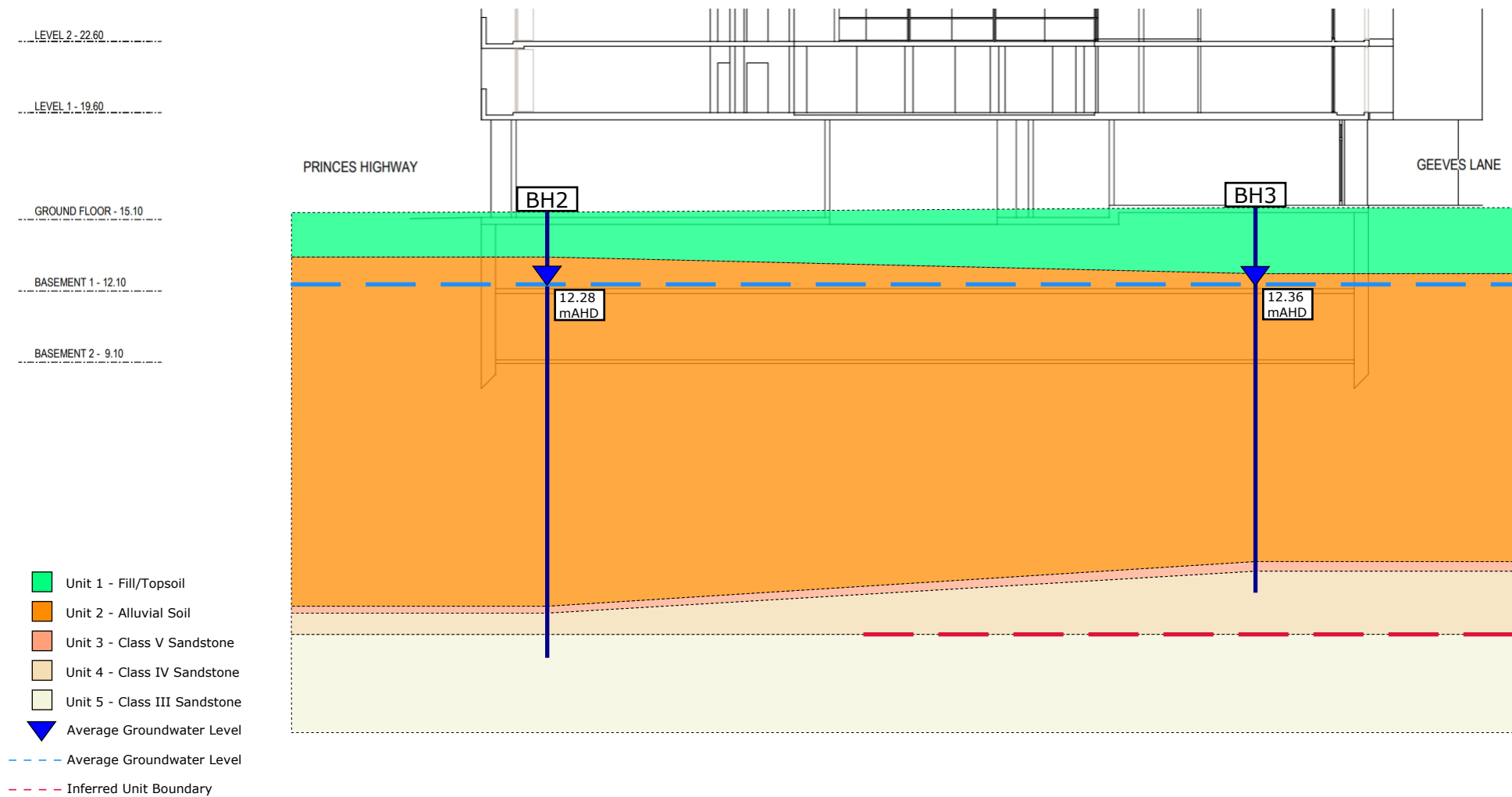


Alan Morrow  
Principal Geotechnical Engineer  
BE (Civil) BSc MIEAust CPEng NER





<div><div></div><div><div><div>02 8599 7579</div></div><div><div>Sydney Gadigal Land. 2/5-7 Malta Steet, Fairfield Ea NSW 2155</div></div><div><div>info@morrowgeo.com.au</div></div></div></div>			
Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155		P: 02 8599 7579 F:	
P3324 - Borehole Location Plan			
Client No:		Job No: P3324	
Client: Emag Apartments Pty Ltd			
Project: Rockdale			
Address: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW			
Legend:			
 Borehole Locations			
Image Source: NearMap		Viewed: 2024-09-23	
Drawn By: Mark Peach	Checked By: Rhiannon McKeon	Date: 2024-09-23	Figure: 1



**morrow**

2/5-7 Malta Street, Fairfield East NSW 2165

79/6 Bellambi Lane, Bellambi NSW 2518

P: 02 8599 7579 | E: info@morrowgeo.com.au

Project  
**Geotechnical Investigation**

Project Address  
**465-469 Princes Highway & 5-7 Geeves Avenue,  
Rockdale NSW 2027**

Drawing Title  
**Section 1**

Client  
**EMAG Apartments Pty Ltd**

Project Number  
**P3324**

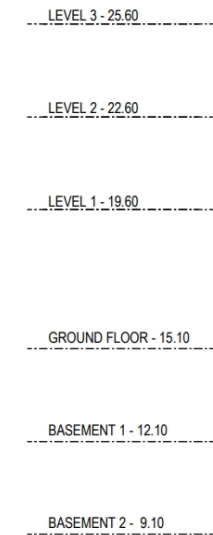
Figure

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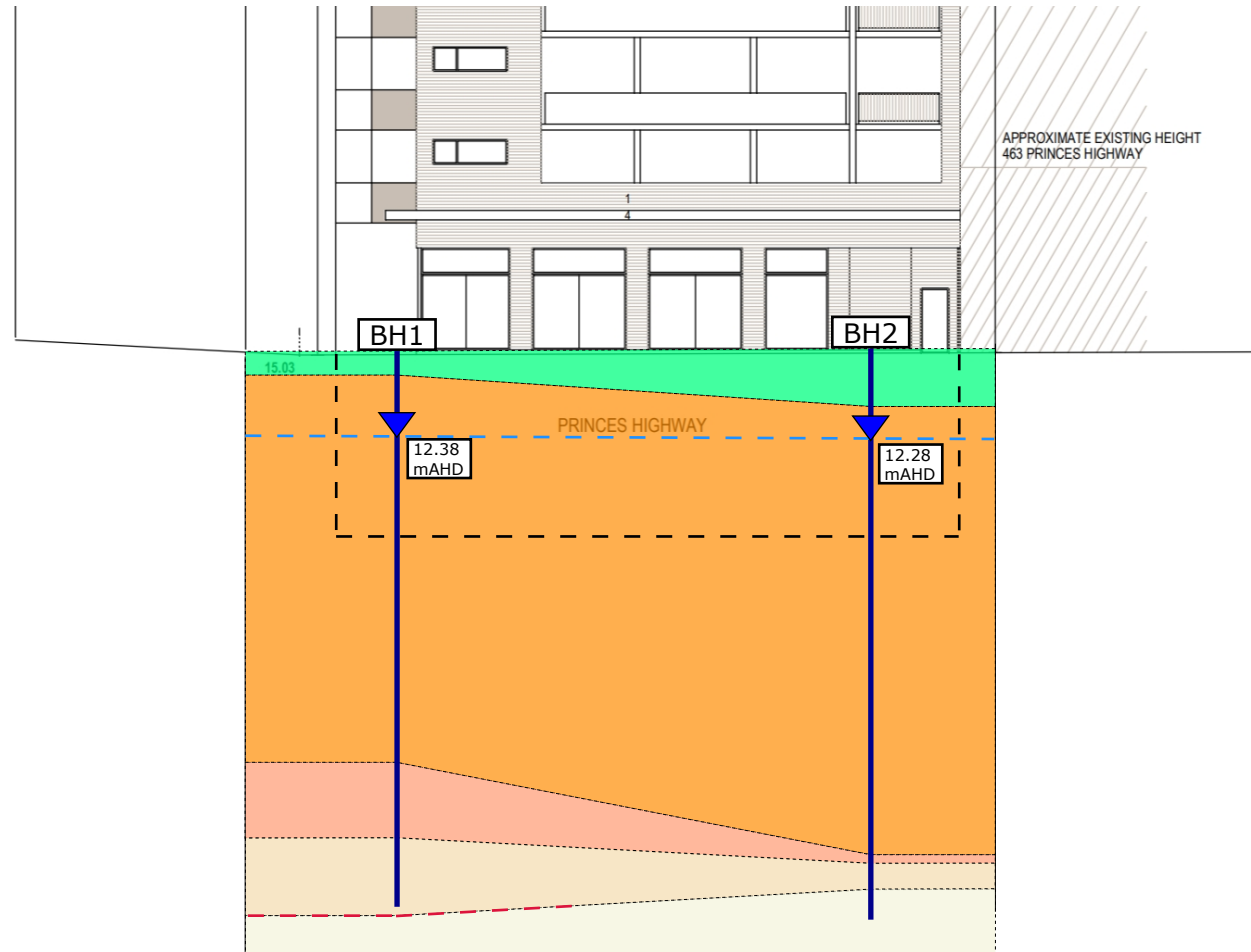
Drawn By:  
**AB**

Date:  
**13 January 2025**

**2**



- Unit 1 - Fill/Topsoil
- Unit 2 - Alluvial Soil
- Unit 3 - Class V Sandstone
- Unit 4 - Class IV Sandstone
- Unit 5 - Class III Sandstone
- Average Groundwater Level
- Average Groundwater Level
- Inferred Unit Boundary



# morrow

2/5-7 Malta Street, Fairfield East NSW 2165

79/6 Bellambi Lane, Bellambi NSW 2518

P: 02 8599 7579 | E: info@morrowgeo.com.au

Project  
**Geotechnical Investigation**

Project Address  
**465-469 Princes Highway & 5-7 Geeves Avenue,  
Rockdale NSW 2027**

Drawing Title  
**Section 1**

Client  
**EMAG Apartments Pty Ltd**

Project Number  
**P3324**

Figure

Scale:  
**Not To Scale**

Drawn By:  
**AB**

Date:  
**13 January 2025**

3

## **BOREHOLE LOGS, EXPLANATORY NOTES AND SITE PHOTOS**



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH1

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,952.36	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,658.76	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation : 15.2 (m)		Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing		Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP							Depth (m)			
Diatube		A	x	Non-Soil			CCT	0.2	Concrete	15.0			
			x							0.2			
ADT	GWNE		2	FILL			SW	0.8	FILL Gravelly SAND SW: medium dense to dense, dark grey brown, fine to medium grained, fine sized gravel, trace low plasticity clay, moist, low resistance .	14.4		MD-D	M
			14										
			11										
			6										
			5										
			5										
			7	Alluvial			SC	1	Alluvial Clayey SAND SC: dense, low plasticity clay, pale grey orange red, medium grained, with fine sized gravel, moist, low resistance, ironstone gravels .	13.1		D	
			5										
			5										
			5										
			6										
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			15										
			21										
			21										



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH1

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Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
ADT	Seepage						5	As above, but CH: very stiff to hard, high plasticity, fine grained sand.				
Washbore					CH		6				VSt-H	
							7					





## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH1

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Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
↑ Washbore ↓						CH	9 10 11 12	As above, but CH: very stiff to hard, high plasticity, fine grained sand.			VSt-H	



## Morrow Geotechnics

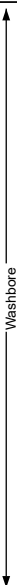
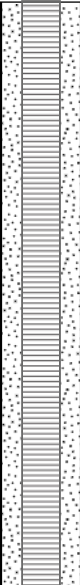

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH1

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
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Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
						CH	13	As above, but CH: very stiff to hard, high plasticity, fine grained sand.			VSt-H	
							13.57		1.6 13.57			
								Commenced Coring at 13.57m				





## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH1

UTM : 56H Drill Rig : Man-Portable Job Number : P3324  
Easting (m) : 327,952.36 Driller Supplier : Hard Access Drilling Client : Emag Apartments Pty Ltd  
Northing (m) : 6,241,658.76 Logged By : Mark Peach Project : Rockdale  
Ground Elevation : 15.2 (m) Reviewed By : Rhiannon McKeon Location : 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW  
Total Depth : 18.41 m BGL Date : 13/09/2024 Loc Comment :

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing		Estimated Strength	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation		Weathering	Defect Spacing (mm)	Defect Description
				Is(50)							Depth (m)				
					MLS LS MS HS VHS BHS									30 100 300 1000 3000	
							13			Commenced Coring at 13.57m					
NMLC Coring	No Water Loss	50mm PVC Slotted	RQD = 0% TCR = 100%				14		SST	Extremely weathered, rock Sandy CLAY SST: hard, low plasticity, pale grey red, fine grained sand, w < pl, iron stained, with sandy clay bands.			XW		
			RQD = 0% TCR = 100%				15								
			RQD = 59% TCR = 100%												

UTM : 56H	Drill Rig : Man-Portable	Job Number : P3324
Easting (m) : 327,952.36	Driller Supplier : Hard Access Drilling	Client : Emag Apartments Pty Ltd
Northing (m) : 6,241,658.76	Logged By : Mark Peach	Project : Rockdale
Ground Elevation : 15.2 (m)	Reviewed By : Rhiannon McKeon	Location : 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth : 18.41 m BGL	Date : 13/09/2024	Loc Comment :

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing		Estimated Strength	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation		Weathering	Defect Spacing (mm)	Defect Description
				Is(50)							Depth (m)				
NMLC Coring Loss - 10%		50mm PVC Slotted	RQD = 59% TCR = 100%		LS		16.05		SST	Extremely weathered, rock Sandy CLAY SST: hard, low plasticity, pale grey red, fine grained sand, w < pl, iron stained, with sandy clay bands.  Rock SANDSTONE: distinctly to highly weathered, low to medium strength, grey orange pale grey, fine grained, sub horizontal bedding with infilled clay bedding partings, iron staining. .	-0.9		XW		16.06-16.36, J, 88°, UN, RO, CT, OP, clay coating.,
				d: 0.22, a: 0.32	MS				SST		16.05		DW-H		16.38-16.39, P, 2°, PL, RO, CT, I, infilled clay ,
					HS										16.42, J, 45°, CV, RO, STN, C,
					VHS										16.52, P, 1°, PL, RO, CT, OP,
					BHS										16.73-16.75, IS, 2°, PL, RO, CT, I, infilled clay ,
							17								16.96-17, XWS, 2°, PL, Very Rough, CT, OP,
				d: 0.39, a: 0.31											17.34-17.38, J, 50°, UN, RO, STN, C,
															17.4, P, 2°, PL, RO, STN, OP,
															17.45, P, 3°, PL, RO, STN, C,
							17.7				-2.5				17.62, P, 3°, UN, Very Rough, STN, OP,
				d: 0.33, a: 0.61						As above, but moderately weathered, pale grey red, generally massive, with sub horizontal bedding and infilled clay bedding partings.	17.7		MW		
							18		SST						18.25, P, 2°, UN, RO, CL, OP,
				d: 0.29, a: 0.28											18.31, P, 1°, PL, RO, CT, I, clay infilled ,
										BH1 Reached Target Depth at 18.41m (Target Depth Reached.)					
							19								

# morrow

CLIENT NAME: EMAG APARTMENTS PTY LTD

PROJECT: ROCKDALE

LOCATION: 465-469 PRINCES HWY  
& 5-7 GEEVES AVE

JOB NUMBER: P3324

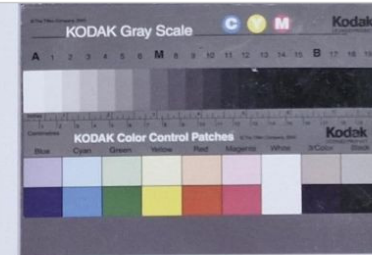
LOGGED BY: MP

BOREHOLE ID: BH1

DEPTH: 13.57m to 18.41m

CORE TRAY NO.: Box 1 + 2 of 2

DATE: 13.09.24



02 8599 7579



Sydney Gadigal Land,  
2/5-7 Malta Steet, Fairfield  
East NSW 2155



info@morrowgeo.com.au

## Photo description

BH1 Box 1 & 2 of 2

## Client

Emag Apartments Pty Ltd

## Location

465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW

## Project name

Rockdale

## Project No

P3324

## Scale

Not to Scale

## BH No

BH1

## BH Depth

13.57m to 18.41m



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM : 56H Drill Rig : Man-Portable Job Number : P3324  
Easting (m) : 327,976.13 Driller Supplier : Hard Access Drilling Client : Emag Apartments Pty Ltd  
Northing (m) : 6,241,690.16 Logged By : Mark Peach Project : Rockdale  
Ground Elevation : 15.3 (m) Reviewed By : Rhiannon McKeon Location : 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW  
Total Depth : 18.9 m BGL Date : 16/09/2024 Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
Diat ube			x	Non-Soil		CCT	0.1	Concrete	15.2			
			1	FILL		SW	0.1	FILL Gravelly SAND SW: medium dense, grey brown, fine to medium grained, fine sized gravel, with low plasticity clay, moist, low resistance..	0.1		MD	M
			1									
			5									
			9									
			11									
			11									
			4									
			11									
			12									
			4				1					
			10									
			6									
			5									
			5									
			7									
			7									
			8									
			11				1.9		13.4		MD-D	
			7	Alluvial		SC	2	Alluvial Clayey SAND SC: medium dense to dense, low plasticity clay, grey red, fine to medium grained, with fine sized gravel, moist, low resistance..	1.9			
			9									
			7									
			7									
			8									
			13									
			18				2.5		12.8			
			18			SC		As above, but pale grey.	2.5			
			25+									
						SC	3	As above, but medium plasticity clay.	12.3			
									3			
						CH	3.3	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..	12.0		H	w ≈ PL
									3.3			



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
ADT	Seepage							Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..				
						CH	5					
							6				H	w ≈ PL
Washbore							7					





## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
↑ Washbore ↓						CH	9 10 11 12	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..			H	w ≈ PL



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
↑ Washbore ↓						CH	13 14 15 16 17 18	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..			H	w ≈ PL



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
↑ Washbore ↓						CH	16.74	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..	-1.4 16.74		H	w ≈ PL
								Commenced Coring at 16.74m				





## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH2

UTM : 56H Drill Rig : Man-Portable Job Number : P3324  
Easting (m) : 327,976.13 Driller Supplier : Hard Access Drilling Client : Emag Apartments Pty Ltd  
Northing (m) : 6,241,690.16 Logged By : Mark Peach Project : Rockdale  
Ground Elevation : 15.3 (m) Reviewed By : Rhiannon McKeon Location : 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW  
Total Depth : 18.9 m BGL Date : 16/09/2024 Loc Comment :

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing		Depth (m)	Graphic Log	Classification Code	Material Description	Elevation		Weathering	Defect Spacing (mm)	Defect Description
				Is(50)	Estimated Strength					Depth (m)				
					MLS LS MS HS VHS BHS				Commenced Coring at 16.74m					
NMLC Coring	No Water Loss	50mm PVC Slotted	RQD = 71% TCR = 100%			17		SST	Extremely weathered, rock Sandy CLAY SST: hard, high plasticity, red pale grey, fine to medium grained sand, with fine to medium sized gravel, w = pl, iron stained.	-1.7		XW		
				d: 0.50, a: 0.43				SST	Rock SANDSTONE: highly weathered, low to medium strength, pale grey red grey, fine grained, iron staining, generally massive with infilled clay bedding partings.	17		HW		17.06-17.1, IS, 2°, UN, Very Rough, CT, I, Infilled clay, 17.13, J, 45°, UN, Very Rough, CL, OP, 17.15, P, 15°, UN, Very Rough, CT, OP, clay coating , 17.26-17.29, IS, 20°, UN, Very Rough, CT, I, Infilled clay, 17.57-17.66, XWS, PL, RO, CT, I,
				d: 0.34, a: 0.54		17.95		SST	Rock SANDSTONE: moderately weathered, medium strength, grey orange red, fine to medium grained, iron staining, sub horizontal bedding .	-2.6 17.95		MW		17.8, P, 5°, UN, RO, STN, OP, 17.9, J, 80°, PL, RO, CL, C, 17.92-17.95, XWS, PL, Very Rough, CT, I, 18.3, P, 2°, PL, RO, STN, OP, Carbonaceous staining ,
						19			BH2 Reached Target Depth at 18.9m (Target Depth Reached )					18.85-18.89, XWS, PL, Very Rough, CT, I,

# morrow

CLIENT NAME: EMAG APARTMENTS PTY LTD

PROJECT: ROCKDALE

LOCATION: 465-469 PRINCES HWY &  
4-7 GEEVES AVE

JOB NUMBER: P3324

LOGGED BY: MP

BOREHOLE ID: BH2

DEPTH: 16.74m to 18.90m

CORE TRAY NO.: Box 1 of 1

DATE: 16.09.24



02 8599 7579



Sydney Gadigal Land,  
2/5-7 Malta Street, Fairfield  
East NSW 2155



info@morrowgeo.com.au

## Photo description

BH2\_Box 1 of 1

## Client

Emag Apartments Pty Ltd

## Location

465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW

## Project name

Rockdale

## Project No

P3324

## Scale

Not to Scale

## BH No

BH2

## BH Depth

16.74m to 18.90m



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
Diatube			x	Non-Soil		CCT	0.2	Concrete	15.4 0.2			
			x									
ADT			2	FILL		SW	1	FILL SAND SW: loose to medium dense, grey yellow, fine to medium grained, trace fine sized gravel, moist, low to medium resistance, construction waste (bricks, concrete), strong hydrocarbon odour.			L-MD	M
			3									
			5									
			4									
			3									
			3									
			6									
			4 HB									
Washbore				Alluvial		SC	3	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .	12.8 2.8		MD	



## Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
Washbore				Alluvial		SC	5 6 7	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .			MD	



## Morrow Geotechnics


Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
↑ Washbore ↓				Alluvial		SC	9 10 11 12	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .			MD	



## Morrow Geotechnics

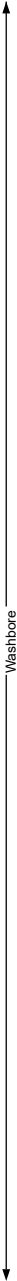

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

## Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation	Weathering	Consistency	Moisture
			DCP						Depth (m)			
				Alluvial		SC	13	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .			MD	
							14					
							15					
							15.43					
								Commenced Coring at 15.43m	0.2 15.43			



**Job Number : P3324**  
**Client : Emag Apartments Pty Ltd**  
**Project : Rockdale**  
**Location : 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW**  
**Loc Comment :**

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing		Estimated Strength VLS LS MS HS Yes No BIS	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation	Weathering	Defect Spacing (mm) 30 100 300 1000 3000	Defect Description
				Is(50)	Depth (m)									
NMLC Coring	No Water Loss		ROD = 26% TCR = 100%				13   <							



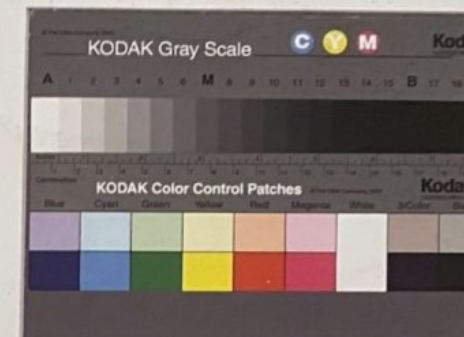




# morrow

CLIENT NAME: EMAG APARTMENTS PTY LTD  
PROJECT: ROCKDALE  
LOCATION: 465-469 PRINCES HWY &  
4-7 GEEVES AVE  
JOB NUMBER: P3324  
LOGGED BY: MR

BOREHOLE ID: BH3  
DEPTH: 15.43m to 16.30m  
CORE TRAY NO.: Box 1 of 1  
DATE: 18.09.24



# morrow



02 8599 7579



Sydney Gadigal Land,  
2/5-7 Malta Street, Fairfield  
East NSW 2155



info@morrowgeo.com.au

## Photo description

BH3 Box 1 of 1

## Client

Emag Apartments Pty Ltd

## Location

465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW

## Project name

Rockdale

## Project No

P3324

## Scale

Not to Scale

## BH No

BH3

## BH Depth

15.43m to 16.30m

## GENERAL

Information obtained from site investigations is recorded on log sheets. The "Cored Drill Hole Log" presents data from an operation where a core barrel has been used to recover material - commonly rock. The "Non-Core Drill Hole - Geological Log" presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 1993 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

## DRILLING

### Drilling & Casing

ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
WB	Wash-bore drilling
RR	Rock Roller
NMLC	NMLC core barrel
NQ	NQ core barrel
HMLC	HMLC core barrel
HQ	HQ core barrel

### Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage.

### Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

VE	Very Easy
E	Easy
M	Medium
H	High
VH	Very High

## Groundwater Levels

Date of measurement is shown.

Standing water level measured in completed borehole

Level taken during or immediately after drilling

D	Disturbed
B	Bulk
U	Undisturbed
SPT	Standard Penetration Test
N	Result of SPT (sample taken)
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test

## EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

### MATERIAL DESCRIPTION - SOIL

Classification Symbol - In accordance with the Unified Classification System (AS 1726-1993, Appendix A, Table A1)

Material Description - In accordance with AS 1726-1993, Appendix A2.3

### Moisture Condition

D	Dry, looks and feels dry
M	Moist, No free water on remoulding
W	Wet, free water on remoulding

Consistency - In accordance with AS 1726-1993, Appendix A2.5

VS	Very Soft	< 12.5 kPa
S	Soft	12.5 – 25 kPa
F	Firm	25 – 50 kPa
St	Stiff	50 – 100 kPa
VSt	Very Stiff	100 – 200 kPa
H	Hard	> 200 kPa

Strength figures quoted are the approximate range of undrained shear strength for each class.

Density Index. (%) is estimated or is based on SPT results.

VL	Very Loose	< 15 %
L	Loose	15 – 35 %
MD	Medium Dense	35 – 65 %
D	Dense	65 – 85 %
VD	Very Dense	> 85 %

## MATERIAL DESCRIPTION -ROCK

### Material Description

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-1993, Appendix A3.1-A3.3 and Tables A6a, A6b and A7.

### Core Loss

Is shown at the bottom of the run unless otherwise indicated.

### Bedding

Thinly Laminated	< 6 mm
Laminated	6 - 20
Very Thinly Bedded	20 - 60
Thinly Bedded	60 - 200
Medium Bedded	200 – 600
Thickly Bedded	600 – 2000
Very Thickly Bedded	> 2000

**Weathering** - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties.

Fresh (F)	Rock substance unaffected by weathering
Slightly Weathered (SW)	Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable.
Moderately Weathered (MW)	Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable.
Highly Weathered (HW)	Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained.
Extremely Weathered (EW)	Rock texture evident but material has soil properties and can be remoulded.

**Strength** - The following terms are used to described rock strength:

Rock Strength Class	Abbreviation	Point Load Strength Index, $I_s(50)$ (MPa)
Extremely Low	EL	< 0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	≥ 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

° Diametral Point Load Test

Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

## MATERIALS STRUCTURE/FRACTURES

### ROCK

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Visual Log - A diagrammatic plot of defects showing type, spacing and orientation in relation to core axis.

Defects		
	—————	Defects open in-situ or clay sealed
	- - - - -	Defects closed in-situ
	.....	Breaks through rock substance

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-1993, Appendix A Table A10, notes and Figure A2.

Orientation - angle relative to the plane normal to the core axis.

Type	BP JT SM FZ SZ VN FL CL DL HB DB	Bedding Parting Joint Seam Fracture Zone Shear Zone Vein Foliation Cleavage Drill Lift Handling Break Drilling Break
Infilling	CN X Clay KT CA Fe Qz MS MU	Clean Carbonaceous Clay Chlorite Calcite Iron Oxide Quartz Secondary Mineral Unidentified Mineral
Shape	PR CU UN ST IR DIS	Planar Curved Undulose Stepped Irregular Discontinuous
Roughness	POL SL S RF VR	Polished Slickensided Smooth Rough Very Rough

### SOIL

Structures - Fissuring and other defects are described in accordance with AS 1726-1993, Appendix A2.6, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

**WATER QUALITY LABORATORY TESTING CERTIFICATES**

## CLIENT DETAILS

Contact Andrew Butel  
Client MORROW GEOTECHNICS PTY LTD  
Address 79/6 Bellambi Lane  
Bellambi  
Carlton  
NSW 2518  
Telephone (Not specified)  
Facsimile (Not specified)  
Email andy@morrowgeo.com.au  
Project **P3324 Rockdale**  
Order Number **P3324**  
Samples 3

## LABORATORY DETAILS

Manager Shane McDermott  
Laboratory SGS Alexandria Environmental  
Address Unit 16, 33 Maddox St  
Alexandria NSW 2015  
Telephone +61 2 8594 0400  
Facsimile +61 2 8594 0499  
Email au.environmental.sydney@sgs.com  
SGS Reference **SE274304 R0**  
Date Received 19/11/2024  
Date Reported 27/11/2024

## COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

Sample #3 contains a layer of hydrocarbon which has been excluded before inorganic/metals tests.

VPH - Sample #3 results based from the x 10 dilution due to sample matrix.

PAH - The Limit of Reporting (LOR) has been raised due to interferences from the sample matrix.

TRH - Sample # 3 and 3 duplicates. Results not match due to sample matrix.

## SIGNATORIES



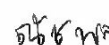
**Akheeqar BENIAMEEN**  
Chemist



**Dong LIANG**  
Metals/Inorganics Team Leader



**Ly Kim HA**  
Organic Section Head



**Tim MEEYAN**  
Lab Tech

VOCs in Water [AN433]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
Benzene	µg/L	0.5	<0.5	<0.5	<b>37</b>
Toluene	µg/L	0.5	<0.5	<0.5	<b>370</b>
Ethylbenzene	µg/L	0.5	<0.5	<0.5	<b>200</b>
m/p-xylene	µg/L	1	<1	<1	<b>1300</b>
o-xylene	µg/L	0.5	<0.5	<0.5	<b>480</b>
Total Xylenes	µg/L	1.5	<1.5	<1.5	<b>1700</b>
Total BTEX	µg/L	3	<3	<3	<b>2300</b>
Naphthalene (VOC)*	µg/L	0.5	<0.5	<0.5	<b>130</b>



Volatile Petroleum Hydrocarbons in Water [AN433]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
TRH C6-C9	µg/L	40	<40	<40	<b>14000</b>
Benzene (F0)	µg/L	0.5	<0.5	<0.5	<b>37</b>
TRH C6-C10	µg/L	50	<50	<50	<b>22000</b>
TRH C6-C10 minus BTEX (F1)	µg/L	50	<50	<50	<b>20000</b>

TRH (Total Recoverable Hydrocarbons) in Water [AN403]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
TRH C10-C14	µg/L	50	<b>390</b>	<50	<b>950000</b>
TRH C15-C28	µg/L	200	<200	<200	<b>64000</b>
TRH C29-C36	µg/L	200	<200	<200	<b>550</b>
TRH C37-C40	µg/L	200	<200	<200	<200
TRH >C10-C16	µg/L	60	<b>440</b>	<60	<b>950000</b>
TRH >C10-C16 - Naphthalene (F2)	µg/L	60	<b>430</b>	<60	<b>950000</b>
TRH >C16-C34 (F3)	µg/L	500	<500	<500	<b>14000</b>
TRH >C34-C40 (F4)	µg/L	500	<500	<500	<500
TRH C10-C40	µg/L	320	<b>540</b>	<320	<b>1000000</b>

## PAH (Polynuclear Aromatic Hydrocarbons) in Water [AN420]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
Naphthalene	µg/L	0.1	<0.1	<0.1	<b>120</b>
2-methylnaphthalene	µg/L	0.1	<b>0.3</b>	<0.1	<b>300</b>
1-methylnaphthalene	µg/L	0.1	<b>0.2</b>	<0.1	<b>240</b>
Acenaphthylene	µg/L	0.1	<0.1	<0.1	<b>3.1</b>
Acenaphthene	µg/L	0.1	<0.1	<0.1	<1.0 †
Fluorene	µg/L	0.1	<0.1	<0.1	<b>1.3</b>
Phenanthrene	µg/L	0.1	<0.1	<0.1	<1.0 †
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)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	µg/L	0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	µg/L	0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.1	<0.1	<0.1	<0.1
Dibenzo(ah)anthracene	µg/L	0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	µg/L	0.1	<0.1	<0.1	<0.1
Total PAH (18)	µg/L	1	<1	<1	<b>660</b>

Anions by Ion Chromatography in Water [AN245]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
Chloride	mg/L	1	<b>42</b>	<b>35</b>	<b>29</b>
Sulfate, SO <sub>4</sub>	mg/L	1	<b>48</b>	<b>21</b>	<b>32</b>
Bromide	mg/L	0.05	-	-	<b>0.08</b>
Fluoride	mg/L	0.1	-	-	<0.10
Nitrate Nitrogen, NO <sub>3</sub> -N	mg/L	0.005	-	-	<b>0.093</b>

Alkalinity [AN135]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER	WATER	WATER
			19/11/24 11:00 SE274304.001	19/11/24 11:00 SE274304.002	19/11/24 11:00 SE274304.003
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	5	<5	<5	<b>270</b>
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	1	<1	<1	<1
Hydroxide Alkalinity as CaCO <sub>3</sub>	mg/L	5	<5	<5	<5
Total Alkalinity as CaCO <sub>3</sub>	mg/L	5	<5	<5	<b>270</b>
Hydroxide Alkalinity as OH (meq/L)	meq/L	0.06	<0.06	<0.06	<0.06
Bicarbonate Alkalinity as HCO <sub>3</sub> (meq/L)	meq/L	0.03	<0.03	<0.03	<b>5.4</b>
Carbonate Alkalinity as CO <sub>3</sub> (meq/L)	meq/L	0.03	<0.03	<0.03	<0.03



ANALYTICAL RESULTS

SE274304 R0

pH in water [AN101]    Tested: 20/11/2024

			BH1	BH2	BH3
			WATER	WATER	WATER
			-	-	-
			19/11/24 11:00	19/11/24 11:00	19/11/24 11:00
			SE274304.001	SE274304.002	SE274304.003
PARAMETER	UOM	LOR			
pH**	No unit	-	4.3	4.5	7.1





ANALYTICAL RESULTS

SE274304 R0

Conductivity and TDS by Calculation - Water [AN106]    Tested: 20/11/2024

			BH1	BH2	BH3
			WATER	WATER	WATER
			-	-	-
			19/11/24 11:00	19/11/24 11:00	19/11/24 11:00
			SE274304.001	SE274304.002	SE274304.003
PARAMETER	UOM	LOR			
Conductivity @ 25 C	µS/cm	2	320	260	650
Total Dissolved Solids (by calculation)	mg/L	10	190	150	390



ANALYTICAL RESULTS

SE274304 R0

Redox Potential (Eh) in water [AN240]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Eh of Sample Relative to Standard H+ Electrode***	mV	-500	<b>381</b>
Temperature of Sample*	°C	0.1	<b>22.8</b>



ANALYTICAL RESULTS

SE274304 R0

Total Dissolved Solids (TDS) in water [AN113]    Tested: 22/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Total Dissolved Solids Dried at 175-185°C	mg/L	10	370



ANALYTICAL RESULTS

SE274304 R0

Dissolved Oxygen by Membrane Electrode [AN176]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Temperature*	°C	-	13.3
Dissolved Oxygen**	mg/L	0.5	2.1
Dissolved Oxygen (percent saturation)**	%	1	20.0



ANALYTICAL RESULTS

SE274304 R0

Turbidity [AN119]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Turbidity	NTU	0.5	130



ANALYTICAL RESULTS

SE274304 R0

Total and Volatile Suspended Solids (TSS / VSS) [AN114]    Tested: 22/11/2024

			BH1	BH2	BH3
			WATER	WATER	WATER
			-	-	-
			19/11/24 11:00	19/11/24 11:00	19/11/24 11:00
			SE274304.001	SE274304.002	SE274304.003
PARAMETER	UOM	LOR			
Total Suspended Solids Dried at 103-105°C	mg/L	5	230	1400	120





ANALYTICAL RESULTS

SE274304 R0

Ammonia Nitrogen by Discrete Analyser [AN291]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Ammonia Nitrogen, NH <sub>3</sub> as N	mg/L	0.01	<b>0.12</b>

Calculation of Anion-Cation Balance (SAR Calc) [AN121]    Tested: 26/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Sum of Cation Milliequivalents*	meq/L	-	<b>7</b>
Sum of Anion Milliequivalents*	meq/L	-	<b>7</b>
Sum of Ions*	mg/L	-	<b>477</b>
Anion-Cation Balance	%	-	<b>2</b>



ANALYTICAL RESULTS

SE274304 R0

Nitrite in Water [AN277]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Nitrite Nitrogen, NO2 as N	mg/L	0.005	0.027
Total Oxidised Nitrogen, NOx-N	mg/L	0.005	0.12



ANALYTICAL RESULTS

SE274304 R0

TKN Kjeldahl Digestion by Discrete Analyser [AN292]    Tested: 21/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Total Kjeldahl Nitrogen	mg/L	0.05	0.45
Total Nitrogen (calc)	mg/L	0.05	0.57



ANALYTICAL RESULTS

SE274304 R0

Total Phosphorus by Kjeldahl Digestion DA in Water [AN279/AN293(Sydney only)]    Tested: 21/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Total Phosphorus (Kjeldahl Digestion) as P	mg/L	0.02	<b>0.27</b>



ANALYTICAL RESULTS

SE274304 R0

Filterable Reactive Phosphorus (FRP) [AN278]    Tested: 20/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Filterable Reactive Phosphorus as P	mg/L	0.005	<0.005



ANALYTICAL RESULTS

SE274304 R0

Forms of Carbon [AN190]    Tested: 21/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Total Organic Carbon as NPOC	mg/L	0.2	15

Acidity and Free CO<sub>2</sub> [AN140]    Tested: 21/11/2024

			BH1	BH2
			WATER	WATER
			-	-
			19/11/24 11:00	19/11/24 11:00
			SE274304.001	SE274304.002
PARAMETER	UOM	LOR		
Acidity to pH 8.3	mg CaCO <sub>3</sub> /L	5	<b>47</b>	<b>50</b>



Metals in Water (Dissolved) by ICPOES [AN320] Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
Calcium, Ca	mg/L	0.1	<b>8.6</b>	<b>3.1</b>	<b>92</b>
Magnesium, Mg	mg/L	0.1	<b>10</b>	<b>6.7</b>	<b>9.1</b>
Total Hardness by Calculation	mg CaCO3/L	1	-	-	<b>270</b>
Sodium Adsorption Ratio	No unit	0.2	-	-	<b>1.1</b>
Sodium, Na	mg/L	0.5	<b>22</b>	<b>24</b>	<b>40</b>
Potassium, K	mg/L	0.1	<b>3.6</b>	<b>2.0</b>	<b>5.4</b>
Lithium, Li	mg/L	0.005	-	-	<0.005
Soluble Silicon as Silica, SiO2*	mg/L	0.1	-	-	<b>3.9</b>
Silicon, Si*	mg/L	0.05	-	-	<b>1.8</b>

Trace Metals (Dissolved) in Water by ICPMS [AN318]    Tested: 21/11/2024

PARAMETER	UOM	LOR	BH1	BH2	BH3
			WATER - 19/11/24 11:00 SE274304.001	WATER - 19/11/24 11:00 SE274304.002	WATER - 19/11/24 11:00 SE274304.003
Aluminium	µg/L	5	-	-	<5
Antimony	µg/L	1	-	-	<1
Arsenic	µg/L	1	<1	<1	<1
Barium	µg/L	1	-	-	<b>38</b>
Beryllium	µg/L	1	-	-	<1
Boron	µg/L	5	-	-	<b>60</b>
Cadmium	µg/L	0.1	<0.1	<0.1	<0.1
Chromium	µg/L	1	<1	<1	<1
Cobalt	µg/L	1	-	-	<b>5</b>
Copper	µg/L	1	<b>2</b>	<b>1</b>	<1
Iron	µg/L	5	-	-	<5
Lead	µg/L	1	<b>2</b>	<1	<1
Manganese	µg/L	1	-	-	<b>440</b>
Molybdenum	µg/L	1	-	-	<b>1</b>
Nickel	µg/L	1	<b>2</b>	<b>2</b>	<b>1</b>
Selenium	µg/L	1	-	-	<b>1</b>
Silver	µg/L	1	-	-	<b>3</b>
Strontium	µg/L	1	-	-	<b>500</b>
Uranium	µg/L	1	-	-	<1
Vanadium	µg/L	1	-	-	<1
Zinc	µg/L	5	<b>15</b>	<b>22</b>	<5



ANALYTICAL RESULTS

SE274304 R0

Mercury (dissolved) in Water [AN311(Perth)/AN312]    Tested: 21/11/2024

			BH1	BH2	BH3
			WATER	WATER	WATER
			-	-	-
			19/11/24 11:00	19/11/24 11:00	19/11/24 11:00
PARAMETER	UOM	LOR	SE274304.001	SE274304.002	SE274304.003
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001

E. coli, Total and Faecal (Thermotolerant) coliforms in Water (MPN) [AN735]    Tested: 21/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Date & Time Processed*	No unit	-	2024-11-20 10:50
Faecal Coliforms	MPN/100mL	1	<b>5</b>
E. coli	MPN/100mL	1	<b>5</b>



ANALYTICAL RESULTS

SE274304 R0

Enterococci in Water [AN750]    Tested: 21/11/2024

			BH3
			WATER
			-
			19/11/24 11:00
			SE274304.003
PARAMETER	UOM	LOR	
Date & Time Processed*	No unit	-	2024-11-20 10:50
Enterococci*	MPN/100mL	1	2

## METHOD

## METHODOLOGY SUMMARY

- AN020** Unpreserved water sample is filtered through a 0.45µm membrane filter and acidified with nitric acid similar to APHA3030B.
- AN101** pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
- AN106** Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.
- AN106** Salinity may be calculated in terms of NaCl from the sample conductivity. This assumes all soluble salts present, measured by the conductivity, are present as NaCl.
- AN113** Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.
- AN113** The Total Dissolved Solids residue may also be ignited at 550 C and volatile TDS (Organic TDS) and non-volatile TDS (Inorganic) can be determined.
- AN114** Total Suspended and Volatile Suspended Solids: The sample is homogenised by shaking and a known volume is filtered through a pre-weighed GF/C filter paper and washed well with deionised water. The filter paper is dried and reweighed. The TSS is the residue retained by the filter per unit volume of sample. Reference APHA 2540 D. Internal Reference AN114
- AN119** Turbidity by Nephelometry: Small particles in a light beam scatter light at a range of angles. A turbidimeter measures this scatter and reports results compared to turbidity standards, in NTU. This procedure is not suitable for very dark coloured liquids or samples with high solids because light absorption causes artificially low light scatter and low turbidity. Reference APHA 2130B.
- AN121** This method is used to calculate the balance of major Anions and Cations in water samples and converts major ion concentration to milliequivalents and then summed. Anions sum and Cation sum is calculated as a difference and expressed as a percentage.
- AN135** Alkalinity (and forms of) by Titration: The sample is titrated with standard acid to pH 8.3 (P titre) and pH 4.5 (T titre) and permanent and/or total alkalinity calculated. The results are expressed as equivalents of calcium carbonate or recalculated as bicarbonate, carbonate and hydroxide. Reference APHA 2320. Internal Reference AN135
- AN140** Acidity by Titration: The water sample is titrated with sodium hydroxide to designated pH end point. In a sample containing only carbon dioxide, bicarbonates and carbonates, titration to pH 8.3 at 25°C corresponds to stoichiometric neutralisation of carbonic acid to bicarbonate. Method reference APHA 2310 B.
- AN176** Dissolved Oxygen: Dissolved oxygen is measured directly using an oxygen permeable membrane electrode and meter. Under steady state conditions the current is directly proportional to the DO concentration. Samples with no headspace are required for this analysis and if headspace is observed this will be recorded on the report. Internal Reference is AN176 based on APHA 4500-O, C and G.
- AN190** TOC and DOC in Water: A homogenised micro portion of sample is injected into a heated reaction chamber packed with an oxidative catalyst that converts organic carbon to carbon dioxide. The CO<sub>2</sub> is measured using a non-dispersive infrared detector. The process is fully automated in a commercially available analyser. If required a sugar value can be calculated from the TOC result. Reference APHA 5310 B.
- AN190** Chemical oxygen demand can be calculated/estimated based on the O<sub>2</sub>/C relation as 2.67\*NPOC (TOC). This is an estimate only and the factor will vary with sample matrix so results should be interpreted with caution.
- AN240** Oxidation-Reduction Potential (Eh): Electrometric measurements are made by potentiometric determination of electron activity (or intensity) with an inert indicator electrode and a suitable reference electrode. At redox equilibrium, the potential difference between the two electrodes equals the redox potential of the system. This measurement is then corrected for the difference between the potential of the reference electrode and that of the standard hydrogen electrode.
- AN245** Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO<sub>2</sub>, NO<sub>3</sub> and SO<sub>4</sub> are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B
- AN277** Nitrite ions, when reacted with a reagent containing sulphanilamide and N-(1-naphthyl)-ethylenediamine dihydrochloride produce a highly coloured azo dye that is measured photometrically at 540nm.

AN278	Filterable Reactive Phosphorus by DA (determined on filtered sample): Orthophosphate reacts with ammonium molybdate (Mo VI) and potassium antimonyl tartrate (Sb III) in acid medium to form an antimony-phosphomolybdate complex. This complex is subsequently reduced with ascorbic acid to form a blue colour and the absorbance is read at 880 nm. The sensitivity of the automated method is 10-20 times that of the macro method. Reference APHA 4500-P F
AN279/AN293(Sydney)	The sample is digested with Sulphuric acid, K <sub>2</sub> SO <sub>4</sub> and CuSO <sub>4</sub> . All forms of phosphorus are converted into orthophosphate. The digest is cooled and placed on the discrete analyser for colorimetric analysis.
AN281	An unfiltered water or soil sample is first digested in a block digester with sulfuric acid, K <sub>2</sub> SO <sub>4</sub> and CuSO <sub>4</sub> . The ammonia produced following digestion is then measured colourimetrically using the Discrete Analyser. A portion of the digested sample is buffered to an alkaline pH, and interfering cations are complexed. The ammonia then reacts with salicylate and hypochlorite to give a blue colour whose absorbance is measured at 660nm and compared with calibration standards. This is proportional to the concentration of Total Kjeldahl Nitrogen in the original sample.
AN291	Ammonia in solution reacts with hypochlorite ions from Sodium Dichloroisocyanate, and salicylate in the presence of Sodium Nitroprusside to form indophenol blue and measured at 660 nm by Discrete Analyser.
AN311(Perth)/AN312	Mercury by Cold Vapour AAS in Waters: Mercury ions are reduced by stannous chloride reagent in acidic solution to elemental mercury. This mercury vapour is purged by nitrogen into a cold cell in an atomic absorption spectrometer or mercury analyser. Quantification is made by comparing absorbances to those of the calibration standards. Reference APHA 3112/3500.
AN318	Determination of elements at trace level in waters by ICP-MS technique,, referenced to USEPA 6020B and USEPA 200.8 (5.4).
AN320	Metals by ICP-OES: Samples are preserved with 10% nitric acid for a wide range of metals and some non-metals. This solution is measured by Inductively Coupled Plasma. Solutions are aspirated into an argon plasma at 8000-10000K and emit characteristic energy or light as a result of electron transitions through unique energy levels. The emitted light is focused onto a diffraction grating where it is separated into components .
AN320	Photomultipliers or CCDs are used to measure the light intensity at specific wavelengths. This intensity is directly proportional to concentration. Corrections are required to compensate for spectral overlap between elements . Reference APHA 3120 B.
AN403	Total Recoverable Hydrocarbons: Determination of Hydrocarbons by gas chromatography after a solvent extraction. Detection is by flame ionisation detector (FID) that produces an electronic signal in proportion to the combustible matter passing through it. Total Recoverable Hydrocarbons (TRH) are routinely reported as four alkane groupings based on the carbon chain length of the compounds: C6-C9, C10-C14, C15-C28 and C29-C36 and in recognition of the NEPM 1999 (2013), >C10-C16 (F2), >C16-C34 (F3) and >C34-C40 (F4). Where F2 is corrected for Naphthalene, the VOC data for Naphthalene is used.
AN403	Additionally, the volatile C6-C9/C6-C10 fractions may be determined by a purge and trap technique and GC/MS because of the potential for volatiles loss. Total Recoverable Hydrocarbons - Silica (TRH-Silica) follows the same method of analysis after silica gel cleanup of the solvent extract. Aliphatic/Aromatic Speciation follows the same method of analysis after fractionation of the solvent extract over silica with differential polarity of the eluent solvents.
AN403	The GC/FID method is not well suited to the analysis of refined high boiling point materials (ie lubricating oils or greases) but is particularly suited for measuring diesel, kerosene and petrol if care to control volatility is taken. This method will detect naturally occurring hydrocarbons, lipids, animal fats, phenols and PAHs if they are present at sufficient levels, dependent on the use of specific cleanup/fractionation techniques. Reference USEPA 3510B, 8015B.
AN420	(SVOCs) including OC, OP, PCB, Herbicides, PAH, Phthalates and Speciated Phenols (etc) in soils, sediments and waters are determined by GCMS/ECD technique following appropriate solvent extraction process (Based on USEPA 3500C and 8270D). Total PAH calculated from individual analyte detections at or above the limit of reporting .
AN433	VOCs and C6-C9 Hydrocarbons by GC-MS P&T: VOC's are volatile organic compounds. The sample is presented to a gas chromatograph via a purge and trap (P&T) concentrator and autosampler and is detected with a Mass Spectrometer (MSD). Solid samples are initially extracted with methanol whilst liquid samples are processed directly. References: USEPA 5030B, 8020A, 8260.
AN703	A known volume of water is passed through a membrane of known pore size. The membrane is placed on a selective agar plate and incubated. The volume of sample filtered depends upon the expected count. Referenced to AS4276.5.
AN705	A known volume of water is passed through a membrane of known pore size. The membrane is placed on a selective agar plate and incubated. The volume of sample filtered depends upon the expected count. Referenced to AS/NZS4276.9 (ISO 7899-2:2000 MOD).
AN735	The Colilert matrix contains two nutrient indicators, ONPG (ortho-nitro-phenyl B-d- galactopyranoside) and MUG (4-methyl-umbelliferyl B-d-glucuronide). As coliforms grow, they use B-galactosidase to metabolise ONPG which causes yellow colouration of the matrix via the nitro-phenyl. E.coli possesses an additional enzyme, B-glucuronidase, which it uses to metabolise MUG and display florescence (caused by the 4 methyl-umbelliferyl). Incubation at 37°C.
AN735	Non target organisms are suppressed by a combination of high salts, detergents etc. present within the matrix . Faecal coliforms are thermotolerant, thus they can be enumerated by testing at 44.5°C.

## AN750

A method for the simultaneous detection, enumeration and confirmation of Enterococci from waters using Defined Substrate Technology (DST) - Enterolert Test Kit.

## Calculation

Free and Total Carbon Dioxide may be calculated using alkalinity forms only when the samples TDS is <500mg/L. If TDS is >500mg/L free or total carbon dioxide cannot be reported. APHA4500CO2 D.

## FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.  
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- 1 Bq is equivalent to 27 pCi
- 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: [www.sgs.com.au/en-gb/environment-health-and-safety](http://www.sgs.com.au/en-gb/environment-health-and-safety).

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## **RISING HEAD PERMEABILITY SHEETS**

# Slug Permeability Results



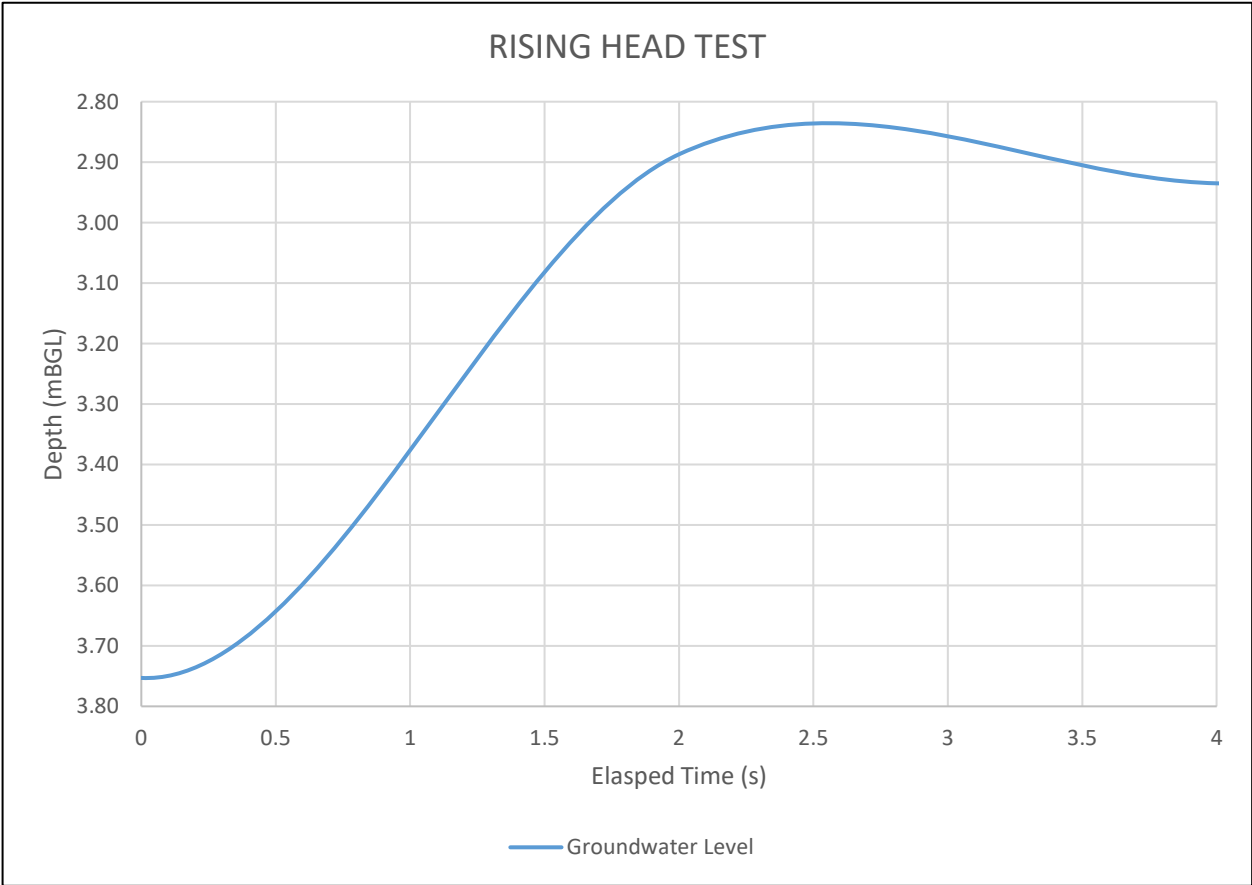
79/6 Bellambi Lane, Bellambi NSW 2518  
P: 0405 843 933 | E: info@morrowgeo.com.au

Project Number	P3324
Address	465-469 Princes Hwy, Rockdale
Borehole	BH1 (test 1)
Monitoring Date	20/11/2024

Static water level (mBGL)	2.89
Internal Diameter (D) (m)	0.07
Length of Standpipe below Ground Level (m)	12.30
Height of Water above Ground Level (m)	0.00
Length of Standpipe above Ground Level (m)	0.00
Water level at start of test (mBGL)	2.89
Top of Response Zone (mBGL)	3.08
Bottom of Response Zone (mBGL)	3.65

Time (t1) (s)	0.5
Time (t2) (s)	1.5
Initial Head (H1) at (t1)	3.65
Final Head (H2) at (t2)	3.08
Length of Response Zone (L)	0.57
Cross Sectional Area (A)	0.0038

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]}$  =  $\frac{3.58}{2.79}$  = 1.28

Permeability (k)  $\frac{A}{F(t_2-t_1)} \log_e \frac{H_1}{H_2}$  = 5.10E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024

# Slug Permeability Results

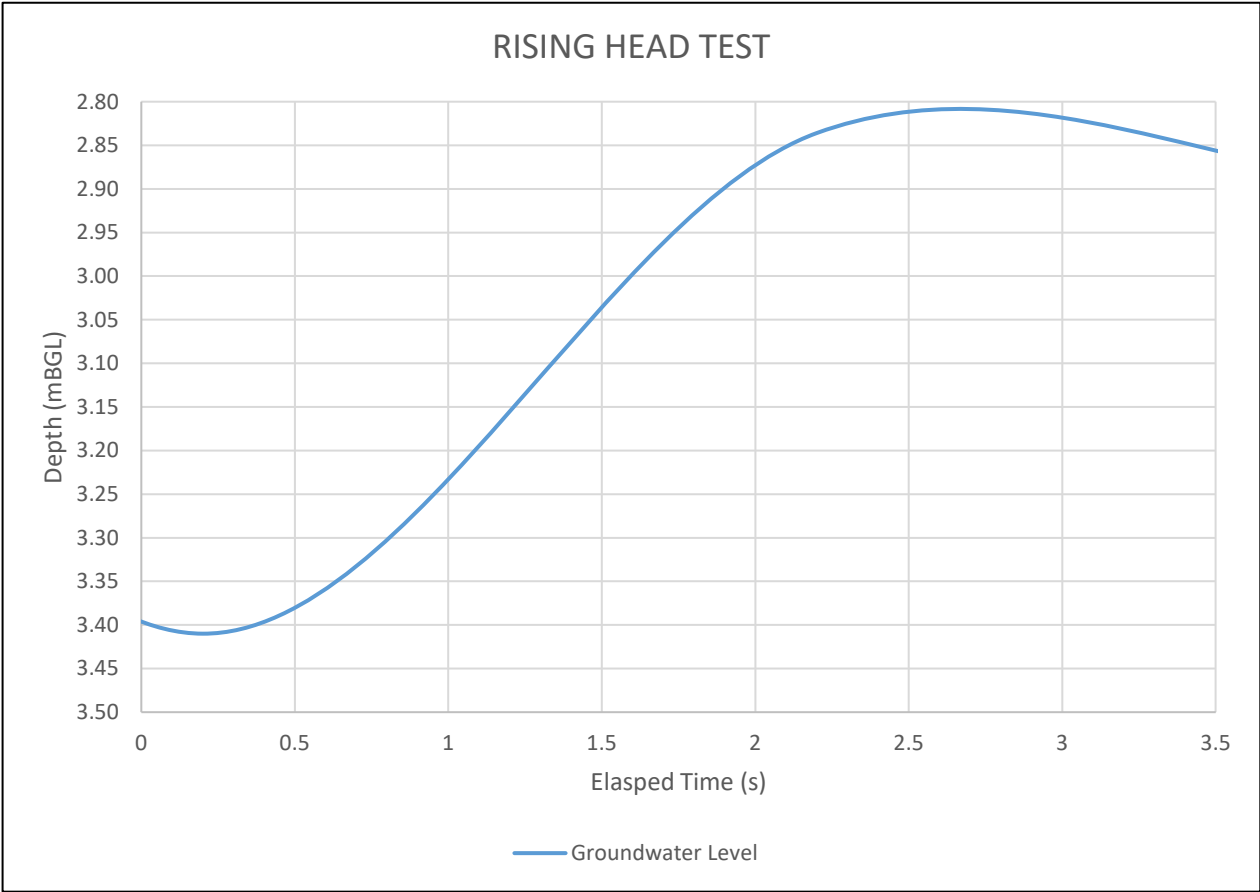


79/6 Bellambi Lane, Bellambi NSW 2518  
P: 0405 843 933 | E: info@morrowgeo.com.au

Project Number	P3324
Address	465-469 Princes Hwy, Rockdale
Borehole	BH1 (test 2)
Monitoring Date	20/11/2024

Static water level (mBGL)	2.89	Time (t1) (s)	0.5
Internal Diameter (D) (m)	0.07	Time (t2) (s)	2
Length of Standpipe below Ground Level (m)	12.30		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	3.38
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	2.87
Water level at start of test (mBGL)	2.89	Length of Response Zone (L)	0.51
Top of Response Zone (mBGL)	2.87	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	3.38		

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \sqrt{1 + (L/D)^2}]}$  =  $\frac{3.20}{2.68}$  = 1.19

Permeability (k)  $\frac{A}{F (t2-t1)} \log_e \frac{H1}{H2}$  = 3.51E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024

# Rising Head Permeability Results

morrow

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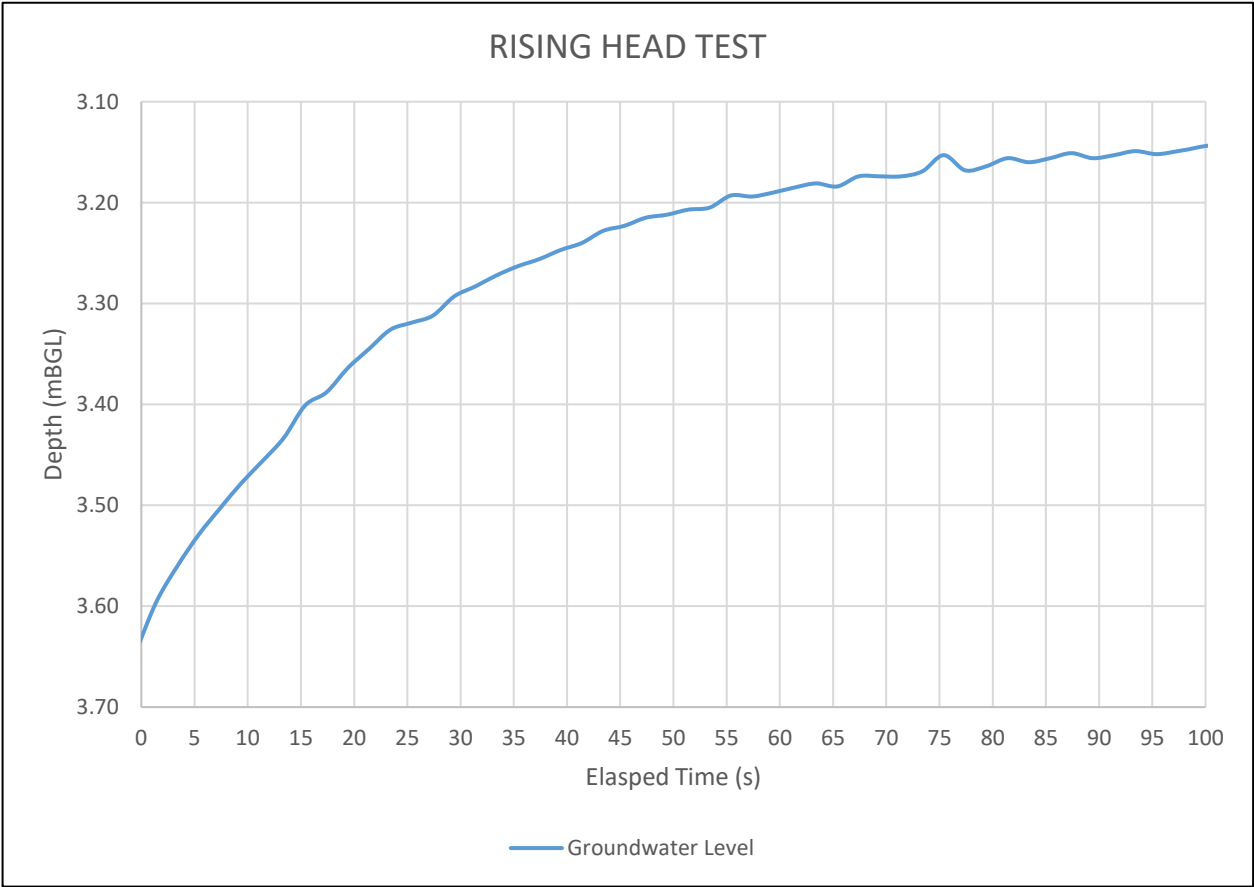
Project Number	P3324
Address	465-469 Princers Hwy, Rockdale
Borehole	BH2 (test 1)
Monitoring Date	19/11/2024

Static water level (mBGL)	3.08
Internal Diameter (D) (m)	0.07
Length of Standpipe below Ground Level (m)	15.66
Height of Water above Ground Level (m)	0.00
Length of Standpipe above Ground Level (m)	0.00
Water level at start of test (mBGL)	3.08
Top of Response Zone (mBGL)	3.32
Bottom of Response Zone (mBGL)	3.60

Time (t1) (s)	1.401
Time (t2) (s)	23.4

Initial Head (H1) at (t1)	3.60
Final Head (H2) at (t2)	3.32
Length of Response Zone (L)	0.28
Cross Sectional Area (A)	0.0038

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D 
$$\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]} = \frac{1.76}{2.09} = 0.84$$

Permeability (k) 
$$\frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2} = 1.66E-05 \text{ m/s}$$

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024

# Rising Head Permeability Results

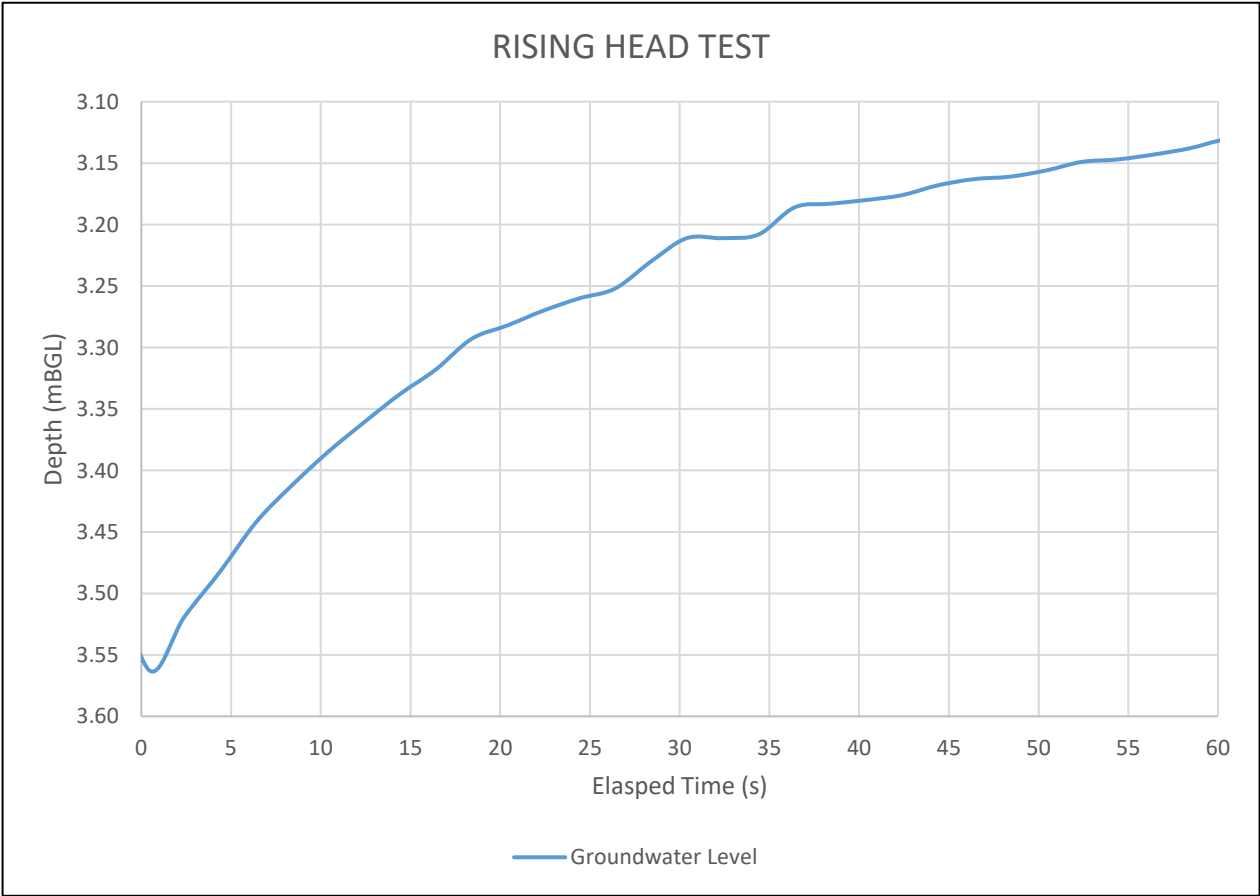
morrow

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Project Number	P3324
Address	465-469 Princers Hwy, Rockdale
Borehole	BH2 (test 2)
Monitoring Date	19/11/2024

Static water level (mBGL)	3.08	Time (t1) (s)	0.4
Internal Diameter (D) (m)	0.07	Time (t2) (s)	16.4
Length of Standpipe below Ground Level (m)	15.66		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	3.56
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	3.31
Water level at start of test (mBGL)	3.08	Length of Response Zone (L)	0.25
Top of Response Zone (mBGL)	3.31	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	3.56		

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]}$  =  $\frac{1.57}{1.99}$  = 0.79

Permeability (k)  $\frac{A}{F(t_2-t_1)} \log_e \frac{H_1}{H_2}$  = 2.21E-05 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

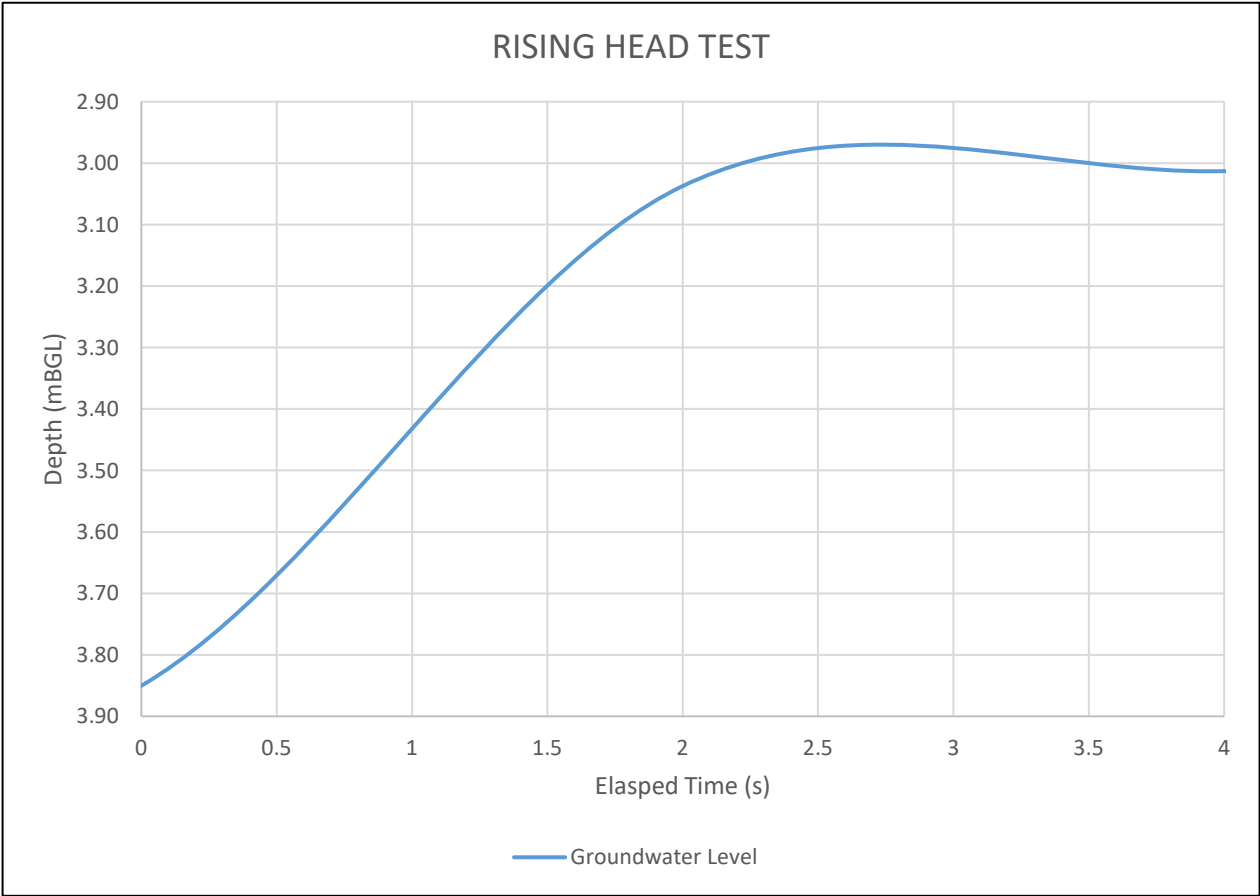
Calculation by: AB      Checked by: AM      Date: 20/11/2024

Slug Permeability Results

Project Number	P3324
Address	465-469 Princers Hwy, Rockdale
Borehole	BH2 (test 3)
Monitoring Date	19/11/2024

Static water level (mBGL)	3.08	Time (t1) (s)	0.2
Internal Diameter (D) (m)	0.07	Time (t2) (s)	2
Length of Standpipe below Ground Level (m)	15.66		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	3.80
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	3.03
Water level at start of test (mBGL)	3.03	Length of Response Zone (L)	0.77
Top of Response Zone (mBGL)	3.03	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	3.80		

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \sqrt{1 + (L/D)^2}]}$  =  $\frac{4.84}{3.09}$  = 1.56

Permeability (k)  $\frac{A}{F (t2-t1)} \log_e \frac{H1}{H2}$  = 3.10E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024

# Slug Permeability Results



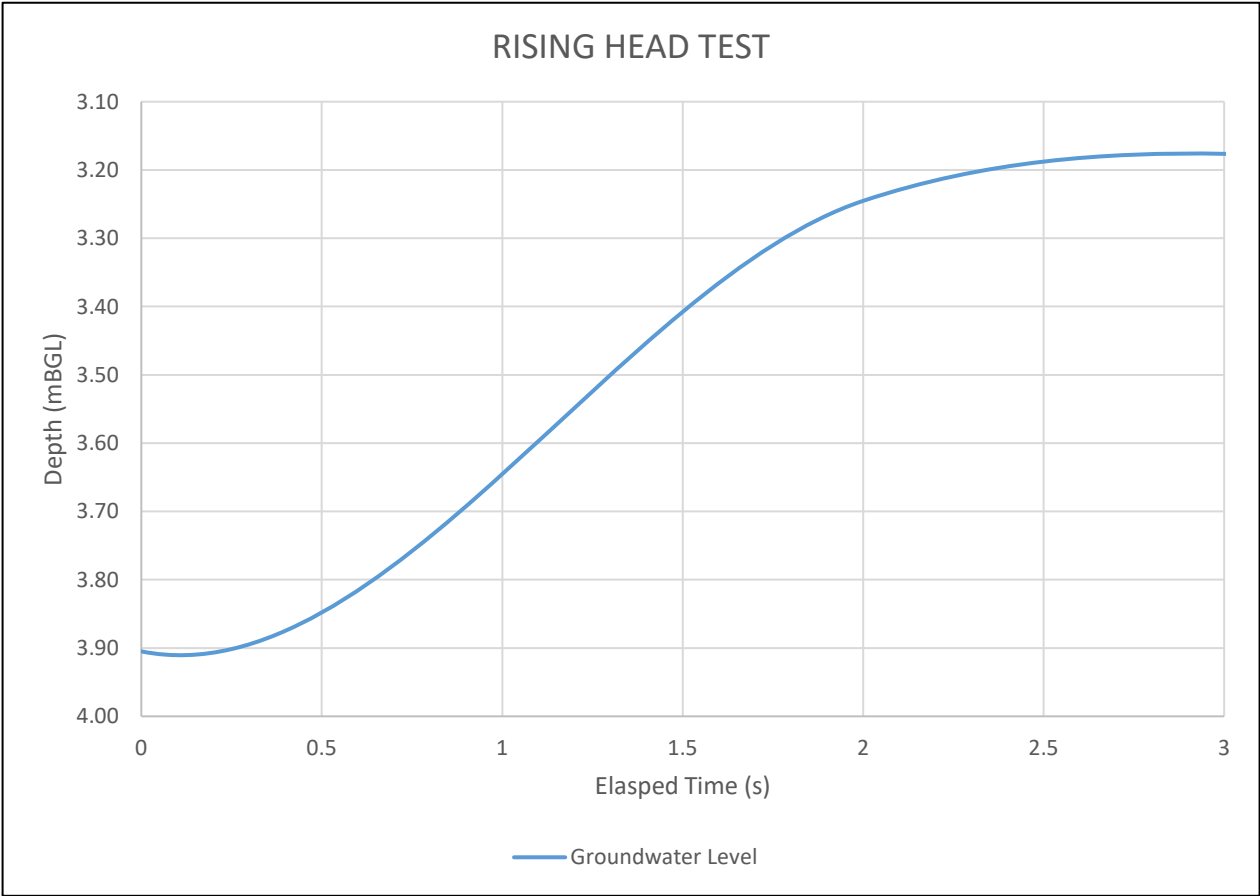
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Project Number	P3324
Address	465-469 Princers Hwy, Rockdale
Borehole	BH2 (test 4)
Monitoring Date	19/11/2024

Static water level (mBGL)	3.08
Internal Diameter (D) (m)	0.07
Length of Standpipe below Ground Level (m)	15.66
Height of Water above Ground Level (m)	0.00
Length of Standpipe above Ground Level (m)	0.00
Water level at start of test (mBGL)	3.03
Top of Response Zone (mBGL)	3.40
Bottom of Response Zone (mBGL)	3.85

Time (t1) (s)	0.5
Time (t2) (s)	1.5
Initial Head (H1) at (t1)	3.85
Final Head (H2) at (t2)	3.40
Length of Response Zone (L)	0.45
Cross Sectional Area (A)	0.0038

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]}$  =  $\frac{2.83}{2.56}$  = 1.10

Permeability (k)  $\frac{A}{F(t_2-t_1)} \log_e \frac{H_1}{H_2}$  = 4.33E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB Checked by: AM Date: 20/11/2024

# Slug Permeability Results

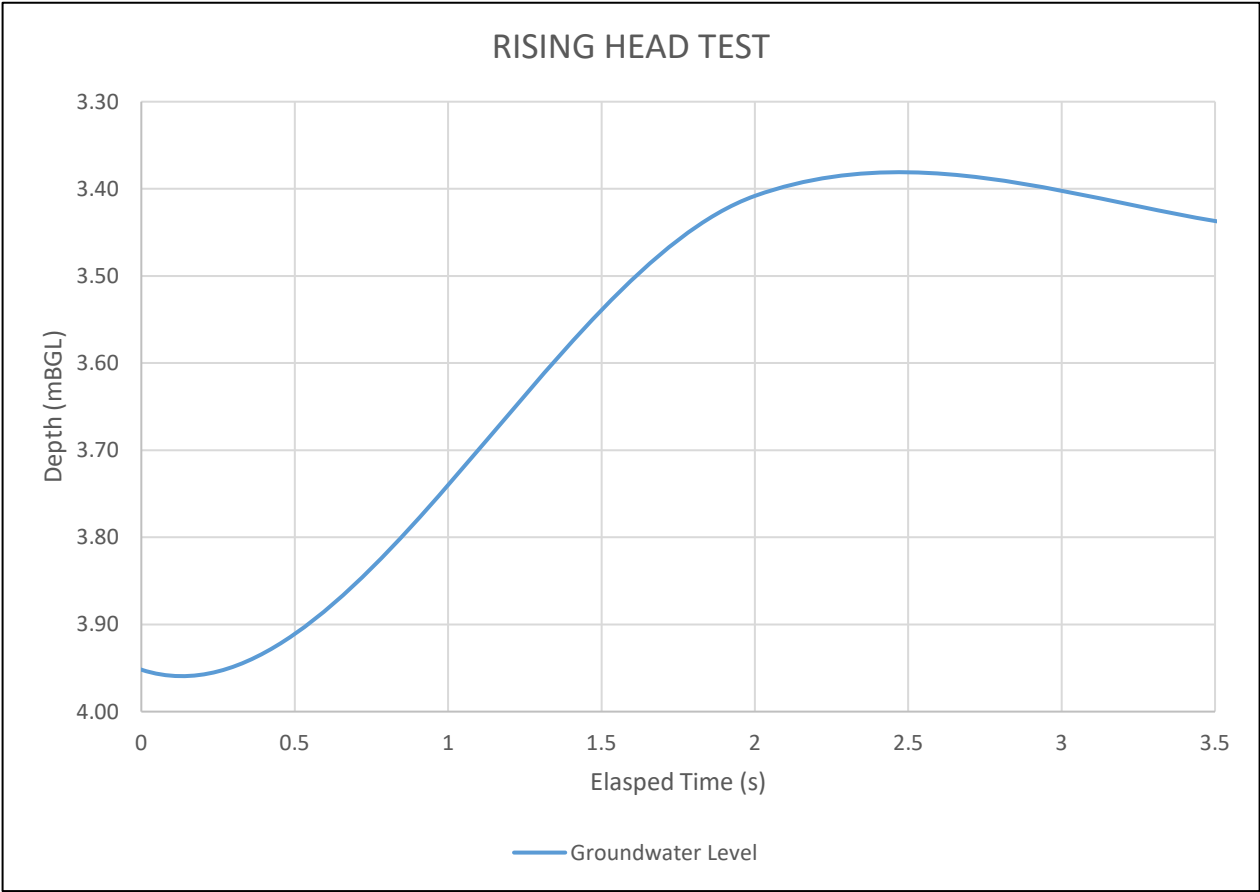


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Project Number	P3324
Address	465 Princes Highway, Rockdale
Borehole	BH2 (test 5)
Monitoring Date	18/09/2024

Static water level (mBGL)	3.08	Time (t1) (s)	0.5
Internal Diameter (D) (m)	0.07	Time (t2) (s)	2
Length of Standpipe below Ground Level (m)	15.66		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	3.91
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	3.41
Water level at start of test (mBGL)	3.08	Length of Response Zone (L)	0.50
Top of Response Zone (mBGL)	3.41	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	3.91		

Stratigraphy Description: Fill and alluvial soil over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]}$  =  $\frac{3.14}{2.66}$  = 1.18

Permeability (k)  $\frac{A}{F(t_2-t_1)} \log_e \frac{H_1}{H_2}$  = 2.99E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024



# Rising Head Permeability Results

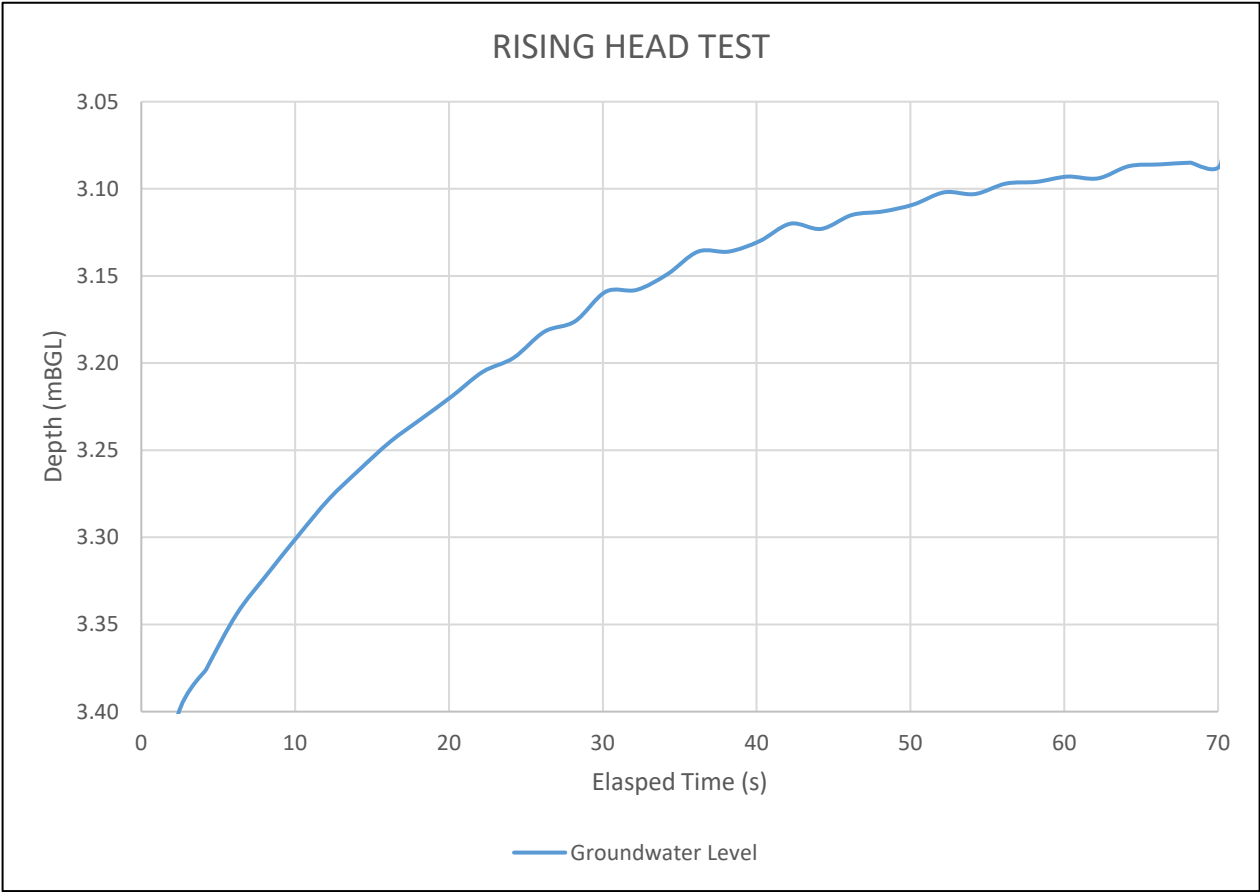
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Project Number	P3324
Address	465 Princes Highway, Rockdale
Borehole	BH2 (test 6)
Monitoring Date	18/09/2024

Static water level (mBGL)	3.08	Time (t1) (s)	4.2
Internal Diameter (D) (m)	0.07	Time (t2) (s)	30
Length of Standpipe below Ground Level (m)	15.66		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	3.37
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	3.15
Water level at start of test (mBGL)	3.08	Length of Response Zone (L)	0.22
Top of Response Zone (mBGL)	3.15	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	3.37		

Stratigraphy Description: Fill and alluvial soil over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \ddot{O}(1 + (L/D)^2)]}$  =  $\frac{1.38}{1.86}$  = 0.74

Permeability (k)  $\frac{A}{F(t_2-t_1)} \log_e \frac{H_1}{H_2}$  = 1.36E-05 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

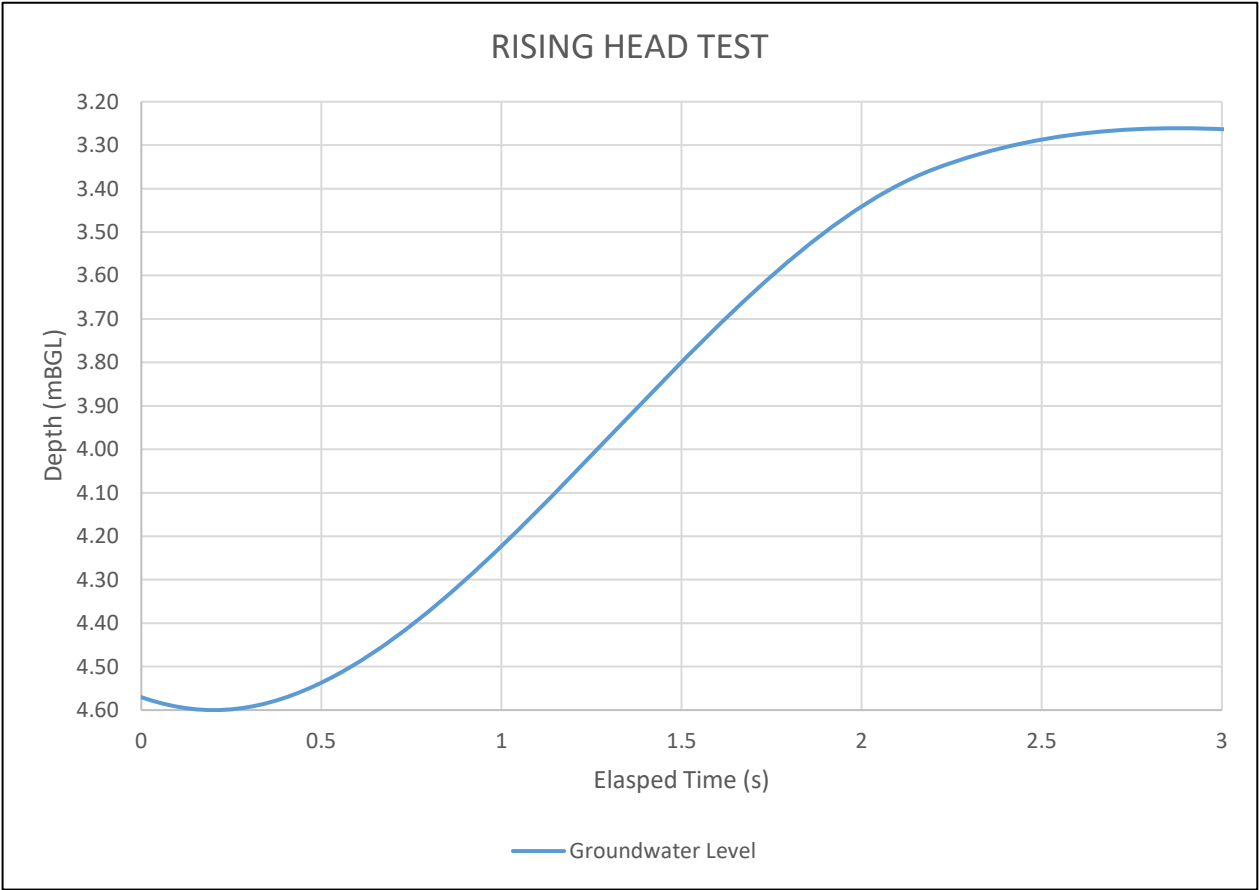
Calculation by: AB Checked by: AM Date: 20/11/2024

Slug Permeability Results

Project Number	P3324
Address	465-469 Princes Hwy, Rockdale
Borehole	BH3 (test 1)
Monitoring Date	18/09/2024

Static water level (mBGL)	3.40	Time (t1) (s)	0.5
Internal Diameter (D) (m)	0.07	Time (t2) (s)	2
Length of Standpipe below Ground Level (m)	6.71		
Height of Water above Ground Level (m)	0.00	Initial Head (H1) at (t1)	4.54
Length of Standpipe above Ground Level (m)	0.00	Final Head (H2) at (t2)	3.45
Water level at start of test (mBGL)	3.40	Length of Response Zone (L)	1.09
Top of Response Zone (mBGL)	3.45	Cross Sectional Area (A)	0.0038
Bottom of Response Zone (mBGL)	4.54		

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D  $\frac{2pL}{\log_e [(L/D) + \sqrt{1 + (L/D)^2}]}$  =  $\frac{6.85}{3.44}$  = 1.99

Permeability (k)  $\frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$  = 3.54E-04 m/s

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB      Checked by: AM      Date: 20/11/2024

# Slug Permeability Results



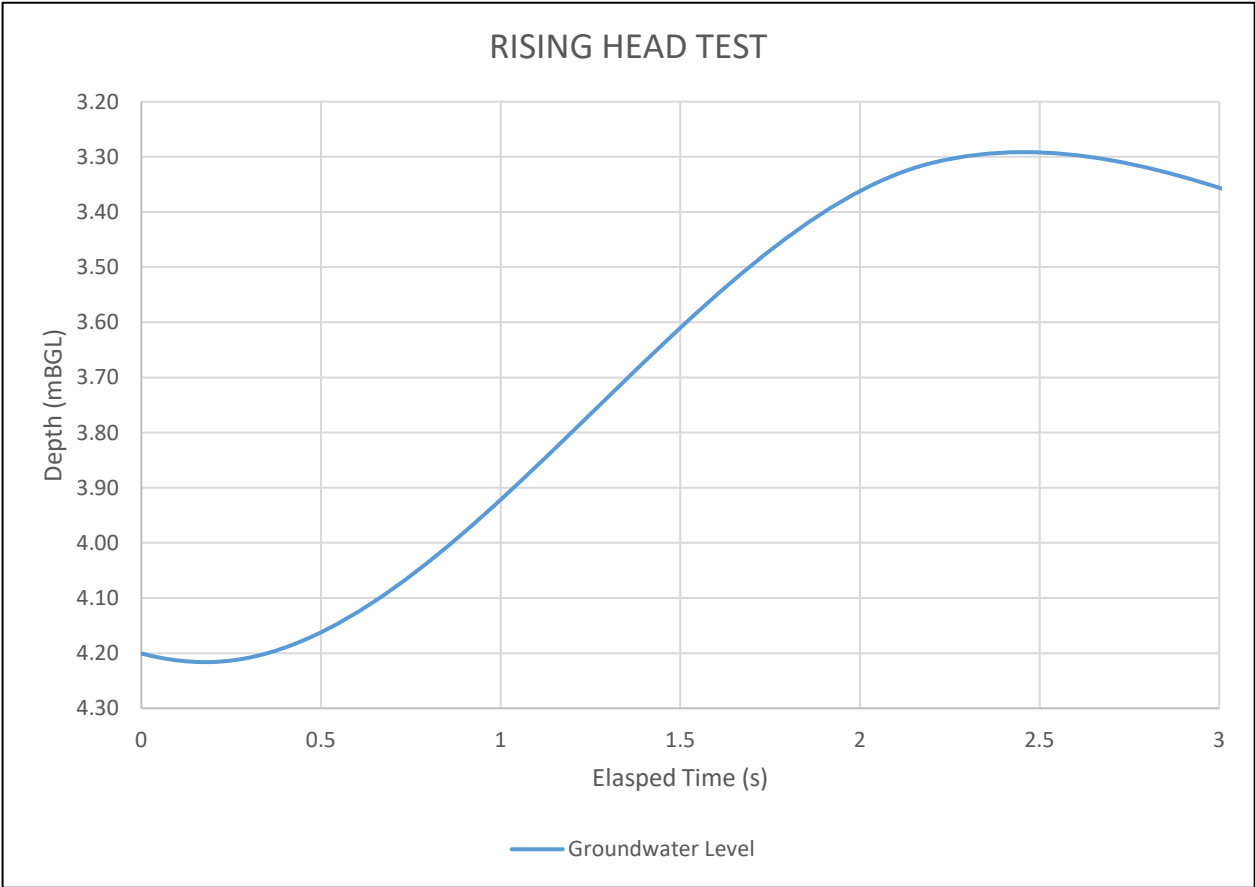
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Project Number	P3324
Address	465-469 Princes Hwy, Rockdale
Borehole	BH3 (test 2)
Monitoring Date	18/09/2024

Static water level (mBGL)	3.40
Internal Diameter (D) (m)	0.07
Length of Standpipe below Ground Level (m)	6.71
Height of Water above Ground Level (m)	0.00
Length of Standpipe above Ground Level (m)	0.00
Water level at start of test (mBGL)	3.40
Top of Response Zone (mBGL)	3.31
Bottom of Response Zone (mBGL)	4.17

Time (t1) (s)	0.5
Time (t2) (s)	2.2
Initial Head (H1) at (t1)	4.17
Final Head (H2) at (t2)	3.31
Length of Response Zone (L)	0.86
Cross Sectional Area (A)	0.0038

Stratigraphy Description: Fill and alluvial soils over sandstone bedrock



Intake Factor (F) Case D 
$$\frac{2pL}{\log_e \left[ \frac{L}{D} + \frac{1}{2} \left( 1 + \left( \frac{L}{D} \right)^2 \right) \right]} = \frac{5.40}{3.20} = 1.69$$

Permeability (k) 
$$\frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2} = 3.10 \times 10^{-4} \text{ m/s}$$

Rising Head Test Method 1 (after Hvorslev)  
Formulae for borehole permeability tests(21.4.6) BS5930 : 1981

Calculation by: AB Checked by: AM Date: 20/11/2024

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