Hydrogeological Assessment

Douglas Park Memorial Park- Concept Plan and Stage 1

Final Report

P2410607JR01V01

May 2025

environmental science & engineering

CONSULTATION DECLARATION

PROJECT DETAILS	
PROJECT NAME	
Application number	SSD- 68287712
Address of subject land	430-490 Douglas Park Drive, Douglas Park
Lot / DP	Lot 2 in DP 250359
APPLICANT DETAILS	
Applicant name	Benima Pty Ltd
Applicant address	PO Box a769, Sydney South, New South Wales, 1235, Australia
REPORT DETAILS	
Name of report this declaration relates	Hydrogeological Assessment
Report reference no.	P2410607JR01V01
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DECLARATION BY CONSULTANT	
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Organisation registered with	Institution of Engineers Australia

Declaration	The undersigned declares that the Hydrogeological Assessment:
	• has been prepared in accordance with the following policy, guidelines, or legislative requirements:
	  ○ Australian Government Bureau of Meteorology (2023). Groundwater Explorer.
	  ○ Department of Planning and Environment (2022). Guidelines for Groundwater Documentation for SSD/SSI Projects.
	  ○ New South Wales Department of Primary Industries Office of Water (2012), NSW Aquifer Interference Policy.
	  ○ New South Wales Government – NSW legislation, Water Management Act 2000.
	• contains all available information relevant to the enviornmental assessment of the development, activity or infrastructure to which the groundwater assessment relates;
	• does not contain information that is false or misleading;
	• identifies and addresses the relevant Planning Secretary's enviornmental assessment requirements (SEARs) for the project;
	• identifies and addresses the relevant statutory requirements for the porject, including any relevant matters for consideration in enviornmental planning instruments to which the groundwater assessment relates;
	• contains a consolidated summary of the proposed or necessary mitigation measures.

Signature	
Date	23 May 2025

Project Details

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Client	Benima Pty Ltd
Document	P2410607JR01V01
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1 Introduction

1.1 Overview

This hydrogeological (groundwater) assessment has been prepared by Martens & Associates Pty Ltd (**MA**) on behalf of Benima Pty Ltd to support a State Significant Development Application (**SSDA**) for a combined Concept Plan approval and Stage 1 detailed works for a new multi-denominational cemetery at 430-490 Douglas Park Drive, Douglas Park (the **Site**). The project is referred to as the 'Douglas Park Memorial Park - Concept Plan and Stage 1'.

The Site is located at 430-490 Douglas Park Drive, Douglas Park within the Wollondilly Local Government Area (**LGA**). The Site is irregular in shape with a total size of 167,940 m^2 and is legally described as Lot 2 in DP250359. The Site is mostly vacant with scattered vegetation and a single residential dwelling with driveway accessible from Douglas Park Drive. The Site comprises two street frontages, to the east is Mitchell Place and to the west is Douglas Park Drive.

Refer to Map 01, Appendix F for an overview of the Site.

1.2 Proposed Development

1.2.1 General Description

Concept approval is sought for the use and operation of the Site as a cemetery with a maximum staged capacity of up to 37,107 burial plots (Arcadia, 2025). The proposal includes a crematoria and chapel, vaults, remembrance sanctuaries, general Site layout and all associated groundworks, roads, pathways, landscaping and ancillary buildings. Refer to Appendix B for the concept site plan prepared by Ethos Urban and Appendix C for a selection of architectural plan pages prepared by Design Cubicle.

The Stage 1 works comprise the following (refer to Map 03, Appendix F for Stage 1 DA works):

- Development of Burial Zones A, B, C, D and E as shown on the Ethos Urban concept site plan.
- All preparatory site works including vegetation protection, enhancement and removal, demolition of existing structures, bulk excavation and replacement for the above burial zones, general ground works and utility service augmentation;
- Vehicular access / egress from Douglas Park Drive with separate vehicular egress only to Mitchell Place;
- Construction of internal roads, pathways and parking areas for approximately 118 car parking spaces inclusive of 1 hearse car parking space;
- Perimeter memorial pedestrian pathway with remembrance sanctuaries;

- Burial zones with a maximum capacity of 15,447 comprising shallow, single and triple layered burial plots;
- Construction of single storey chapel, single storey administration building and single storey storage shed and garage;
- Site landscaping, fencing, lighting and signage; and
- The cemetery operating hours, including public access, will be between the hours of 6:00am and 6:00pm, 7 days a week. The opening hours of the Chapel and Administration Building (including café) will be between 8:00am and 5:00pm, 7 days a week.

We understand that burial zone preparation works within Stage 1 will be carried out sequentially within each burial zone and will be based on the demand for burial plots.

This report has been prepared in the context of the nearby Appin West Colliery, refer to the mine subsidence assessment prepared by Rapid Geo [RG881-GR-1-1 (Rev 4)].

For a detailed project description refer to the Environmental Impact Statement (**EIS**) prepared by Ethos Urban. The extent of Stage 1 works is shown in the concept site plan also prepared by Arcadia and provided in Appendix B.

1.2.2 Proposed Burial Extents

We understand that there will be several different burial types which shall be applied to different areas of the Site depending on depth to observed groundwater. The burial types are:

- Triple burials: this shall result in the lowest casket being placed at a maximum depth of 2.85 m below ground level (**BGL**).
- Single burials: base of casket buried to a maximum depth of 1.35 mBGL.
- Shallow burials: base of casket buried to maximum depth of 1.05 mBGL.

This is with reference to the cut/fill and burial earthworks plans prepared by Lanigan Civil (LC2996-EW100, LC2996-TP01 to EW04, dated 23/4/25) which details proposed excavation depths and burial management. Refer to Appendix D for civil earthwork drawings.

1.3 Assessment Scope

This assessment scope included the following:

1. Review and analysis of publicly available hydrogeological data for the Site and surrounding area.
2. Installation of monitoring wells (MWs) and continuous groundwater level monitoring.
3. Groundwater quality testing.

4. Analysis of results from field investigations and groundwater monitoring.
5. Assessment of existing groundwater conditions for potential constraints on the proposed development.
6. Complete an impact assessment with respect to the Aquifer Interference Policy (**AIP**) and appropriate groundwater guidelines.
7. Provide recommendations for the proposed development and any future assessment requirements.

1.4 Secretary's Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements (**SEARs**) where issued by the NSW Department of Planning, Housing and infrastructure (**DPHI**) for the proposal on 4 April 2024. The following SEARs requirements, relating to groundwater, have been addressed within this report.

SEARs Requirement	Relevant Sections of Report

Item 14.0 [Stage 1] - Ground and Water Conditions
• Assess the suitability of ground conditions for burial and potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity, and acid sulfate soils.
• Provide a Surface and Groundwater Impact Assessment that assesses potential impacts on:
  ○ surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses.
  ○ groundwater resources in accordance with the relevant *Groundwater* Guidelines.
• The surface and Groundwater Impact Assessment to include:
  ○ a detailed and consolidated site water balance.
  ○ description of all works/activities (both temporary and permanent) that may intercept, extract use divert or receive surface water and/or groundwater.
  ○ details of all water take (directly and indirectly) for the life of the project and post closure where applicable.
  ○ details of Water Access Licences (WALs) held to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring.
  ▪ any exemptions or exclusions to requiring approvals or licences under the Water Management Act 2000 should be provided.
	Section 2.3
	Section 2.5
	Section 3.2 – 3.4
	Section 3.5.3
	Section 3.6
	Section 4.1
	Section 4.3
	Section 5.2
	Section 6
	Section 3.6
	This report does not assess surface water impact.

SEARs Requirement	Relevant Sections of Report

Item 16.0 [Concept Proposal] - Ground and Water Conditions
• Assess the suitability of ground conditions for burial and potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity, and acid sulfate soils.
• Provide a Surface and Groundwater Impact Assessment for the Concept Proposal that assesses potential impacts on:
  ○ surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses.
  ○ groundwater resources in accordance with the relevant *Groundwater* Guidelines.
	Section 2.3
	Section 2.5
	Section 3.2 – 3.4
	Section 3.5.3
	Section 3.6
	Section 4.1
	Section 4.3
	Section 5.2
	Section 6
	Section 3.6

1.5 Previous Investigations

The following previous investigations that relate to ground or groundwater conditions on the Site have been provided to MA by the Client:

- **Geotechnique (2025)** Douglas Park Memorial Park – Concept Plan and Stage 1 Geotechnical Investigation (ref: 14329/3-AA R3, 19 May 2025). This report documents the assessment of soil and rock conditions on the Site from augered boreholes, test pits and rock cored holes.

- **Rapid Geo (2024)** Groundwater Assessment (ref: RG881-GR-2-1 R2). This report provides a preliminary assessment of hydrogeological conditions via the initial installation of 11 MWs up to a depth of 5 mBGL.

1.6 General Site Details

Site information is summarised in Table 1 and Map 01, Appendix F.

Table 1: Site details.

Item	Description / Comment
Property address	430 – 490 Douglas Park Drive, Douglas Park, NSW (‘**Site**’)
Lot / DP	Lot 2 in DP 250359
LGA	Wollondilly Shire Council ('Council')
Site area	167,940 m^2 (Ethos Urban, 2025)
Topography	The Site is located within gently undulating terrain, on an upper to mid slope of a northeast facing slope.
Slopes, aspect, elevation	The Site has a northeasterly aspect with overall grades ranging between 15 - 20%. Ground elevation across the Site ranges between approximately 131 mAHD in the northern portion of the Site and 151 mAHD in the southern portion of the Site (BW, 2024).

Item	Description / Comment
Surrounding land uses	North and east contain rural residential properties along Mitchell Place, to the south is a large rural property containing the Catholic retreat centre for the Missionaries of the Sacred Heart. To the west of the Site is the Hume Highway, with bushland beyond.
Existing development	The Site is occupied by residential dwelling and ancillary features in the southwestern potion of the Site. A septic tank, located to the east of the dwelling disposes of effluent downslope of the dwelling in a grassed paddock. The northern portion of the Site primarily consists of vegetated land with some livestock facilities interspersed throughout.
Surface hydrology	Drainage primarily consists of overland flow to Site drainage depressions which discharge to Mitchell Place to the north and east. There is a farm dam located in the central western portion of the Site (to the north of the dwelling). Overland flow is expected to eventually discharge to the Nepean River approximately 400 m to the north.

1.7 Groundwater Guidelines

1.7.1 Overview

The groundwater guidelines "*Guidelines for Groundwater Documentation for SSD/SSI Projects: Technical Guideline,*" developed by the Water Group of the NSW Department of Planning and Environment (the **Guidelines**), have been considered in this assessment. The Guideline provides an overview of the regulatory and policy framework applying to major projects in NSW and includes detail on how to assess groundwater impacts due to state significant development and infrastructure projects in New South Wales and are designed to assist project proponents in demonstrating compliance with the principles of the *Water Management Act 2000* (NSW), the groundwater policy documents, and the *Environmental Planning and Assessment Act 1979*.

1.7.2 Investigation Requirements

The Guidelines require that proposals establish pre-development baseline conditions, this being critical to assessing the potential impact of a project on the water environment. Specific data requirements for each project type and location will differ and will depend on the potential risk the proposed development poses to the water environment. Data requirements will vary based on the scale and scope of the project and whether the project activities will intersect the water table.

Table 2 presents an overview of the requirements for both groundwater desktop study and field investigation.[1]

[1] DPE (2022) *Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical guideline* pp 23, 34 – 41.

Table 2: Data requirements for groundwater investigations.

Requirements	Related Information
Desktop study	Geographical information
	Geological information
	Hydrogeological information & data
	Groundwater receptors
Field investigations and monitoring network	Surface geophysical surveys
	Drilling and construction of bores
	Downhole geophysical surveys
	Groundwater level monitoring
	Aquifer testing
	Hydrogeochemical analysis
	Receptor identification
	Surface water monitoring

1.7.3 Impact Assessment Considerations

The Guidelines specify that Groundwater Impact Assessments (**GIA**s) should evaluate activities interfering with aquifers, other water-affecting actions (e.g., water supply bores), and potential impacts on receptors. GIAs should address direct and indirect effects on groundwater and propose mitigation measures to address any anticipated potential impacts. Table 3 summarises general considerations included in the Guidelines.

Table 3: Groundwater impact assessment criteria.

Attribute	Issue	Consideration
Climate	Rainfall & evaporation	To what extent is groundwater depletion likely?
		Over what timeframe will resource replenishment take place?
		What water-use efficiency measures will be implemented?
Physical setting	Water resources	What water systems might be impacted by the project activities?
		What will be the scale of change induced to water systems by the operations (quantity & quality)?
		What is the spatial distribution of groundwater elevations?
	Lithology & soils	What is the spatial distribution of lithology and soil types?
		How will lithology and soil type constrain the location of water holding facilities?
		Are there suitable materials available for rehabilitation at completion of the development?
		How will acid rock drainage be managed?
	Topography	What is the spatial distribution of depth to water table (i.e. difference between topography and groundwater elevations)?

Attribute	Issue	Consideration
		What is the location of proposed infrastructure in relation to the depth to water table plan?
Groundwater	Quantity	Will there be any reductions or fluctuations in groundwater levels and/or piezometric pressure, including the timeframes for these changes?
		Will there be any reduction in seasonal baseflow condition?
	Quality	Changes in water quality attributes, such as pH, dissolved oxygen, nutrients, temperature, turbidity, salinity?
		Changes in water quality (as above) that may impact on any beneficial use of the aquifer.
Community & Economic	Traditional owners	Are there culturally significant sites (for example, springs) that may be impacted by the project activities?
		Has an assessment been conducted of the effect project activities might have on maintenance of spring environmental flows?
	Agriculture	Have pastoral and irrigated agriculture interests that utilise groundwater been identified?
		Has an assessment been conducted of the effect proposed activities might have on continued access to groundwater by agricultural interests?
	Municipal & domestic	Have municipal and domestic interests that utilise groundwater been identified?
		Has an assessment been conducted of the effect project activities might have on continued access to groundwater by these water users?
Environment	Terrestrial vegetation	Have groundwater dependent ecosystems that might be impacted by the project been identified?
	Spring-fed wetlands & baseflow-fed streams	Has vadophytic vegetation that might be impacted by mining activities been identified?
	Aquifer	Have the environmental water requirements of the groundwater dependent ecosystems and vadophytic vegetation been assessed?
	Marine	Has an assessment been conducted of the effect project activities might have on continued access to assessed environmental water requirements?

Notes:

1. Source: DPE (2022) *Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical guideline* pp 75 - 77.

2 Environmental Setting

2.1 Geology Mapping

The Sydney 1:100,000 Geological Sheet 9130 indicates that the Site is underlain by Hawkesbury Sandstone comprising medium to coarse grained quartz sandstone, very minor shale and laminate lenses.

The Ashfield Shale outcrop zone, comprising dark grey to black claystone-siltstone and fine sandstone-siltstone laminate, is mapped as being located approximately 200 m to the south of the Site.

Site geological mapping is shown in Map 05 of Appendix F.

2.2 Soil Landscapes

The NSW Office of Environment and Heritage's (**OEH**) geological information system (eSPADE) indicates the Site is located within the Blacktown (**bt**) soil landscape, consisting of gently undulating rises on the Wianamatta Group. This soil landscape is characterised by > 200 cm of soil on lower side slopes. It is often associated with localised seasonal waterlogging, localised water erosion hazard, moderately reactive highly plastic subsoil and localised surface movement potential.

Soil landscapes are shown on Map 06 of Appendix F.

2.3 Geotechnical Investigations

A comprehensive analysis of borehole geological data from the Site has been conducted with key findings from investigations completed by MA as well as review of the Geotechnique (2025) report summarised below:

1. Local geology within the Site is characterised by extensive sandstone formations with interbedded shale layers, particularly in the central portion of the Site.
2. Soil depth within the Site ranges between 0.7 - 3.4 m depending on location and relative elevation.
3. Investigation revealed the following generalised subsurface units underlying the Site:

   Unit A: Topsoil comprising of low plasticity silty clay encountered at depths ranging from approximately 0.15 to 0.2 meters below ground level (mbgl).

   Unit B: Residual soil comprising medium plasticity silty sandy clay encountered below unit A, extending to depths of approximately 0.5 to 1.0 mbgl.

   Unit C: Highly – slightly weathered, inferred medium - high strength bedrock, typically comprising of sandstone with interbedded shale layers, below Unit B and down to maximum borehole termination depths of 9.27 mbgl.

Encountered ground conditions are described in more detail on the borehole logs in Appendix G.

2.4 Climate Data

2.4.1 Rainfall and Evapotranspiration

The nearest operating rainfall station to Douglas Park is St Marys Tower (BoM station 068200, 1974 – present) which is located 820 m to the South of the Site. Mean annual rainfall at the station is 791 mm. Mean annual evapotranspiration has been derived from BoM's average monthly evapotranspiration maps as 757 mm.[2] A summary of mean monthly rainfall, evapotranspiration data and calculated surplus / deficit is shown below in Table 4.

Table 4: Mean monthly climate summary.

Month	Rainfall (mm)	Evapotranspiration (mm)	Rainfall Surplus Rainfall – Evap. (mm)
January	71.0	88	-17
February	89.5	85	4.5
March	96.2	66	30.2
April	66.3	56	10.3
May	56.6	47	9.6
June	67.1	38	29.1
July	44.5	32	12.5
August	42.6	42	0.6
September	40.9	57	-16.1
October	56.5	78	-21.5
November	76.6	84	-7.4
December	57.6	84	-26.4
Annual	**772.2**	**757**	**15.2**

2.4.2 Cumulative Residual Rain

Cumulative residual rainfall is the running total of recorded rainfall minus average rainfall. Analysed over preceding months and years, cumulative residual rainfall indicates whether the conditions leading up to monitoring are average, drier than average or wetter than average. Historical annual rainfall and cumulative annual residual rainfall plots are provided in Figure 1, Appendix H. Recorded and average monthly rainfall and cumulative monthly residual rainfall since January 2022 up to March 2025, including the monitoring period is provided in Figure 2, Appendix H.

The cumulative annual residual rainfall graph indicates that precipitation levels were significantly below average from 2017 to 2021. However, in 2022, a sharp increase in rainfall was observed, indicating wetter-than-average conditions at the start of the monitoring period. This is also reflected in the cumulative monthly residual rainfall graph (Figure 2, Appendix H) which shows a rising trend in rainfall from 2022 to 2025. Based on

[2] http://www.bom.gov.au/climate/maps/averages/evapotranspiration/

the overall rainfall data, the monitoring period aligns with the wetter climatic conditions recorded over the past decade.

2.5 Groundwater Data

2.5.1 Surrounding Licensed Groundwater Users

According to the Bureau of Meteorology's (BoM) 'Australian Groundwater Explorer' (2025) website, there are 6 registered boreholes within 3 km of the Site. Available data is summarised in Table 5. Two of the registered bores in the study area have water level data available.

Table 5: Registered bores within 3km of the Site.

Well I.D.	Distance from Site (m)	Bore Depth (m)	Purpose	Standing Water Level (mbgl)
GW138059.1.1	950	305	Stock and Domestic	Unknown
GW100688.1.1	2371	8	Monitoring Bore	5.42
GW100690.1.1	2350	8	Monitoring Bore	4.0
GW100689.1.1	2350	8	Monitoring Bore	Unknown
GW112558.1.1	2240	2450	Dewatering and Mining	Unknown

2.5.2 Water Sharing Plans

The Water Sharing Plan (**WSP**) for the Greater Metropolitan Region Groundwater Sources cover the study area of the proposed development.

2.5.3 Groundwater Dependant Culturally Significant Sites

No groundwater dependent culturally significant sites are identified in the Water Sharing Plans for the Greater Metropolitan Region Groundwater Sources.

2.5.4 Groundwater Dependent Ecosystems

The WSP for the Greater Metropolitan Region Groundwater Sources does not identify any high priority groundwater dependent ecosystems (**GDEs**) in the study area.

Travers Bushfire and Ecology (**TBE**) has conducted a comprehensive ecology investigation to support the SSDA and also did not identify any GDEs on the Site. For a more in-depth analysis and detailed findings of the ecology investigation, refer to the ecological report prepared by Travers Bushfire and Ecology [18BENI02F].

2.5.5 Regional Hydrogeology

The WSP identifies the Site and its surrounding area as part of the Sydney Basin Nepean Groundwater Source, a significant groundwater system within the Sydney Basin. A review of the Bureau of Meteorology's (BoM) Australian Groundwater Insight (BoM, 2025) indicates that the hydrology of the proposed development area and adjacent land is characterised by a lower groundwater source (aquifer).

Groundwater within the fractured rock of the proposed development area is associated with the Sydney Basin Nepean Groundwater Source. The area's hydrogeology is defined by porous rock formations, supporting extensive aquifers of low to moderate productivity, with salinity levels exceeding 3,000 mg/L, indicating fresh to saline water quality.

The water-bearing zones within the vicinity of the Site and wider surrounding area is occupied by Hawkesbury Sandstone, which features a dual porosity flow system (Larry Cook, 2010). The primary water bearing zones occupy relatively porous stacked layers of rock which is interbedded with contrasting less permeable massive units. The secondary water bearing zones occupy geological discontinuities such as fractures, joints, faults and bedding planes and have higher conductivity but generally constitute minor storage. Within the broader Site area, groundwater movement is predominantly controlled by secondary porosity, with flow occurring primarily through fracture networks, especially along joints and shear zones.

The southern portion of the Sydney Geological Basin (of which the Site resides) has been documented to contain some areas of shallow perched aquifers. These are recognised as unconfined to semi-confined systems, primarily due to the presence of Hawkesbury Sandstone overlying shale lenses of the Berry Formation (part of the Shoalhaven Group), which act as a basal aquitard. These systems can be ephemeral during drier than normal climatic periods.

Groundwater in the regional lower aquifer is generally encountered within the weathered bedrock (typically >15 mbgl) where flow is controlled by the degree of weathering (EMM, 2016). Hydraulic conductivity values ranging from 0.1 to 0.5 m/day reflect the friable and weathered nature of the sandstone, influenced by the interbedded shale layers (Aquaterra, 2011).

Groundwater discharge occurs through spring flows at creeks and depressions, seepage faces, evapotranspiration, and groundwater extraction at bores or quarries. The primary discharge point for the regional aquifer in the local area is expected to be the Nepean River, with an anticipated groundwater level of approximately 62 mAHD (based on the lowest topographic contour to the north of the Site) and its associated tributaries.

3 Groundwater Investigations

3.1 Overview

The following investigations have been completed and data collected for the purposes of the detailed groundwater investigation:

1. Groundwater monitoring wells (**MWs**) were installed over various installation dates by MA and Rapid Geo.
2. Groundwater levels in each well have been continuously monitored using groundwater level data loggers at 15-minute frequency intervals.
3. Groundwater quality testing (field and laboratory analysis) has been completed on MWs that contain groundwater.

Refer to Map 02, Appendix F for borehole and monitoring well locations.

3.2 Groundwater Monitoring Well Installation

3.2.1 Rapid Geo MW Installation

Rapid Geo installed a total of eleven groundwater monitoring wells (MW01–MW11) across two phases of field investigations at the Site, utilising NMLC cored boreholes for installation. The initial phase comprised seven wells (MW01 – MW07), followed by a second phase of four wells (MW08 – MW11), each reportedly installed to a depth of 5 mBGL. However, subsequent depth verification conducted by MA indicated actual well depths ranged between approximately 4.82 to 5.20 mBGL. We note that MW02 was observed to be blocked at 3.27 mBGL during our initial inspection.

Rapid Geo (2024) report indicates all wells were constructed with uniform screen lengths of 3 m and bentonite backfill up to 0.5 mBGL. The report does not document if boreholes were reamed prior to installation of PVC screens and casing to allow for a proper bentonite seal (which is required to prevent seepage from surface water ingress or ephemeral seepage holding at the soil / rock interface).

Construction levels are summarised below in Table 6, with locations shown in Appendix F and construction logs in Appendix G.

3.2.2 MA MW Installation

MA installed a total of ten additional MWs across two phases of field investigations at the Site. The first phase, conducted on 20/01/2025 involved installation of three nested MW pairs consisting of MW12a / MW12b, MW13a / MW13b, MW14a / MW14b in upper elevations of the Site. Each pair comprised a shallow well, terminating at the top of rock (1.30–1.40 mBGL), and a deeper adjacent well (7.9–9.21 mBGL), screened within the sandstone bedrock.

The second phase, undertaken on 20/02/2025, involved the installation of MW15 – MW17 to supplement the groundwater data. MWs were installed to depths of between 7.80–7.90 mbgl.

We note that MW13b was damaged on the 7 February 2025 and was subsequently replaced during the second MW installation round.

MW depths and surface levels are summarised below in Table 6, with locations shown in Appendix F and detailed construction logs in Appendix G.

3.3 Groundwater Monitoring

3.3.1 Monitoring Methodology

Groundwater level monitoring was undertaken across MWs from 07 November 2024 to 22 April 2025 using automated data loggers set to record at 15-minute intervals. Monitoring commenced at each MW following their respective installation dates.

- MW01 – MW11: Monitoring began on 07 November 2024.
- MW12 – MW14: Monitoring began on 23 January 2025.
- MW15 – MW17: Monitoring began on 27 February 2025.

Monitoring was ongoing at the date of this report issue.

3.3.2 Groundwater Levels

Groundwater level monitoring data are summarised in Table 6, which provides details of ground levels at the well, minimum, maximum, median and mean groundwater levels, percentage of monitoring period that the wells were dry, and average groundwater depths below natural ground level. Monitoring well locations with average groundwater depth labels are provided in Map 02, Appendix F.

Table 6: Groundwater monitoring data summary.

Well I.D.	Ground Level (mAHD)[1]	Min. (mAHD)	Median (mAHD)	Mean (mAHD)	Max (mAHD)	% Dry	Well Depth (mBGL)	Average Depth (mBGL)
Monitoring period: 7/11/24 – 22/04/25								
MW01	151.10	Dry	Dry	Dry	Dry	100%	4.99	Dry
MW02	145.80	Dry	Dry	Dry	Dry	100%	3.27	Dry
MW03	141.10	139.35	139.76	139.77	140.18	0%	5.09	1.33
MW04	137.00	134.94	135.32	135.33	135.69	0%	4.98	1.67
MW05	142.98	140.12	141.20	141.17	141.40	0%	5.06	1.81
MW06	142.75	140.69	141.07	141.11	141.50	0%	5.00	1.64
MW07	138.65	135.83	136.29	136.28	136.67	0%	4.92	2.37
MW08	145.25	143.11	143.60	143.58	144.04	0%	5.20	1.67
MW09	139.17	134.71	135.08	135.06	135.41	0%	4.86	4.11
MW10	140.60	Dry	Dry	Dry	Dry	100%	4.91	Dry
MW11	146.00	141.20	141.72	141.81	145.47	0%	5.01	4.19
Monitoring period: 23/01/2025 – 22/04/2025								
MW12a	149.36	Dry	Dry	Dry	Dry	100%	1.29	Dry
MW12b	149.60	Dry	Dry	Dry	Dry	100%	9.00	Dry
MW13a	148.89	Dry	Dry	Dry	Dry	100%	1.27	Dry
MW13b	148.36	Dry	Dry	Dry	Dry	100%	7.90	Dry
MW14a	142.13	Dry	Dry	Dry	Dry	100%	1.35	Dry
MW14b	141.83	Dry	Dry	Dry	Dry	100%	9.21	Dry
Monitoring period: 27/02/2025 – 22/04/2025								
MW15	140.25	132.88	136.61	136.68	137.51	0%	7.9	3.57
MW16	135.90	128.46	129.21	129.14	129.37	11.5%	7.8	6.76
MW17	142.57	135.18	136.00	135.95	136.21	4.9%	7.9	6.62

Notes

1. Ground level from survey (BW, 2025).

The groundwater level in MW02 was observed to respond rapidly to precipitation events indicating an interconnection with surface hydrology (most likely from insufficient sealing of the monitoring well). Subsequently MW02 was considered to be 'dry' for the purposes of this assessment.

Time series plots for all MWs that contained water are provided in Figure 3 and Figure 4, Appendix H, with mean groundwater levels for all MWs shown on Map 04 in Appendix F.

3.3.3 Observed Hydrogeological Zones

Based on monitoring completed to date, the Site has been divided into three 'hydrological zones' with similar hydrogeological characteristics to delineate groundwater areas. These zones correspond to the following potential burial plot areas derived from the architectural plans (Design Cubicle, 2025):

1. Hydrogeological Zone 1: Burial areas D, E and portion of B
2. Hydrogeological Zone 2: Burial area C
3. Hydrogeological Zone 3: Burial areas A, F, G, H, I, J and portion of B.

Refer to Map 04, Appendix F for hydrogeological zones corresponding to the proposed burial plots.

3.4 Hydraulic Conductivity

Rising head slug tests were conducted at 10 monitoring wells to determine saturated hydraulic conductivity (K_{sat}) of the fractured rock aquifer under the Site. The results are provided in Table 7 and calculation sheets provided in Appendix I. Data indicates low K_{sat} values with the mean and geometric mean calculated at approximately 0.012 m/day and 0.0011 m/day, respectively. These values reflect the high permeability of local clay soil and underlying sandstone/shale bedrock.

Table 7: K_{sat} testing summary.

	Test 1		Test 2	
Well I.D.	**Date**	**K_{sat} (m/day)**	**Date**	**K_{sat} (m/day)**
MW03	07/11/2024	0.002	23/01/2025	0.002
MW04	07/11/2024	0.071	NA [1]	NA [1]
MW05	07/11/2024	0.00009	23/01/2025	0.0002
MW06	07/11/2024	0.00007	23/01/2025	0.0002
MW07	07/11/2024	0.0001	23/01/2025	0.010
MW08	07/11/2024	0.018	23/01/2025	0.044
MW09	07/11/2024	0.00004	23/01/2025	0.0001
MW11	07/11/2024	0.0006	23/01/2025	0.0001
MW15	28/02/2025	0.009	20/03/2025	0.002
MW17	27/02/2025	0.0002	NA [1]	NA [1]

Notes:
1. Slug test was not carried out.

3.5 Groundwater Quality

3.5.1 Results

Two rounds of groundwater sampling were conducted on MW03 – MW09 and MW11 on 9 December 2024 and 23 January 2025. A single groundwater sample was collected from MW15 on 20 March 2025.

Samples collected from the MWs containing sufficient groundwater were field tested for pH and EC and grab samples sent to a NATA-certified laboratory for assessment of analytes including sulfate, chloride, major cations / anions (ionic balance suite) nutrients and dissolved heavy metals.

Results of physicochemical parameters and nutrient analysis are provided in Table 8 and Table 9, with laboratory reports provided in Appendix K. Statistical summaries are provided in Table 10.

Table 8: Groundwater sampling test data – major analytes.

Well I.D.	Date Sampled	pH	Electrical Conductivity	Sulphate, SO_4	Chloride, Cl	Sodium – Dissolved
	Units	pH Units	µS/cm	mg/L	mg/L	mg/L
	PQL	N/A	1	1	1	0.5
MW03	11/12/2024	6.4	8600	58	2800	1500
	30/01/2025	6.8	11000	110	3400	1700
MW04	11/12/2024	5.1	9500	360	3300	1600
	30/01/2025	5.7	9800	330	3400	1500
MW05	11/12/2024	6.7	2400	150	440	420
	30/01/2025	6.9	2500	420	120	390
MW06	11/12/2024	6.8	7900	92	2700	1400
	30/01/2025	6.8	8400	160	2600	1300
MW07	11/12/2024	5.5	13000	110	4800	2400
	30/01/2025	5.7	17000	220	6600	2600
MW08	11/12/2024	7.1	6500	120	1600	1100
	30/01/2025	7.2	9500	190	2900	1500
MW09	11/12/2024	7.4	13000	370	4300	2400
	30/01/2025	7.4	14000	320	4600	2200
MW11	11/12/2024	6.0	6600	210	2000	1100
	30/01/2025	5.9	11000	370	3800	1700
MW15	24/03/2025	6.1	5100	110	1300	750

Table 9: Groundwater sampling test data – nutrients and carbonates.

Well I.D.	Date Analysed	Total Phosphorus	Total Nitrogen in water	Ammonia as N in water	Hardness	Total Alkalinity as $CaCO_3$
	Units	mg/L	mg/L	mg/L	$mgCaCO_3/L$	mg/L
	PQL	0.05	0.1	0.005	3	5
MW03	12/12/2024	<0.05	0.6	0.13	980	460
	29/01/2025	<0.05	0.5	0.13	1300	600
MW04	12/12/2024	<0.05	0.4	0.072	980	25
	29/01/2025	<0.05	0.3	0.083	970	48
MW05	12/12/2024	<0.05	0.4	0.079	230	420
	29/01/2025	<0.05	0.4	0.062	220	490

Well I.D.	Date Analysed	Total Phosphorus	Total Nitrogen in water	Ammonia as N in water	Hardness	Total Alkalinity as $CaCO_3$
	Units	mg/L	mg/L	mg/L	$mgCaCO_3/L$	mg/L
	PQL	0.05	0.1	0.005	3	5
MW06	12/12/2024	<0.05	0.3	0.038	790	460
	29/01/2025	<0.05	0.2	0.041	750	470
MW07	12/12/2024	<0.05	2.5	0.024	2200	55
	29/01/2025	<0.05	0.3	0.095	2400	64
MW08	12/12/2024	<0.05	0.5	0.39	710	990
	29/01/2025	0.64	0.4	0.41	1100	1200
MW09	12/12/2024	<0.05	1.1	0.13	1600	680
	29/01/2025	0.08	0.3	0.13	1700	880
MW11	12/12/2024	0.30	1	0.25	580	52
	29/01/2025	<0.05	0.7	0.23	920	45
MW15	25/03/2025	<0.05	0.4	0.021	400	63

Table 10: Groundwater quality summary statistics.

Analyte	Units	Min	Median	Mean	Max
pH	pH Units	5.1	6.7	6.44	7.4
Electrical conductivity	µS/cm	2400	9500	9165	17000
Sulphate, SO_4	mg/L	58	190	218	420
Chloride, Cl	mg/L	120	2900	2980	6600
Sodium – Dissolved	mg/L	390	1500	1504	2600
Total Phosphorus	mg/L	0.08	0.3	0.34	0.64
Total Nitrogen in water	mg/L	0.2	0.4	0.61	2.5
Ammonia as N in water	mg/L	0.021	0.095	0.14	0.41
Hardness	$mgCaCO_3/L$	220	970	1049	2400
Total Alkalinity as $CaCO_3$	mg/L	25	460	412	1200

Groundwater contamination has been assessed using default guideline values (DGVs) from the ANZG (2023) 95% level of species protection for fresh water. Laboratory summary tables are provided in Appendix J. Results suggest that:

- Zinc is above DGVs in all MWs.
- Copper, lead and nickel are above DGVs in several MWs.

3.5.2 Water Quality Classification Schemes

The water quality classification framework provides a basis for assessing groundwater salinity and hardness to inform its suitability for water supply, environmental protection,

and potential remediation. Groundwater salinity is classified by comparing on-site salinity levels with total dissolved solids (**TDS**) and electrical conductivity (**EC**) results. Similarly, groundwater hardness is evaluated against established thresholds to determine its appropriateness for irrigation or reuse applications.

Table 11: Groundwater salinity classification scheme.

Groundwater Salinity Level	TDS (mg 1^{-1})	EC (µS cm^{-1})
Fresh water	<1.500	<1.500
Slightly saline	1.500 – 3.000	1.500 – 5.000
Moderately saline	3.000 – 10.000	5.000 – 15.000
Saline	10.000 – 35.000	15.000 – 50.000
Brine	> 35.000	> 50.000

Table 12: Groundwater hardness classification scheme.

Total hardness (as $CaCO_3$, mg/L)	Water classification
<75	Soft
75 – 150	Moderately hard
150 – 300	Hard
>300	Very hard

3.5.3 Water Quality Discussion

The following commentary is provided in respect of groundwater quality conditions within the Site:

1. pH ranged between 5.1 - 7.4 (tending from slightly acidic to slightly alkaline) with a mean pH of 6.44.

2. In accordance with the classification scheme in Table 11, groundwater was typically moderately saline at most monitoring sites. Some temporal variation in salinity occurred at specific wells, presumably in association with varying long-term rainfall-recharge conditions. MW07 indicated saline water levels with electrical conductivity exceeding 15,000 µS/cm. Groundwater salinity levels are such that shallow groundwater would not be considered suitable for irrigation or agricultural uses.

3. Laboratory testing found that site groundwater contained concentrations of dissolved heavy metals (copper, lead, nickel and zinc) exceeding the adopted DGVs. Given that groundwater is not expected to be encountered during excavation, ongoing risk to sensitive receptors or the development posed by groundwater is expected to be low.

4. Phosphorus levels are similar across the Site, with most locations indicating levels close to or below detection limits.

5. Total nitrogen and ammonia levels were variable across the Site.

6. In accordance with the classification scheme in Table 12, groundwater was classified as very hard, indicating that Site groundwater would not be desirable for domestic purposes without significant treatment.

3.6 Groundwater Discussion and Hydrogeological Zones

Shallow or perched groundwater is likely present in the southeastern portion of the Site (which has sandstone with interbedded shale lenses), whilst the southwestern, western and northern portions of the Site appear to have a deeper aquifer in the sandstone bedrock. To guide cemetery design, 3 'hydrogeological zones' have been mapped (see Map 04, Appendix F) and are described below:

- Zone 1: located in the southeastern portion of the Site includes MW04, MW05, MW06, MW07, MW08 and MW15. It has an average mean groundwater level of 2.12 mBGL.

- Zone 2: includes monitoring well MW03, which exhibited the shallowest groundwater table with a mean depth of 1.33 mBGL.

- Zone 3: includes the remaining MWs and has a groundwater depth typically >5.0 mBGL. Several of the MWs in Zone 3 were observed to be dry, up to a maximum MW installation depth of 9.21 mBGL.

It is noted that shallow groundwater observed in Zone 1 and Zone 2 could be impacted by several up gradient factors including the existing farm dam in the central west portion of the Site; current irrigation of the horse paddocks downslope of the existing dwelling; and possibly from effluent disposal from the dwelling.

MW08 which has an average groundwater depth of 1.67 mBGL has been included in Zone 1. However, this location appears to be an anomaly as adjacent MWs (upgradient MW13b, along gradient MW02 and down gradient MW17) are either dry or have observed groundwater depths greater than 6.5 mBGL.

In light of the above, we recommend the following burials for each zone to ensure there is no interception of the groundwater table and there are appropriate buffers to protect groundwater quality:

1. Zone 1 is suitable for single burials only with a maximum depth of 1.35mBGL.

2. Zone 2 is suitable for 'shallow' burials, which shall permit only special burials at depths less than 1.05 mBGL.

3. Zone 3 is suitable for triple burials with a maximum depth of 2.85mBGL.

4 Impact Assessment

4.1 Hazard Identification and Mitigation

Potential groundwater hazards, pathways to these hazards and recommended impact mitigation measures are outlined in Table 13. This considers the following key potential groundwater hazards:

1. Contamination of groundwater.
2. Loss of groundwater resource.
3. Loss of yield to other groundwater users.

Refer to Appendix A for an overview of the mitigation measures that have been identified to be implemented throughout the design, construction, and operational phases of the project.

Table 13: Potential groundwater hazards and impact mitigation measures.

Item	Hazard	Hazard Pathway	Impact Mitigation Measures
1	**Groundwater contamination**	Contaminated stormwater released to groundwater	1. Minimise extent of internal roads and driveways. 2. Provide natural at source treatment of stormwater adjacent to impervious areas where possible. 3. Place clay capping material over burial zones to limit infiltration. 4. Capture and treat all surface water to appropriate standards within a formal stormwater management system.
		Burial plots intersect groundwater	1. Burial plots require planning to ensure that there is appropriate separation (preferably 1.0 m) between the excavation base and groundwater. 2. Shallow, single and triple burial zones have been designated so that they do not intersect and maintain appropriate buffers to groundwater.
		Wastewater discharged to groundwater	1. All sewer systems shall be designed to the relevant engineering standards and certified by installer and engineer to be compliant with relevant standards following construction. 2. Treat all wastewater generated on-site by an approved sewage treatment plant. 3. Dispose of any effluent to an approved effluent management area not located in burial zones.

Item	Hazard	Hazard Pathway	Impact Mitigation Measures
			4. Site effluent disposal preferably to surface / shallow subsurface to encourage evapotranspiration of effluent. 5. Obtain approvals and operate on-site wastewater management systems in accordance with s68 of the Local Government Act and any relevant approval.
2	**Loss of groundwater resource**	Excavation for burials	1. Burials to be limited in accordance with the various hydrogeological zones to ensure excavation avoids intersection with the observed groundwater table. 2. Minimise groundwater interference if avoidance is not possible. 3. Obtain relevant *Water Management Act* approvals for any aquifer interference activity. 4. Encourage stormwater recharge to offset any losses.
		Stormwater system drains groundwater	1. Design drainage system to avoid as far as possible, elements that would intersect the groundwater table. Given the site has significant fall and groundwater is located within the sandstone bedrock, we don't anticipate stormwater drainage mechanisms will intercept groundwater. 2. Line proposed stormwater basins to minimise interaction with groundwater that would cause significant changes to the natural groundwater table. 3. Encourage stormwater recharge to offset any losses.
		Services (water, sewer, power) intersect and drain groundwater	1. Design the services system to avoid as far as possible, elements that would intersect the groundwater table. 2. Minimise groundwater interference if avoidance is not possible. 3. Where services pipelines are located below the water table, these should be contained within sealed systems. 4. Prepare a groundwater management plan for any required temporary groundwater dewatering to assess anticipated groundwater extraction, water quality treatment requirements and discharge requirement. 5. Obtain relevant Water Management Act approvals for any aquifer interference activity.

Item	Hazard	Hazard Pathway	Impact Mitigation Measures
3	**Loss of yield to other GW users**	Development causes lowering of groundwater levels at nearby groundwater extraction bores	1. Intersection of groundwater is not expected as burials have been designed with respect to the various groundwater zones of the Site. 2. Shallow perched aquifers are not considered a viable or productive resource given the low permeability and elevated hardness.
		Bore extraction within development area causes losses at nearby extraction bores.	1. No bores are proposed for the Site and beneficial reuse of groundwater is not proposed as part of the development.

4.2 Risk Assessment Methodology

Risks of the proposed development to groundwater resources, the environment and groundwater users, were assessed in accordance with the following general methodology:

1. Identify hazards through each receptor and hazard pathway (refer to Table 13).
2. Assess consequence of each hazard (refer to Table 14).
3. Determine likelihood of each hazard occurring (Table 15) with risk mitigation measures in place.
4. Classify risk as a combination of consequence and likelihood (Table 16).

Table 14: Adopted hazard consequence definitions.

Descriptor	Definition
Insignificant (A)	No detectable impact on groundwater resources or users.
Minor (B)	Minor changes to groundwater conditions but no material harm.
Moderate (C)	Medium term environmental harm or moderate impacts on users
Major (D)	Long term environmental harm or major impacts on users.
Severe (E)	Severe, permanent impact on groundwater resources or users.

Table 15: Adopted hazard likelihood definitions.

Descriptor	Definition
Almost certain (1)	Event is expected to occur often (several times per year).
Likely (2)	Event will probably occur often (once every 1 to 3 years).
Possible (3)	Event might occur (once every 3-10 years).
Unlikely (4)	Event could occur (once every 20 years).
Rare (5)	Event will occur only in rare circumstances (once every 100 years).

Table 16: Adopted risk definitions.

		Consequence				
		Insignificant (A)	**Minor (B)**	**Moderate (C)**	**Major (D)**	**Severe (E)**
Likelihood	**Almost certain (1)**	Low	Medium	High	Very High	Very High
	Likely (2)	Low	Medium	High	Very High	Very High
	Possible (3)	Low	Low	Medium	High	Very High
	Unlikely (4)	Very Low	Low	Low	Medium	High
	Rare (5)	Very Low	Very Low	Low	Medium	High

4.3 Risk Evaluation

A risk assessment for each of the identified hazards is presented in Table 17. This provides an assessment of the hazard consequence (**Cons**) and likelihood (**Prob**) and resultant risks in accordance with the criteria in Table 14, Table 15 and Table 16. Based on the adopted risk mitigation measures, risks to groundwater arising from the proposed development are assessed as acceptable. On this basis, if hazards to groundwater are appropriately managed, significant impacts are not expected to arise from the development proposal.

Table 17: Risk assessment outcomes.

Receptor	Hazard Pathway	Cons	Prob	Risk
Groundwater contamination	Contaminated stormwater released to groundwater	B	3	L
	Burial plots intersect groundwater	B	4	L
	Wastewater discharged to groundwater	B	4	L
Loss of GW resource	Internal driveways intersect and drain groundwater	A	4	VL
	Stormwater system drains groundwater	B	3	L
	Services (water, sewer, power) intersect and drain groundwater	A	4	VL
Loss of yield to other GW users	Development causes lowering of groundwater levels at nearby groundwater extraction bores	B	3	L
	Bore extraction within development area causes losses at nearby extraction bores.	A	5	VL

5 Aquifer Interference Policy

5.1 Groundwater System Productivity and Classification

The NSW Department of Primary Industries Office of Water NSW Aquifer Interference Policy (2012) (**AIP**) defines groundwater systems as 'highly productive' or 'less productive', with highly productive groundwater systems characterised by:

1. Groundwater quality – total dissolved solids (**TDS**) < 1500 mg/L; and
2. Groundwater supply – yield > 5 L/s.

Based on measured hydraulic conductivities, 5 L/s abstraction from the aquifer is not likely to be readily achievable, and EC results indicate moderate levels of salinity across the Site, with an average of EC of 9165 µS/cm reported across nine sampled MWs. This corresponds to TDS levels in the order of 5900 mg/L, using a scaling factor of 0.64 (Dahaan et al, 2016).

As outlined in Section 3.2, the perched groundwater table at the Site is present within the rock profile, and bedrock is encountered at shallow depths, ranging from 0.5 m to 1.7 mbgl. We therefore assess this aquifer as being a 'less productive porous and fractured rock water source' in accordance with the AIP.

5.2 Aquifer Interference Policy

The AIP details the role and requirements of the Minister administering the Water Management Act 2000 regarding water licencing and assessment processes for aquifer interference activities under the Act. The AIP applies to all activities that penetrate, interfere with, obstruct, abstract water from, or dispose of water to, an aquifer. The AIP requires that proponents demonstrate that the minimal impact considerations specified under the AIP can be met.

An assessment of the proposal's compliance with the AIP is provided in Table 18 and is based on the groundwater results reported in Section 3, noting that the groundwater source category at the Site is defined as being a 'less productive porous and fractured rock water source'.

Table 18: NSW Aquifer Interference Policy assessment.

Minimal Impact Consideration	MA Assessment
Water Table	
1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any: a) high priority groundwater dependent ecosystem; or b) high priority culturally significant site listed in the schedule of the relevant WSP; or c) a maximum of a 2m decline cumulatively at any water supply work.	**Complies**. No high-priority GDEs listed in the water sharing are within the affected area. No high-priority culturally significant sites listed in the water sharing plan are within the affected area. No water supply work within the affected area would suffer a decline in head of more than 2m as no dewatering is proposed.

Minimal Impact Consideration	MA Assessment
2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40m from any: a) high priority groundwater dependent ecosystem; or b) high priority culturally significant site listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2m decline cumulatively at any water supply work, then make good provisions should apply.	**N/A**
Water Pressure	
1. A cumulative pressure head decline of not more than a 2m decline, at any water supply work.	**Complies**. No water supply work within the affected area would suffer a decline in head of more than 2m caused by the proposal because no dewatering is proposed.
2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	**N/A**
Water Quality	
1. (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.	**Complies**. The proposal will not significantly reduce groundwater quality since it incorporates stormwater mitigation measures and burials shall be located with appropriate buffer to groundwater. The proposal will not cause drawdown greater than what would otherwise occur due to seasonal and climatic variations.
2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	**N/A**

6 Conclusions and Recommendations

6.1 Summary of Findings

The outcome of groundwater investigations documented in this hydrogeological assessment are summarised as follows:

Groundwater Conditions

1. Groundwater monitoring was conducted through the installation of a network of 20 monitoring wells distributed across the investigation Site. MW01 – MW11 were constructed by other consultants prior to MA commencing on the project, with MW12 – MW17 constructed by MA under engineering supervision. MW12, MW13 and MW14 were constructed as nested well configurations.

2. Well monitoring was conducted by MA on all MWs using continuous automatic data loggers monthly for all MWs, with the total Site monitoring period extending to over 5 months for MW01 – MW11.

3. Before the commencement of MA monitoring, Rapid Geo conducted groundwater monitoring (manual dipping) for MW01 - MW11 over a seven-week period from 5 June to 23 July 2024.

4. Groundwater monitoring has been completed over a wetter than average period based on cumulative rainfall experienced in the last few years in the Sydney Basin (see Section 2.4.2).

5. Groundwater was found to occur at variable depths over the Site and was largely contained within underlying weathered sandstone (with interbedded shale) bedrock materials. Based on these findings, 3 hydrogeological zones were determined (as documented on Map 04, Appendix F).

    a. Hydrogeological Zone 1 and Zone 2 are characterized by a relatively shallow, perched groundwater system, with a mean depth of 2.12 m and 1.33 mbgl respectively.

    b. Hydrogeological Zone 3 is characterised by deeper groundwater system, typically > 5 mBGL.

6. We consider that MW05 and MW08 (within Zone 1) and MW03 (within Zone 2) are unlikely to be representative of natural Site groundwater conditions due to nearby anthropogenic influences, including proximity to the upslope existing farm dam and site irrigation systems. These factors have affected the data recorded at these wells, possibly making them unreliable indicators of the natural groundwater table in those locations. MW15 (which was installed by MA in Zone 1) had an average groundwater depth of 3.57 mBGL. This MW is considered a more reliable indicator of Site groundwater conditions in Zone 1.

7. Nested wells MW12 – MW14, for which the deeper wells were installed by MA down to depths of 8 - 9 mBGL, were observed to be dry over the monitoring period.

8. The Site is situated within the Sydney Basin Nepean Groundwater Source, for which the productive and continuous lower regional groundwater aquifer is expected to be present at depths > 20 mBGL.

9. Based on our findings and a review of the BoM Groundwater Insight, it is inferred that the shallow perched groundwater tables observed in Zones 1 and 2 are the result of variable rock defects, interbedded shale irregularities, and potential anthropogenic influences.

Site Suitability

10. Whilst groundwater depths varied across the Site, conditions in Zone 1 and Zone 2 would present constraints for triple burial plots without some form of aquifer interference. It is recommended that Zone 1 be restricted to single burial plots, while Zone 2 be restricted to 'shallow' burials at depths of less than 1.05 mBGL. Future development application stages will need to be cognisant of groundwater depths in these areas and use this information in the planning of amended burial plot types or conduct further investigations in this area.

11. Groundwater depths in Zone 3 do not present a constraint to proposed triple burials, with groundwater in this zone typically >5 mBGL.

Impact of Proposal on Groundwater

12. A number of groundwater receptors and potential hazard pathways were identified including:

    a. Groundwater contamination – via stormwater, burial interception or wastewater disposal.

    b. Loss of groundwater resource – via earthworks, stormwater drainage and services, draining and / or modifying groundwater flow conditions.

    c. Loss of yield to other groundwater users – via modifications to the hydrogeological regime within the Site or excessive groundwater abstraction within the development Site.

13. For each identified hazard, several design or construction measures have been recommended to mitigate the risk to groundwater systems, the environment and other users of the groundwater resource. These are outlined in Table 13.

14. Based on the adopted risk mitigation measures, risks to groundwater arising from the proposed development are assessed as acceptable for all hydrogeological zones. On this basis, if hazards to groundwater are appropriately managed, significant impacts to groundwater quantity or quality are not expected to arise from the development proposal.

6.2 Conformance with Guidelines

A conformance evaluation against the groundwater Guidelines is provided in Table 19 for investigation requirements and in Table 20 for impact assessment requirements. The evaluation demonstrates that this assessment meets the relevant investigation and impact assessment obligations.

Table 19: Study investigation scope conformance evaluation.

Requirements	Related Information	Conformance
Desktop Study	Geographical Information	Yes. Refer to sections 1.4, Table 1.
	Geological Information	Yes. Refer to sections 2.1-2.3, Map 05 and Map 06, Appendix F.
	Hydrogeological Information and Data	Yes. Refer to section 2.5, section 3. Map 02, Map 03 and Map 04, Appendix F.
	Groundwater Receptors	Yes. Refer to section 2.5.
Field investigations and monitoring network	Surface geophysical surveys	Yes. Refer to section 1.4 and Appendix E.
	Drilling and construction of bores	Yes. Refer to Section 3.1 and Appendix G.
	Downhole geophysical surveys	Not Applicable
	Groundwater level monitoring	Yes. Refer to Section3.2 and Figure 3 and Figure 4, Appendix H.
	Aquifer testing	Yes. Refer to Section 3.3.
	Hydrogeochemical analysis	Yes. Refer to Section 3.4 and Appendix J.
	Receptor identification	Yes. Refer to Section 2.5.
	Surface water monitoring	Not Applicable

Table 20: Impact assessment scope conformance evaluation.

Attribute	Issue	Consideration	Comments
Climate	Rainfall & evaporation	To what extent is groundwater depletion likely?	No groundwater depletion is likely because of the impact mitigation measures in Section 4.1, Table 13 (item 2).
		Over what timeframe will resource replenishment take place?	Not Applicable.
		What water-use efficiency measures will be implemented?	Not Applicable.

Attribute	Issue	Consideration	Comments
Physical Setting	Water resources	What water systems might be impacted by the project activities?	None. No water systems will be impacted by the project activities if the mitigation measures in Section 4.1, Table 13 are implemented.
		What will be the scale of change induced to water systems by the operations (quantity & quality)?	None. No material changes to the quantity and quality of groundwater at the site are anticipated if the mitigation measures in Section 4.1, Table 13 are implemented.
		What is the spatial distribution of groundwater elevations?	Refer to Section 3.2 and Mao 02, Appendix F.
	Lithology & soils	What is the spatial distribution of lithology and soil types?	Refer to Section 2.1 – 2.3, and Map 05 and Map 06, Appendix F.
		How will lithology and soil type constrain the location of water holding facilities?	Not Applicable.
		Are there suitable materials available for rehabilitation at completion of the development?	Not Applicable.
		How will acid rock drainage be managed?	Not Applicable.
	Topography	What is the spatial distribution of depth to water table (i.e. Difference between topography and groundwater elevations)?	Refer to Section 3.2 and Map 02, Appendix F.
		What is the location of proposed infrastructure in relation to the depth to water table plan?	Refer to Map 02, Map 03 and Map 04 in Appendix F for groundwater depths in conjunction with the proposed concept plan – Stage 1. For more details about the concept master plan, refer to Appendix B.
Groundwater	Quantity	Will there be any reductions or fluctuations in groundwater levels and/or piezometric pressure, including the	There will be no material changes to groundwater levels caused by the proposed development due to the risk management measures

Attribute	Issue	Consideration	Comments
		timeframes for these changes?	identified in Section 4.1, Table 13 (items 2 and 3).
		Will there be any reduction in seasonal baseflow condition?	There will be no material reduction in seasonal baseflow conditions by the proposed development due to the risk management measures identified in Section 4.1, Table 13 (items 2 and 3).
	Quality	Changes in water quality attributes, such as pH, dissolved oxygen, nutrients, temperature, turbidity, salinity?	There will be no material changes to groundwater levels caused by the proposed development due to the risk management measures identified in Section Section 4.1, Table 13, (items 1).
		Changes in water quality (as above) that may impacts on any beneficial use of the aquifer.	There will be no material impact on any beneficial use of the aquifer because of the risk management measures identified in Section 4.1, Table 13 (item 1).
Community & Economic	Traditional owners	Are there culturally significant sites (for example, springs) that may be impacted by the project activities?	No culturally significant sites were identified in the study area. Refer to Section 2.5.3.
		Has an assessment been conducted of the effect project activities might have on maintenance of spring environmental flows?	Not Applicable.
	Agriculture	Have pastoral and irrigated agriculture interests that utilise groundwater been identified?	Yes. Refer to Section 2.5.1.
		Has an assessment been conducted of the effect proposed activities might have on continued access to groundwater by agricultural interests?	Yes. Refer to Section 4.1, Table 13 (item 3).
	Municipal & domestic	Have municipal and domestic interests that utilise groundwater been identified?	Yes. Refer to Section 2.5.1.

Attribute	Issue	Consideration	Comments
		Has an assessment been conducted of the effect project activities might have on continued access to groundwater by these water users?	Yes. Refer to Section 4.1, Table 13 (item 3).
Environment	Terrestrial vegetation Spring-fed wetlands & baseflow-fed streams Aquifer Marine	Have groundwater dependent ecosystems (GDE) that might be impacted by the project been identified?	No GDEs were identified in the study area. Refer to Section 2.5.3.
		Has vadophytic vegetation that might be impacted by mining activities been identified?	Not Applicable.
		Have the environmental water requirements of the groundwater dependent ecosystems and vadophytic vegetation been assessed?	Not Applicable.
		Has an assessment been conducted of the effect project activities might have on continued access to assessed environmental water requirements?	Not Applicable.

6.3 Recommendations

The following recommendations are made:

1. Hydrogeological Zone 3 allows for triple burial plots.
2. Hydrogeological Zones 1 and 2 will need to be restricted to single burial plots and shallow burial plots, respectively (subject to further investigation and monitoring).
3. Further groundwater investigations is recommended after the existing Site dam is decommissioned and all Site irrigation ceases to confirm the impact of anthropogenic influences on long-term groundwater levels in Hydrogeological Zones 1 and 2. If levels fall, then deeper burials (such as double or triple burials) may be deemed acceptable in Zones 1 and 2 subject to the monitoring findings.
4. Development applications for future development stages should be supported, as needed, with additional groundwater monitoring data to confirm final civil engineering designs.
5. A detailed groundwater assessment is recommended to be prepared for each future development stage once designs and earthworks have been completed. The detailed assessment should have regard to the data and findings of this report.
6. Each subsequent stage of development should utilise any data and groundwater modelling prepared for any previous stages of development.
7. A groundwater monitoring plan is recommended to be prepared and appropriate licensing arranged under the requirements of the *Water Management Act 2000* (NSW) for any temporary dewatering be needed as part of any future construction phase of the development and prior to CC.

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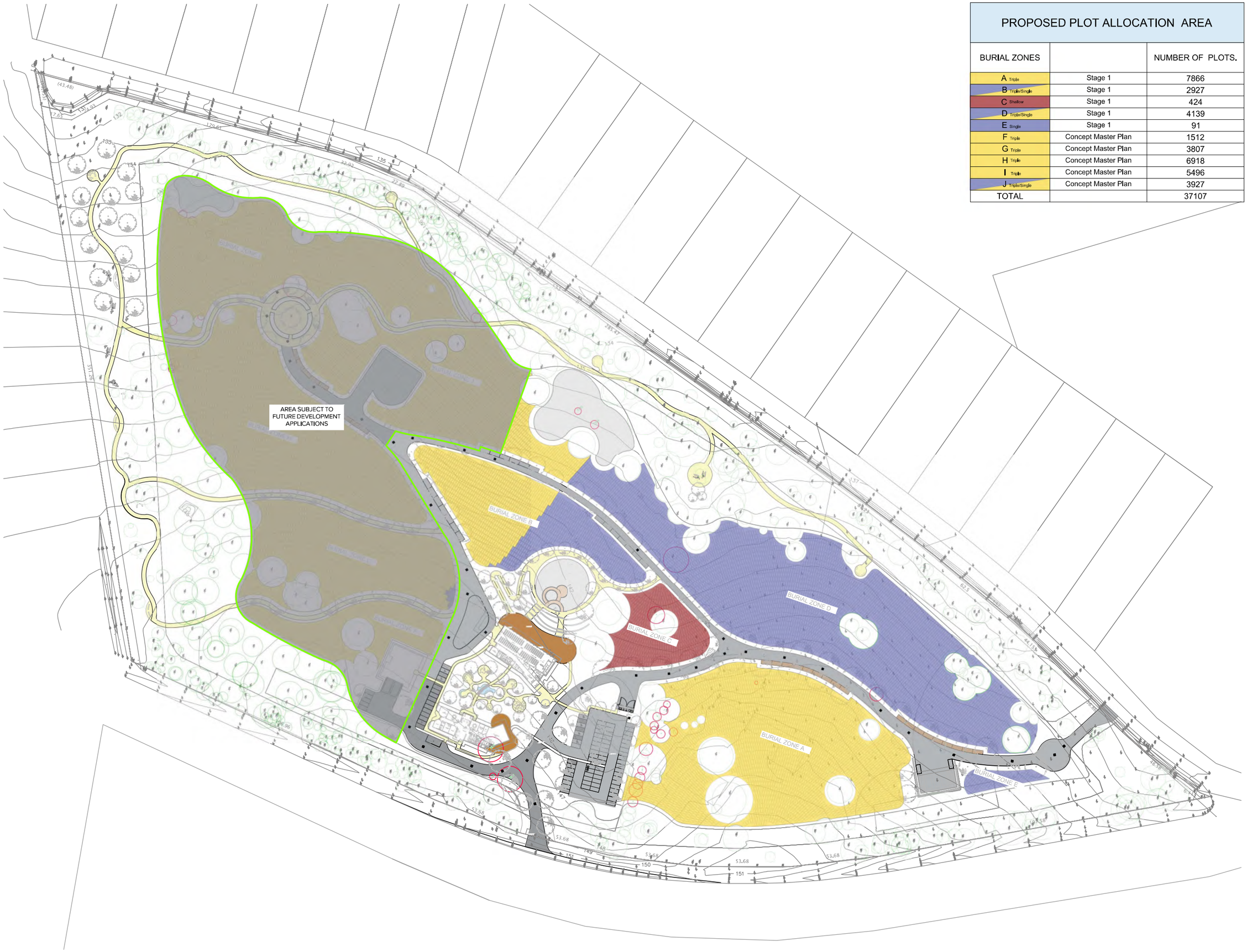
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Appendix A – Mitigation Measures

Project Stage	Mitigation Measures	Relevant Section of Report
Design	Ensure that burial plots are located at designated single and triple burial zones to prevent intersection of the groundwater table.	Section 3.3 Section 3.6 Section 4.1 Section 6.1 Section 6.3
Design	Avoid excavation that will intersect the groundwater table and design stormwater recharge systems to offset any groundwater losses.	Section 4.1 Section 6.1 Section 6.3
Design	Design service systems and drainage to avoid intersecting the groundwater table where possible.	Section 4.1 Section 6.1 Section 6.3
Construction	For burial plots to not intersect groundwater: • Ensure single burials do not exceed 1.35 m depth in Hydrogeological Zone 1. • Ensure shallow burials do not exceed 1.05 m depth in Hydrogeological Zone 2. • Ensure triple burials do not exceed 2.85 m depth in Hydrogeological Zone 3. • Place compacted clay fill capping as necessary to restrict surface water ingress in burial zones.	Section 3.3 Section 3.6 Section 4.1 Section 6.1 Section 6.3
Construction	If groundwater dewatering is required, address requirements under the Water Management Act (2000) prepare a groundwater monitoring plan.	Section 4.1 Section 6.3

Appendix B – Concept Layout Plans



PROPOSED PLOT ALLOCATION AREA

BURIAL ZONES		NUMBER OF PLOTS.
A Triple	Stage 1	7866
B Triple/Single	Stage 1	2927
C Shallow	Stage 1	424
D Triple/Single	Stage 1	4139
E Single	Stage 1	91
F Triple	Concept Master Plan	1512
G Triple	Concept Master Plan	3807
H Triple	Concept Master Plan	6918
I Triple	Concept Master Plan	5496
J Triple/Single	Concept Master Plan	3927
TOTAL		37107

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Legend

- TRIPLE BURIAL ZONE
- SINGLE BURIAL ZONE
- SHALLOW BURIAL ZONE
- EXISTING TREES TO BE RETAINED

Issue	Revision Description	Drawn	Check	Date
C	SSDA - For Submission	CX	AB/CT	15.05.25
B	SSDA - For Submission	RM/CX	AB/CT	06.05.25
A	SSDA - For Coordination	RM	AB/CT	06.03.25

Not for Construction

Project

Douglas Park Memorial

Stage 1

Lot 2 in DP 250359

SSDA

Client

Drawing No. L-102

Drawing Name: Burial Lots Layout Plan

Job No. 24-1005

Issue C

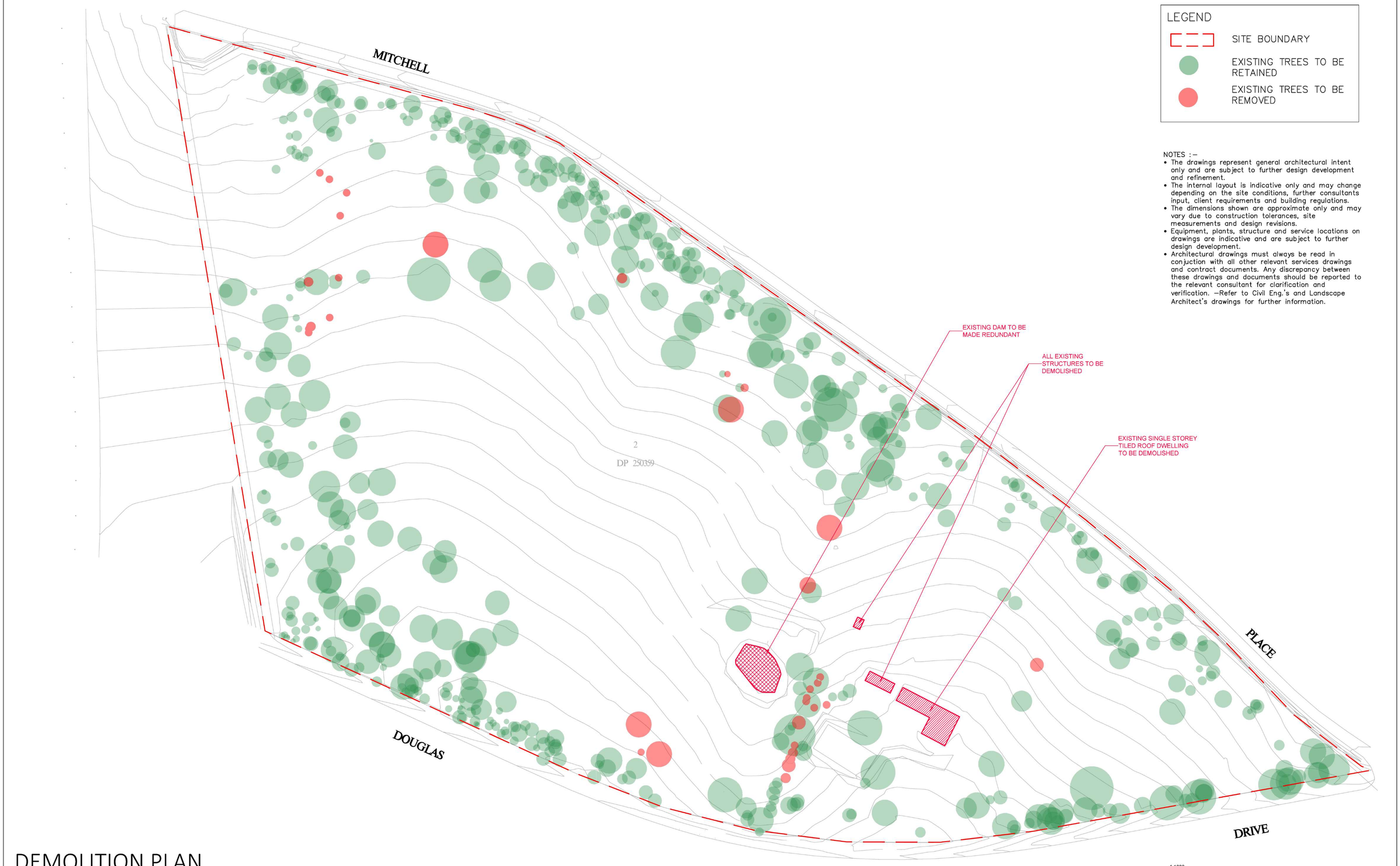
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0 5 10 25 50m

Sydney, Suite 70, Jones Bay Wharf, 26-32 Pirrama Road, Pyrmont NSW 2009
E sydney@arcadiala.com.au
T 02 8571 2900

ARCADIA

Appendix C – Architectural Plans



NOTES :–

- The drawings represent general architectural intent only and are subject to further design development and refinement.
- The internal layout is indicative only and may change depending on the site conditions, further consultants input, client requirements and building regulations.
- The dimensions shown are approximate only and may vary due to construction tolerances, site measurements and design revisions.
- Equipment, plants, structure and service locations on drawings are indicative and are subject to further design development.
- Architectural drawings must always be read in conjuction with all other relevant services drawings and contract documents. Any discrepancy between these drawings and documents should be reported to the relevant consultant for clarification and verification. –Refer to Civil Eng.'s and Landscape Architect's drawings for further information.

DEMOLITION PLAN

Scale 1:1000 (on A1)

ISSUE	AMENDMENT	DATE	DRAWN
1	STAGE 1 – ISSUED FOR DEVELOPMENT APPLICATION	09.05.25	SS/MJ/MR

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ABN: 47 116 316 333

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SHEET TITLE:

LOGGED AT:

DRAWN BY: MR

CHECKED BY: FG

DATE: 28.01.25

PROPOSED MULTI – DENOMINATIONAL CEMETERY AT 430 – 490 DOUGLAS PARK DRIVE, DOUGLAS PARK

ISSUE: 1

JOB No. 180911 DA 101

SCALE: 1:1000 (On A1)

PROPOSED CAR SPACES			
CAR SPACES	STAGE 1	FUTURE DEVELOPMENT	CONCEPT MASTER PLAN
GENERAL	61	-	61
STAFF	15	5	20
VISITORS	41	9	50
HEARSE	1	3	4
TOTAL	118	17	135

NOTE :-

- *The drawings represent general architectural intent only and are subject to further design development and refinement.*
- *The internal layout is indicative only and may change depending on the site conditions, further consultants input, client requirements and building regulations.*
- *The dimensions shown are approximate only and may vary due to construction tolerances, site measurements and design revisions.*
- *Equipment, plants, structure and service locations on drawings are indicative and are subject to further design development.*
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LEGEND

1 Chapel
2 Administration Building
3 Storage Shed / Garage
4 Crematorium
5 Crypts
6 Reflection Pond
7 Memorial Park
8 Carpark
9 Main Entry / Egress
10 Secondary Entry / Egress / Maintenance Access
11 Ecological Protection Area
12 Detention Basin
13 Bin Storage Area
Stage 1 Works
Future Development Applications
Asset Protection Zone (APZ) / IPA Boundary Line

MITCHELL
PLACE
DOUGLAS
DRIVE
BURIAL ZONE I
BURIAL ZONE J
BURIAL ZONE H
BURIAL ZONE B
BURIAL ZONE G
BURIAL ZONE F
BURIAL ZONE C
BURIAL ZONE D
BURIAL ZONE A
BURIAL ZONE E
SUBJECT TO FUTURE DEVELOPMENT APPLICATIONS
DP 250359

SITE PLAN - Concept Master Plan & Stage 1

Scale 1:1000 (on A1)

ISSUE	AMENDMENT	DATE	DRAWN
1	STAGE 1 – ISSUED FOR DEVELOPMENT APPLICATION	09.05.25	SS/MJ/MR

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PROPOSED MULTI – DENOMINATIONAL CEMETERY AT 430 – 490 DOUGLAS PARK DRIVE, DOUGLAS PARK

ISSUE: 1

JOB No. 180911 DA 102

SCALE: 1:100 (On A1)

Appendix D – Civil Drawings



CUT/FILL PLAN

20 10 0 20 40 60 80 100

LENGTHS ARE IN METRES
SCALE 1 : 1000

Earthworks Depth Table			
	Min. Depth	Max. Depth	Colour
	-7.50	0.05	
	-0.05	2.50	

STAGE 1 EARTHWORKS:

CUT: 12,300m³ FILL: 5,400m³ NET: 6900m³ (CUT)

ASSUMPTION:
1. CUT/FILL PLAN IS BASED ON THE COMPARISON BETWEEN THE EXISTING GROUND LEVELS VS THE PROPOSED FINISHED SURFACE LEVELS FOR STAGE 1 ONLY.

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NO	REVISION	DATE	NO	REVISION	DATE
A	PLANNING ISSUE	16/05/25			
P1	PRELIMINARY ISSUE	24/04/25			

DATUMS USED FOR THIS DESIGN/DRAWING
VERTICAL: AHD - REFER BENCH MARKS ON PLAN
PM 25154 RL 226.451 VIDE SCIMS
HORIZONTAL: ....
SURVEYED BY: JOHN M. DALY & ASSOCIATES PTY LTD
DATED: OCT 2017
REF No: 16116DS

Lanigan Civil
Patama Pty Ltd (ABN: 79 108 035 463)
Trading as Lanigan Civil
Consulting Civil Engineers
Unit 4, 7-9 Hall Street, Braeside VIC 3195
Tel: 03 9558 4380 Fax: 03 9587 9707
Email: admin@lancivil.com.au

PROPOSED MULTI - DENOMINATIONAL CEMETERY AT LOT 2 DOUGLAS PARK DRIVE, DOUGLAS PARK, NSW

STAGE 1
CUT/FILL PLAN

NORTH

DESIGNED	DRAWN	CHECKED
MJL	MJL	NJC
DATE	SCALE/S	
23-04-25	AS NOTED	
DRG NO.		ISSUE
LC2996-EW100		A

MITCHELL PLACE

HUME MOTORWAY

DOUGLAS PARK DRIVE

375m³ RETENTION BASIN

6000m³ RETENTION BASIN

BURIAL ZONE I SECTION 1 3,138m²

BURIAL ZONE I SECTION 2 3,245m²

BURIAL ZONE J SECTION 1 2,169m²

CRYPTS FFL141.40

BURIAL ZONE J SECTION 2 2,283m²

BURIAL ZONE H SECTION 2 4,003m²

BURIAL ZONE H SECTION 1 4,050m²

SUBJECT TO FUTURE DETAILED APPLICATIONS

BURIAL ZONE G SECTION 1 2,322m²

BURIAL ZONE G SECTION 2 2,140m²

BURIAL ZONE F SECTION 2 919m²

CREMATORIUM FFL147.63

BURIAL ZONE F SECTION 1 803m²

BURIAL ZONE B SECTION 1 2,017m²

BURIAL ZONE B SECTION 2 2,285m²

REFLECTION PONDS

CHAPEL FFL145.80

ADMIN FFL147.50

BURIAL ZONE C SECTION 1 1,495m²

BURIAL ZONE D SECTION 1 3,088m²

BURIAL ZONE D SECTION 2 3,079m²

BURIAL ZONE D SECTION 3 3,034m²

BURIAL ZONE D SECTION 4 3,327m²

BURIAL ZONE A SECTION 1 3,087m²

BURIAL ZONE A SECTION 2 2,967m²

BURIAL ZONE A SECTION 3 3,096m²

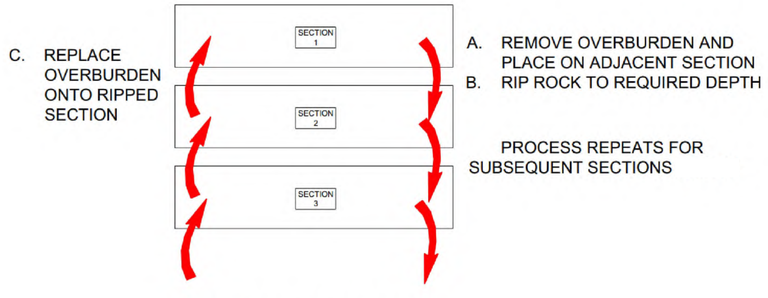
BURIAL ZONE E SECTION 1 308m²

STORAGE SHED/GARAGE FFL143.700

BURIAL SECTIONS ARRANGEMENT PLAN

20 10 0 20 40 60 80 100

LENGTHS ARE IN METRES
SCALE 1 : 1000



C. REPLACE OVERBURDEN ONTO RIPPED SECTION

A. REMOVE OVERBURDEN AND PLACE ON ADJACENT SECTION
B. RIP ROCK TO REQUIRED DEPTH

PROCESS REPEATS FOR SUBSEQUENT SECTIONS

SCHEMATIC DIAGRAM OF EARTHWORK SEQUENCING

EARTHWORKS STAGES

BURIAL ZONE	TOTAL AREA	SECTION	SECTION AREA
A	9,150m²	1	3,087m²
		2	2,967m²
		3	3,096m²
B	4,303m²	1	2,017m²
		2	2,285m²
C	1,495m²		
D	12,528m²	1	3,088m²
		2	3,079m²
		3	3,034m²
		4	3,327m²
E	308m²		
F	1,723m²	1	803m²
		2	919m²
G	4,462m²	1	2,322m²
		2	2,140m²
H	8,053m²	1	4,050m²
		2	4,003m²
I	6,383m²	1	3,138m²
		2	3,245m²
J	4,452m²	1	2,169m²
		2	2,283m²

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P1	PRELIMINARY ISSUE	28/04/25

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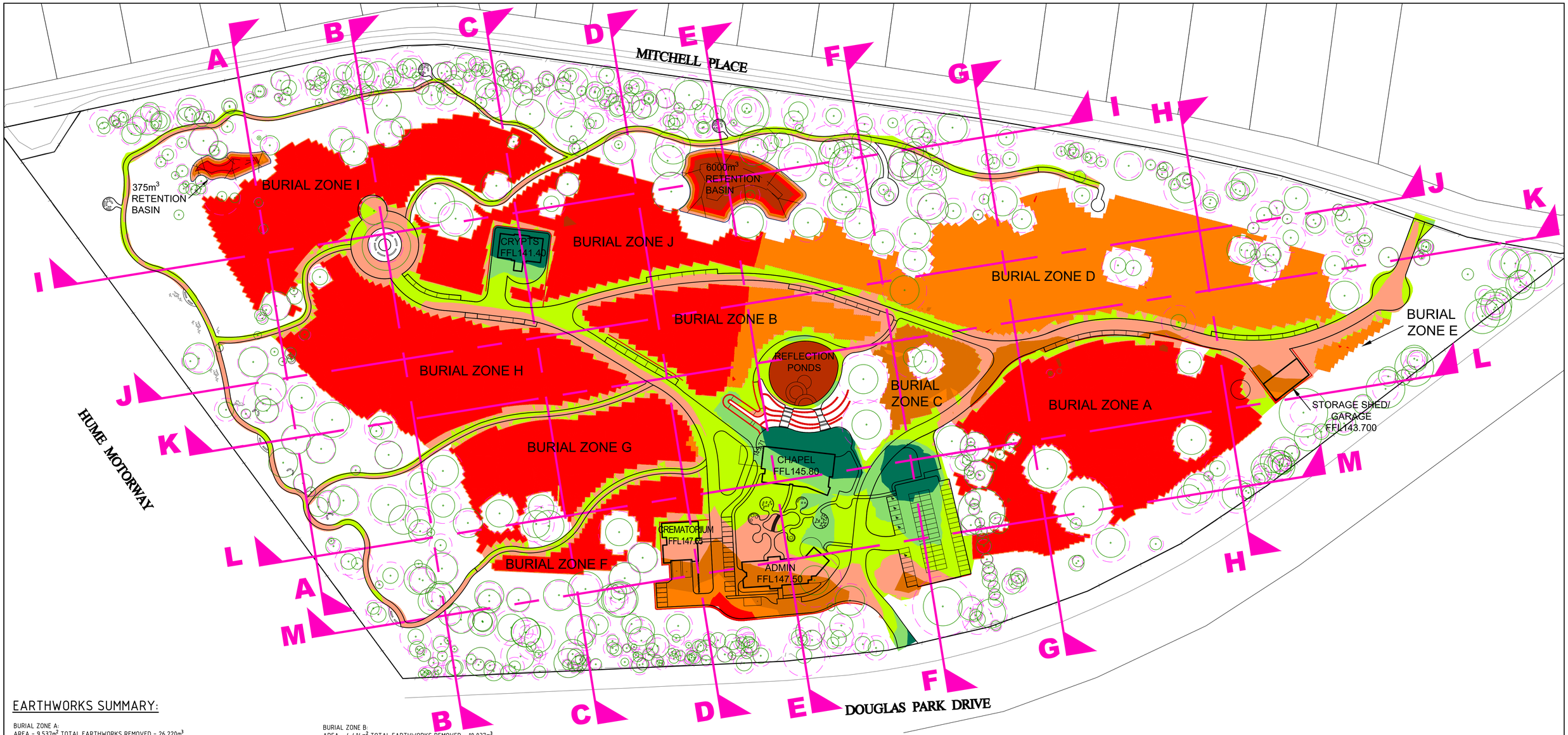
BURIAL SECTIONS ARRANGEMENT PLAN

NORTH

DESIGNED	DRAWN	CHECKED
MJL	MJL	NJC

DATE	SCALE/S
23-04-25	AS NOTED

DRG NO	ISSUE
LC2996-TP01	A



EARTHWORKS SUMMARY:

BURIAL ZONE A:
AREA = 9,537m² TOTAL EARTHWORKS REMOVED = 26,220m³
BURIALS = 7,866 (7,079m³) TOPSOIL = 1431m³ CAPPING MATERIAL = 1431m³ WON FILL MATERIAL = 16,279m³
THEREFORE 9,941m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE B:
AREA = 4,414m² TOTAL EARTHWORKS REMOVED = 10,037m³
BURIALS = 2,914 (2,623m³) TOPSOIL = 662m³ CAPPING MATERIAL = 662m³ WON FILL MATERIAL = 6,090m³
THEREFORE 3,947m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE C:
AREA = 1,507m² TOTAL EARTHWORKS REMOVED = 1,580m³
BURIALS = 424 (382m³) TOPSOIL = 226m³ CAPPING MATERIAL = 226m³ WON FILL MATERIAL = 746m³
THEREFORE 834m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE D:
AREA = 11,741m² TOTAL EARTHWORKS REMOVED = 15,792m³
BURIALS = 3,421 (3,079m³) TOPSOIL = 1,761m³ CAPPING MATERIAL = 1,761m³ WON FILL MATERIAL = 9,191m³
THEREFORE 6,601m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE E:
AREA = 313m² TOTAL EARTHWORKS REMOVED = 419m³
BURIALS = 91 (82m³) TOPSOIL = 47m³ CAPPING MATERIAL = 47m³ WON FILL MATERIAL = 234m³
THEREFORE 185m³ TO BE STOCKPILED AND REPLACED.

BURIAL ZONE F:
AREA = 1,895m² TOTAL EARTHWORKS REMOVED = 5,011m³
BURIALS = 1,512 (1,361m³) TOPSOIL = 284m³ CAPPING MATERIAL = 284m³ WON FILL MATERIAL = 3,082m³
THEREFORE 1,929m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE G:
AREA = 4,691m² TOTAL EARTHWORKS REMOVED = 12,806m³
BURIALS = 3,786 (3,407m³) TOPSOIL = 704m³ CAPPING MATERIAL = 704m³ WON FILL MATERIAL = 7,991m³
THEREFORE 4,815m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE H:
AREA = 8,298m² TOTAL EARTHWORKS REMOVED = 23,090m³
BURIALS = 6,918 (6,226m³) TOPSOIL = 1,245m³ CAPPING MATERIAL = 1,245m³ WON FILL MATERIAL = 14,374m³
THEREFORE 8,716m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE I:
AREA = 6,653m² TOTAL EARTHWORKS REMOVED = 18,299m³
BURIALS = 5,496 (4,946m³) TOPSOIL = 998m³ CAPPING MATERIAL = 998m³ WON FILL MATERIAL = 11,357m³
THEREFORE 6,942m³ TO BE STOCKPILED AND REPLACED

BURIAL ZONE J:
AREA = 5,499m² TOTAL EARTHWORKS REMOVED = 14,956m³
BURIALS = 4,644 (4,180m³) TOPSOIL = 825m³ CAPPING MATERIAL = 825m³ WON FILL MATERIAL = 9,126m³
THEREFORE 5,830m³ TO BE STOCKPILED AND REPLACED

TOTAL EARTHWORKS:

CUT = 142,366m³ FILL = 6,762m³ TOTAL SITE WON MATERIAL = 78,470m³

NET = 57,104m³ CUT (TO BE STOCKPILED AND REPLACED)

ASSUMPTIONS:
- ALL VOLUMES ARE STATIC, THEREFORE NO COMPACTION FACTORS HAVE BEEN ALLOWED FOR.
- ROAD, FOOTPATH AND BUILDING CUT LEVELS HAVE NOT BEEN ALLOWED FOR.
- REFER TO SHEET EW04 FOR TYPICAL BURIAL SECTIONS

Earthworks Depth Table			
Min. Depth	Max. Depth	Colour	
-7.50	-2.90		CUT
-2.90	-2.85		
-1.36	-1.35		
-1.10	-0.50		
-0.50	0.00		
0.00	0.50		FILL
0.50	1.00		
1.00	2.25		

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NO	REVISION	DATE	NO	REVISION	DATE
A	PLANNING ISSUE	16/05/25			
P1	PRELIMINARY ISSUE	24/04/25			

DATUMS USED FOR THIS DESIGN/DRAWING
VERTICAL: AHD - REFER BENCH MARKS ON PLAN
PM 25154 RL 226.451 VIDE SCIMS
HORIZONTAL: ....
SURVEYED BY: JOHN M. DALY & ASSOCIATES PTY LTD
DATED: OCT 2017
REF No: 16116DS

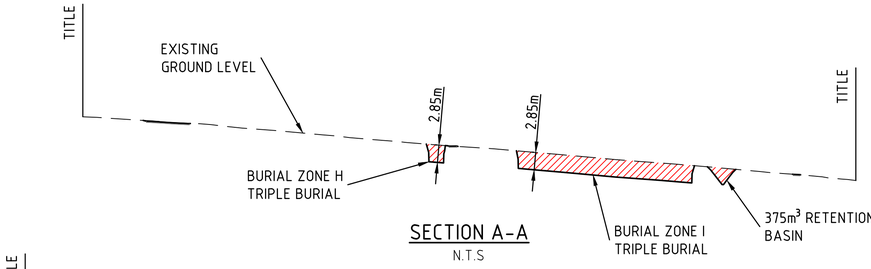
Lanigan Civil
Patama Pty Ltd (ABN: 79 108 035 463)
Trading as Lanigan Civil
Consulting Civil Engineers
Unit 4, 7-9 Hall Street, Braeside VIC 3195
Tel: 03 9558 4380 Fax: 03 9587 9707
Email: admin@lancivil.com.au

PROPOSED MULTI - DENOMINATIONAL CEMETERY AT LOT 2 DOUGLAS PARK DRIVE, DOUGLAS PARK, NSW

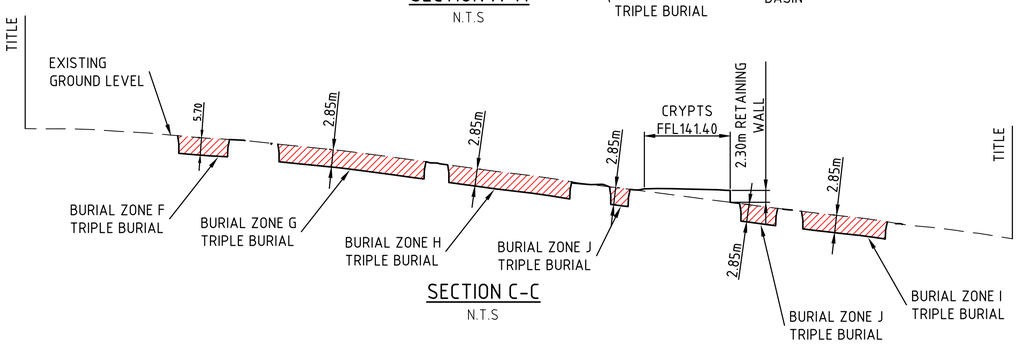
BURIAL EARTHWORKS PLAN

NORTH

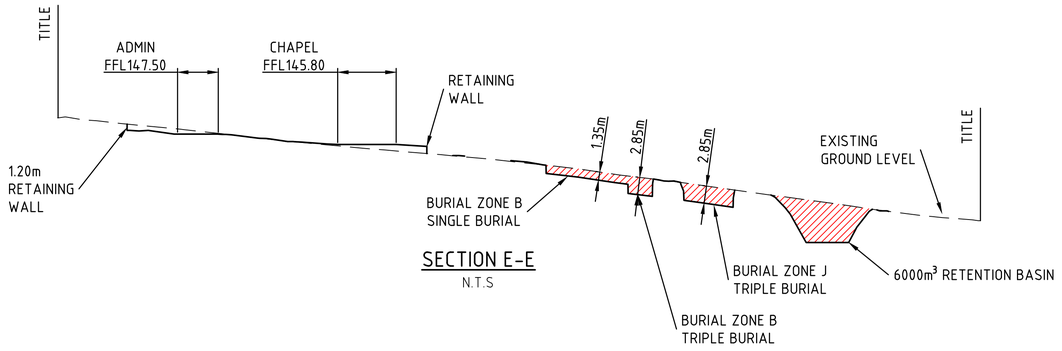
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MJL	MJL	NJC
DATE	SCALE/S	
23-04-25	AS NOTED	
DRG NO		ISSUE
LC2996-EW01		A



SECTION A-A
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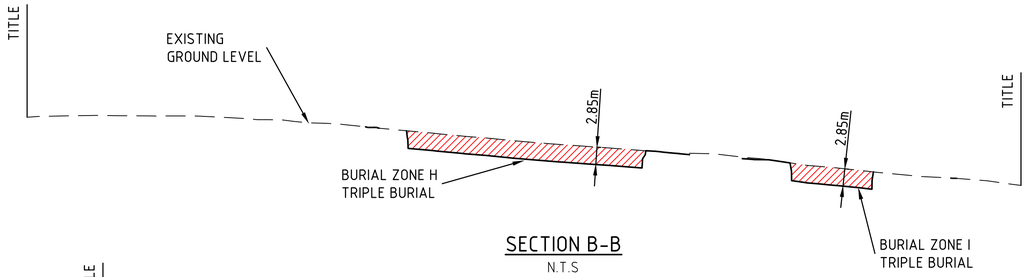


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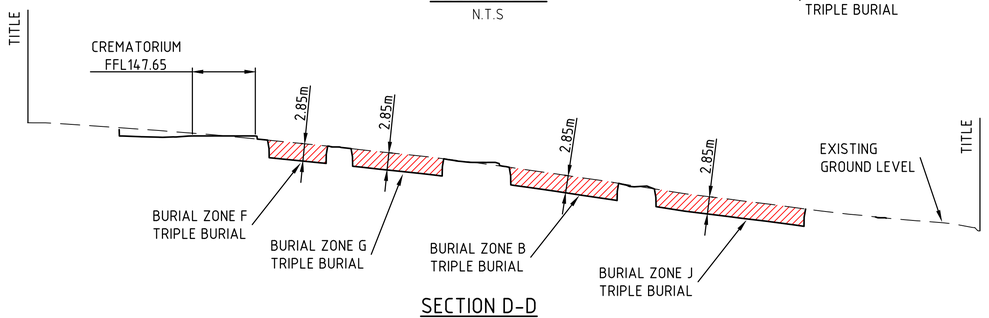


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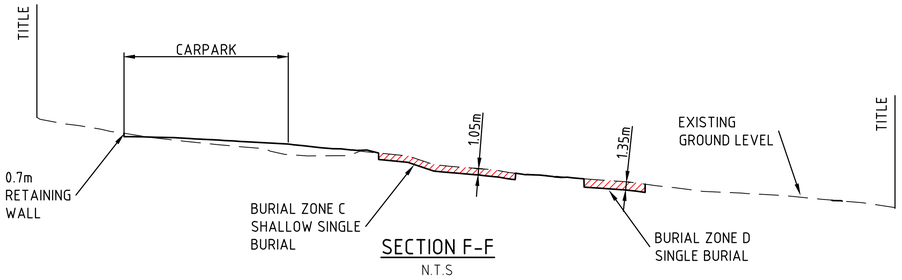
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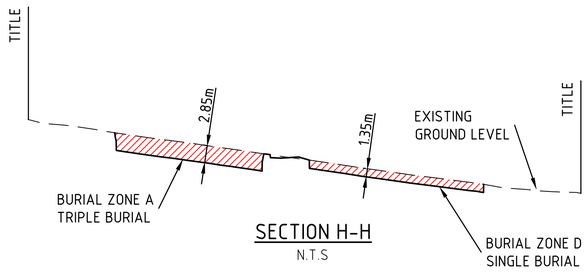
SECTION B-B
N.T.S



SECTION D-D
N.T.S



SECTION F-F
N.T.S



SECTION H-H
N.T.S

HOR. (1 : 1000) 20 10 0 20 40 60 80 100
VER. (1 : 50) 10 5 0 10 20 30 40 50
LENGTHS ARE IN METRES

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P1	PRELIMINARY ISSUE	24/04/25			

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DATED: OCT 2017
REF No: 16116DS

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Tel: 03 9558 4380 Fax: 03 9587 9707
Email: admin@lancivil.com.au

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BURIAL EARTHWORKS PLAN

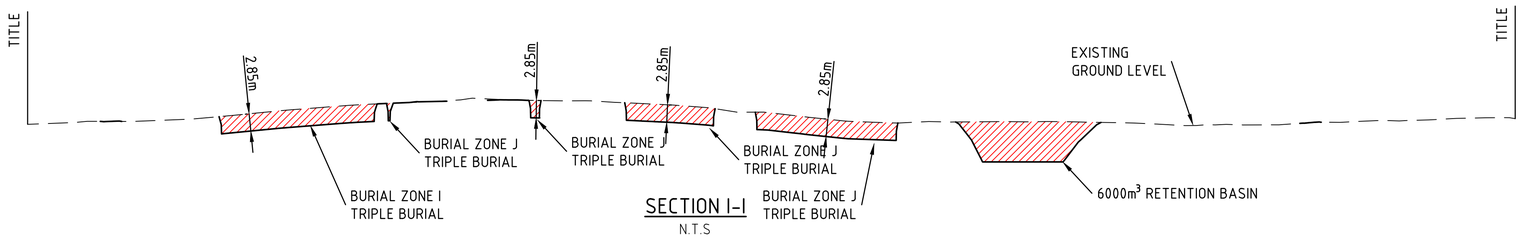
TYPICAL SECTIONS
SHEET 1 OF 2

NORTH

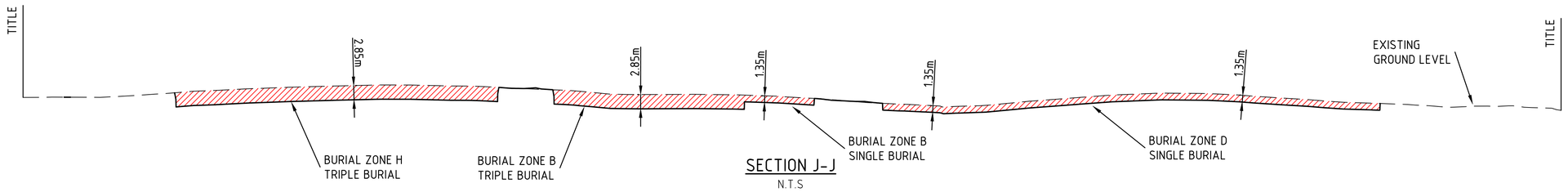
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MJL	MJL	NJC

DATE	SCALE/S
23-04-25	AS NOTED

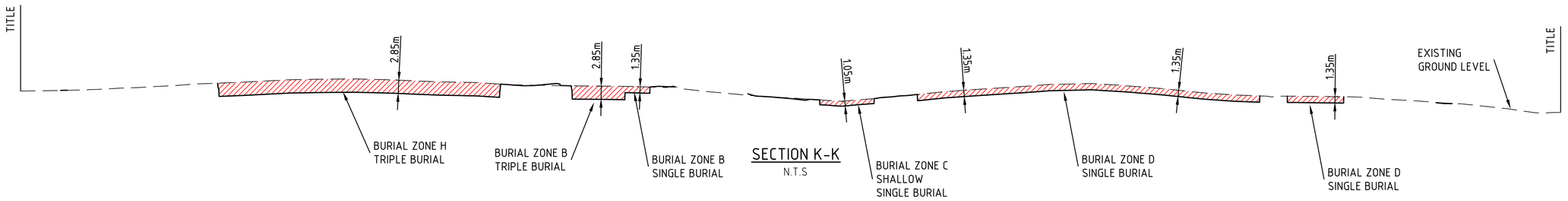
DRG NO	ISSUE
LC2996-EW02	A



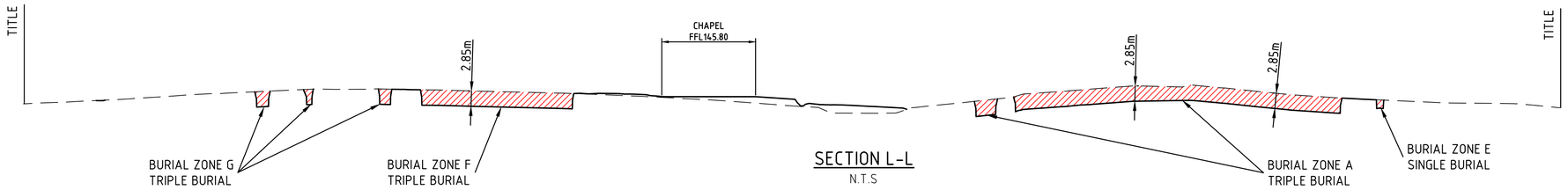
SECTION I-I
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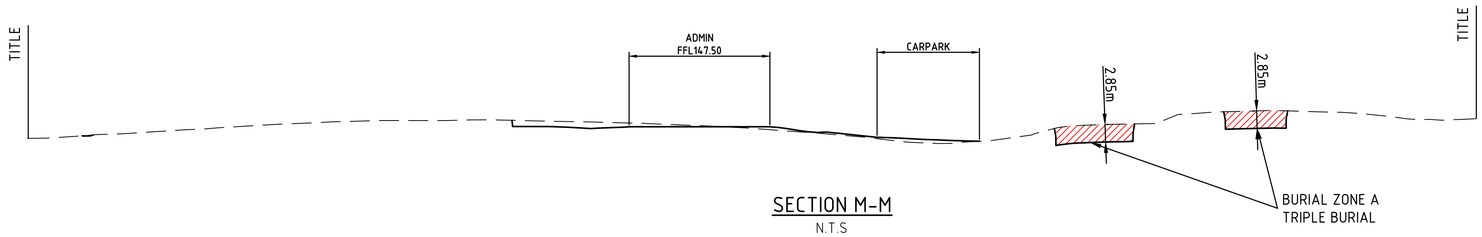
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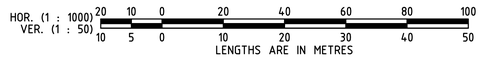
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N.T.S



SECTION L-L
N.T.S



SECTION M-M
N.T.S



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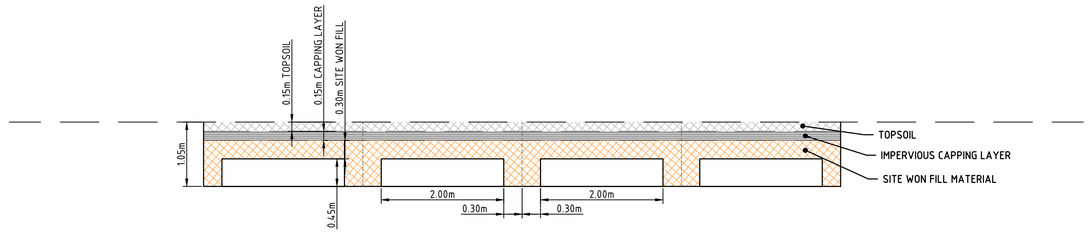
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SHEET 2 OF 2

NORTH

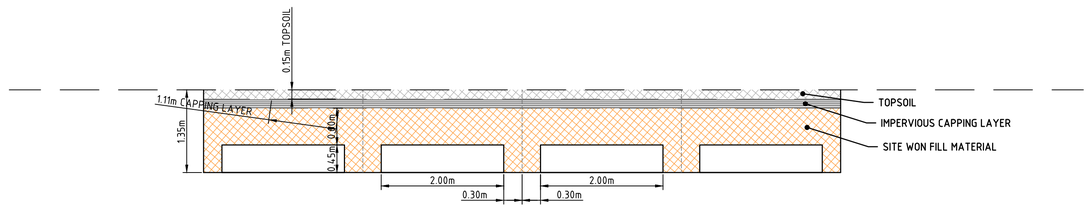
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MJL	MJL	NJC

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23-04-25	AS NOTED

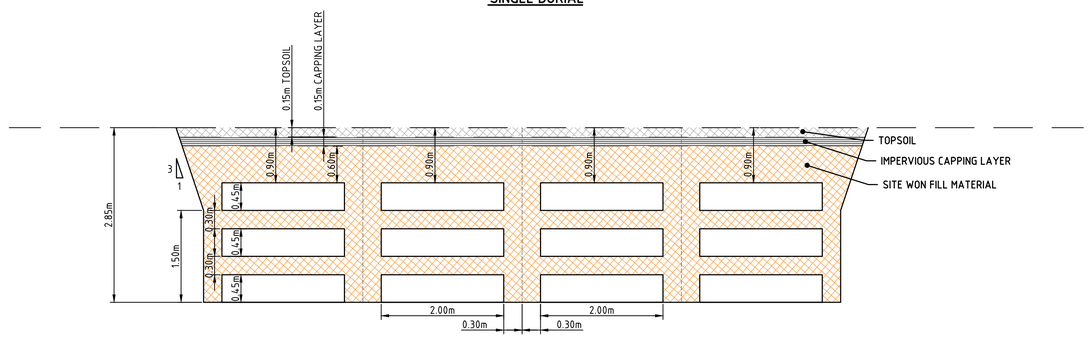
DRG NO	ISSUE
LC2996-EW03	A



SHALLOW SINGLE BURIAL



SINGLE BURIAL



TRIPLE BURIAL

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P1	PRELIMINARY ISSUE	24/04/25			

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BURIAL EARTHWORKS PLAN

TYPICAL BURIAL SECTIONS

NORTH

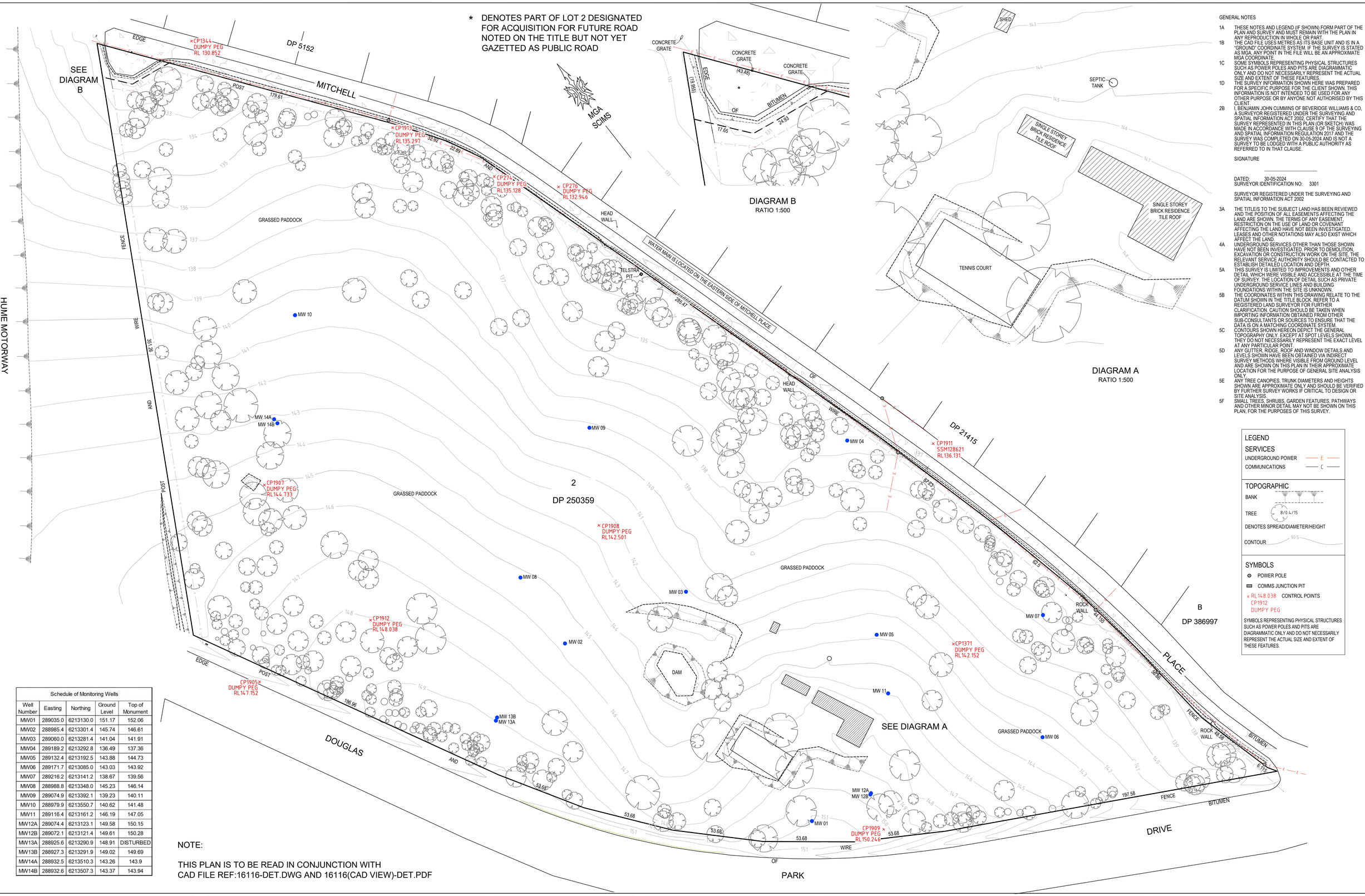
DESIGNED	DRAWN	CHECKED
MJL	MJL	NJC

DATE	SCALE/S
23-04-25	AS NOTED

DRG NO	ISSUE
LC2996-EW04	A

Appendix E - Site Survey

* DENOTES PART OF LOT 2 DESIGNATED FOR ACQUISITION FOR FUTURE ROAD NOTED ON THE TITLE BUT NOT YET GAZETTED AS PUBLIC ROAD



Schedule of Monitoring Wells				
Well Number	Easting	Northing	Ground Level	Top of Monument
MW01	289035.0	6213130.0	151.17	152.06
MW02	288985.4	6213301.4	145.74	146.61
MW03	289060.0	6213281.4	141.04	141.91
MW04	289189.2	6213292.8	136.49	137.36
MW05	289132.4	6213192.5	143.88	144.73
MW06	289171.7	6213085.0	143.03	143.92
MW07	289216.2	6213141.2	138.67	139.56
MW08	288988.8	6213348.0	145.23	146.14
MW09	289074.9	6213392.1	139.23	140.11
MW10	288979.9	6213550.7	140.62	141.48
MW11	289116.4	6213161.2	146.19	147.05
MW12A	289074.4	6213123.1	149.58	150.15
MW12B	289072.1	6213121.4	149.61	150.28
MW13A	288925.6	6213290.9	148.91	DISTURBED
MW13B	288927.3	6213291.9	149.02	149.69
MW14A	288932.5	6213510.3	143.26	143.9
MW14B	288932.6	6213507.3	143.37	143.94

NOTE:

THIS PLAN IS TO BE READ IN CONJUNCTION WITH CAD FILE REF:16116-DET.DWG AND 16116(CAD VIEW)-DET.PDF

GENERAL NOTES

1A THESE NOTES AND LEGEND (IF SHOWN) FORM PART OF THE PLAN AND SURVEY AND MUST REMAIN WITH THE PLAN IN ANY REPRODUCTION IN WHOLE OR PART.

1B THE CAD FILE USES METRES AS ITS BASE UNIT AND IS IN A "GROUND" COORDINATE SYSTEM. IF THE SURVEY IS STATED AS MGA, ANY POINT IN THE FILE WILL BE AN APPROXIMATE MGA COORDINATE.

1C SOME SYMBOLS REPRESENTING PHYSICAL STRUCTURES SUCH AS POWER POLES AND PITS ARE DIAGRAMMATIC ONLY AND DO NOT NECESSARILY REPRESENT THE ACTUAL SIZE AND EXTENT OF THESE FEATURES.

1D THE SURVEY INFORMATION SHOWN HERE WAS PREPARED FOR A SPECIFIC PURPOSE FOR THE CLIENT SHOWN. THIS INFORMATION IS NOT INTENDED TO BE USED FOR ANY OTHER PURPOSE OR BY ANYONE NOT AUTHORISED BY THIS CLIENT.

2B I, BENJAMIN JOHN CUMMINS OF BEVERIDGE WILLIAMS & CO, A SURVEYOR REGISTERED UNDER THE SURVEYING AND SPATIAL INFORMATION ACT 2002, CERTIFY THAT THE SURVEY REPRESENTED IN THIS PLAN (OR SKETCH) WAS MADE IN ACCORDANCE WITH CLAUSE 9 OF THE SURVEYING AND SPATIAL INFORMATION REGULATION 2017 AND THE SURVEY WAS COMPLETED ON 30-05-2024 AND IS NOT A SURVEY TO BE LODGED WITH A PUBLIC AUTHORITY AS REFERRED TO IN THAT CLAUSE.

SIGNATURE

DATED: 30-05-2024
SURVEYOR IDENTIFICATION NO: 3301

SURVEYOR REGISTERED UNDER THE SURVEYING AND SPATIAL INFORMATION ACT 2002

3A THE TITLE/S TO THE SUBJECT LAND HAS BEEN REVIEWED AND THE POSITION OF ALL EASEMENTS AFFECTING THE LAND ARE SHOWN. THE TERMS OF ANY EASEMENT, RESTRICTION ON THE USE OF LAND OR COVENANT AFFECTING THE LAND HAVE NOT BEEN INVESTIGATED. LEASES AND OTHER NOTATIONS MAY ALSO EXIST WHICH AFFECT THE LAND.

4A UNDERGROUND SERVICES OTHER THAN THOSE SHOWN HAVE NOT BEEN INVESTIGATED. PRIOR TO DEMOLITION, EXCAVATION OR CONSTRUCTION WORK ON THE SITE, THE RELEVANT SERVICE AUTHORITY SHOULD BE CONTACTED TO ESTABLISH DETAILED LOCATION AND DEPTH.

5A THIS SURVEY IS LIMITED TO IMPROVEMENTS AND OTHER DETAIL WHICH WERE VISIBLE AND ACCESSIBLE AT THE TIME OF SURVEY. THE LOCATION OF DETAIL SUCH AS PRIVATE UNDERGROUND SERVICE LINES AND BUILDING FOUNDATIONS WITHIN THE SITE IS UNKNOWN.

5B THE COORDINATES WITHIN THIS DRAWING RELATE TO THE DATUM SHOWN IN THE TITLE BLOCK. REFER TO A REGISTERED LAND SURVEYOR FOR FURTHER CLARIFICATION. CAUTION SHOULD BE TAKEN WHEN IMPORTING INFORMATION OBTAINED FROM OTHER SUB-CONSULTANTS OR SOURCES TO ENSURE THAT THE DATA IS ON A MATCHING COORDINATE SYSTEM.

5C CONTOURS SHOWN HEREON DEPICT THE GENERAL TOPOGRAPHY ONLY. EXCEPT AT SPOT LEVELS SHOWN, THEY DO NOT NECESSARILY REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT.

5D ANY GUTTER, RIDGE, ROOF AND WINDOW DETAILS AND LEVELS SHOWN HAVE BEEN OBTAINED VIA INDIRECT SURVEY METHODS WHERE VISIBLE FROM GROUND LEVEL AND ARE SHOWN ON THIS PLAN IN THEIR APPROXIMATE LOCATION FOR THE PURPOSE OF GENERAL SITE ANALYSIS ONLY.

5E ANY TREE CANOPIES, TRUNK DIAMETERS AND HEIGHTS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED BY FURTHER SURVEY WORKS IF CRITICAL TO DESIGN OR SITE ANALYSIS.

5F SMALL TREES, SHRUBS, GARDEN FEATURES, PATHWAYS AND OTHER MINOR DETAIL MAY NOT BE SHOWN ON THIS PLAN, FOR THE PURPOSES OF THIS SURVEY.

LEGEND

SERVICES
UNDERGROUND POWER — E —
COMMUNICATIONS — C —

TOPOGRAPHIC
BANK
TREE 8/0.4/15
DENOTES SPREAD/DIAMETER/HEIGHT
CONTOUR 90.5

SYMBOLS
POWER POLE
COMMS JUNCTION PIT
x RL148.038 CONTROL POINTS
CP1912
DUMPY PEG

SYMBOLS REPRESENTING PHYSICAL STRUCTURES SUCH AS POWER POLES AND PITS ARE DIAGRAMMATIC ONLY AND DO NOT NECESSARILY REPRESENT THE ACTUAL SIZE AND EXTENT OF THESE FEATURES.

VER	BY	AMENDMENTS	DATE
A	BC	ORIGINAL ISSUE	31-05-2024
B	BC	ADDITION OF MONITORING WELL LOCATIONS	05-02-2025

- THE POSITION OF SERVICES SHOWN ON THIS DRAWING ARE INDICATIVE ONLY AND HAVE BEEN PLOTTED FROM PLANS AND DRAWINGS SUPPLIED BY RELEVANT AUTHORITIES.
- SERVICE AUTHORITY PITS, MANHOLES, POLES, MARKER POSTS, ETC., WHERE SIGHTED AT TIME OF SURVEY, HAVE BEEN LOCATED. THE SURVEY DOES NOT INCLUDE INVESTIGATION OR LOCATION OF UNDERGROUND INFRASTRUCTURE.
- SERVICES INFORMATION SHOWN ON THIS DRAWING HAS BEEN OBTAINED THROUGH A DIAL BEFORE YOU DIG SEARCH AND IS VALID FOR THE PERIOD OF TIME FROM THE DATE OF ISSUE NOMINATED BY THE AUTHORITY.
- PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON OR ADJACENT TO THE SITE IT IS THE RESPONSIBILITY OF THE DEVELOPER AND CONTRACTORS TO APPLY FOR AND OBTAIN UP TO DATE PLANS THROUGH A NEW DIAL BEFORE YOU DIG SEARCH AND TO CONTACT ALL THE RELEVANT AUTHORITIES TO ESTABLISH AND CONFIRM THE DETAILED LOCATION AND DEPTH OF ALL UNDERGROUND SERVICES.

www.dialbeforeyoudig.com.au DIAL 1100 BEFORE YOU DIG

CLIENT:
BENIMA

Beveridge Williams
Development and Infrastructure Consultants
Western Sydney (02) 4625 5055 www.beveridgewilliams.com.au

DETAILS:
PLAN OF DETAIL AND CONTOURS OVER SITE
LOT 2 IN DP250359
DOUGLAS PARK DRIVE
DOUGLAS PARK

ORIGINAL
SCALE 1:1000 SHEET SIZE A1
CAD REFERENCE: 16116-DET
0 20 40 60
SCALE ON ORIGINAL DRAWING AT 1:1000

SURVEYOR:	----
DRAWN:	AA
CHECKED:	BC
SURVEY DATE:	N/A
VERTICAL DATUM:	AHD
HORIZONTAL DATUM:	MGA 2020

PROJECT No. 16116
DRAWING REF. 16116-DET
VERSION B
SHEET 1 OF 1

Appendix F – Maps

Legend

- Site boundary
- 1m contours - survey

135 mAHD
135 mAHD
140 mAHD
145 mAHD
150 mAHD
MITCHELL PLACE
HUME MOTORWAY
HUME MOTORWAY
DOUGLAS PARK DRIVE

Map	Title
Map 01	Overview
Map 02	Borehole and Monitoring Well Locations
Map 03	Stage 1 DA works extent
Map 04	Mean Groundwater Depths and Preliminary Hydrogeological Zones
Map 05	Geology
Map 06	Soil Landscape

0 20 40 60 80 100 m

1:2500 @ A3

Viewport A

Sources: Nearmap (2024), Contours (Beveridge Williams Survey, 2025)

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Project No: P2410607 Map Set: MS01-R09 EPSG: 28356

Map Title / Figure:

Overview

martens
Environment | Water | Geotechnics | Civil | Projects

Map 01	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

Legend

- Martens MWs (Installed 2025)
- Rapid Geo MWs (Installed 2024)
- Site boundary
- 1m contours - survey

135 mAHD
135 mAHD
MW16
MW04
MITCHELL PLACE
MW09
MW10
MW15
MW07
MW17
140 mAHD
MW14b
MW05
MW06
MW03
145 mAHD
MW11
MW08
MW02
MW12b
MW13b
MW01
150 mAHD
DOUGLAS PARK DRIVE
HUME MOTORWAY
HUME MOTORWAY
N

0 20 40 60 80 100 m

1:2500 @ A3

Viewport A

Sources: Nearmap (2024), Contours (Beveridge Williams Survey, 2025), Site Boundary (Beveridge Williams Survey, 2025)

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Project No: P2410607 Map Set: MS01-R09 EPSG: 28356

Map Title / Figure:

Borehole and Monitoring Well Locations

martens
Environment | Water | Geotechnics | Civil | Projects

Map 02	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

Legend

- Martens MWs (Installed 2025)
- Rapid Geo MWs (Installed 2024)
- Proposed extent of burial plots
- Site boundary
- Stage 1 DA

MITCHELL PLACE

MW16
GW Level: 6.76 mbgl

MW04
GW Level: 1.67 mbgl

MW10
GW Level: > 4.91 mbgl

MW09
GW Level: 4.11 mbgl

MW15
GW Level: 3.57 mbgl

MW07
GW Level: 2.37 mbgl

MW17
GW Level: 6.62 mbgl

MW05
GW Level: 1.81 mbgl

MW14b
GW Level: > 9.21 mbgl

MW03
GW Level: 1.33 mbgl

MW06
GW Level: 1.64 mbgl

MW11
GW Level: 4.19 mbgl

MW08
GW Level: 1.67 mbgl

MW02
GW Level: > 3.27 mbgl

MW12b
GW Level: > 9.0 mbgl

MW13b
GW Level: > 7.9 mbgl

MW01
GW Level: > 4.99 mbgl

HUME MOTORWAY

HUME MOTORWAY

Portion of the site subject to future DA approval

DOUGLAS PARK DRIVE

Stage 1 DA works extent shown as horizontal hatch

N

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Project No: P2410607 Map Set: MS01-R09 EPSG: 28356

0 20 40 60 80 100 m

1:2500 @ A3

Viewport A

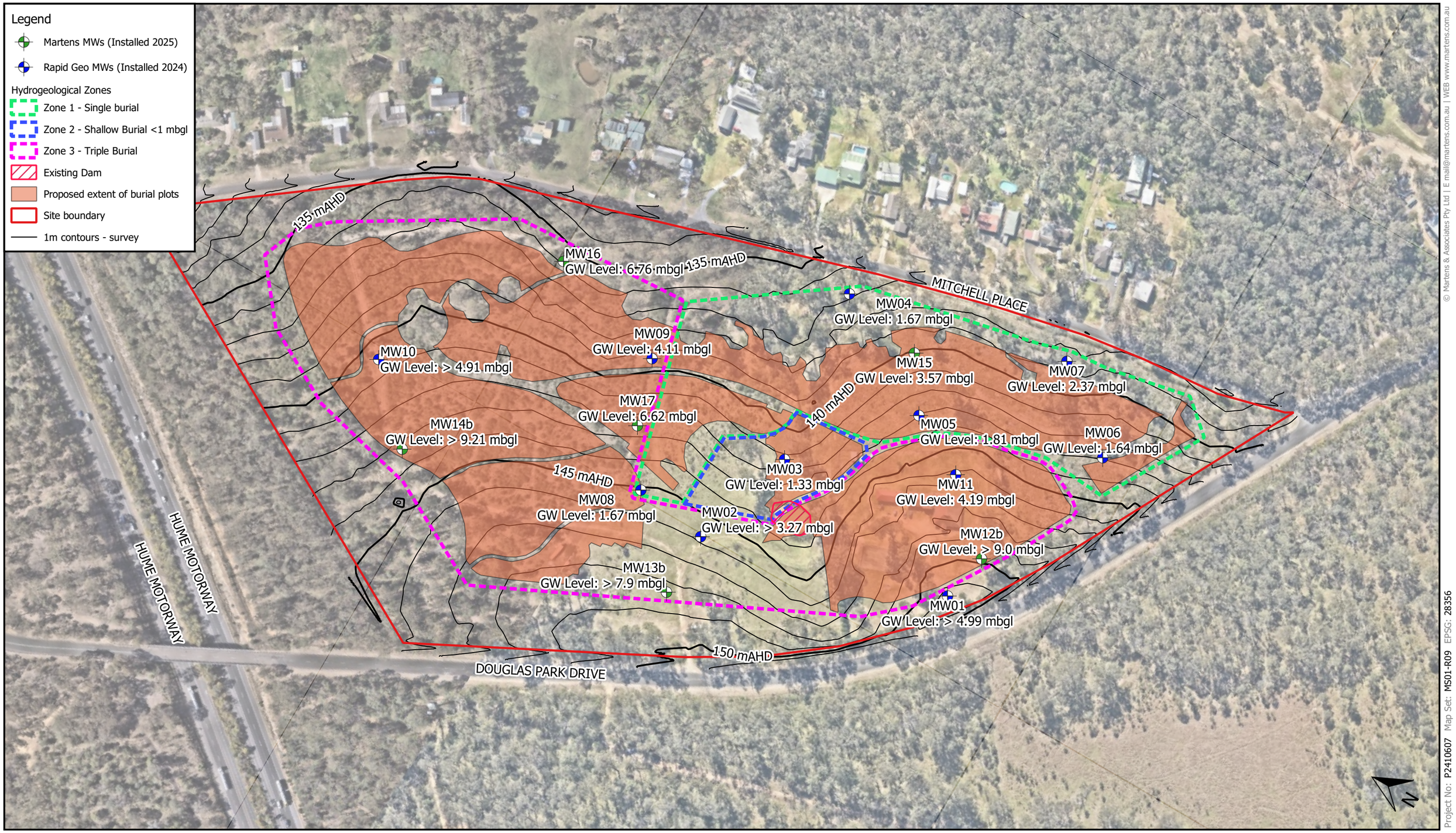
Sources: Nearmap (2024), Contours (Beveridge Williams Survey, 2025), Burial Plots (Design Cubicle Architectural Plan, 2025), Site Boundary (Beveridge Williams Survey, 2025), Stage 1 Works (Arcadia Landscape Architecture, 2024).

Map Title / Figure:

Stage 1 DA works extent

Map 03	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

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0 20 40 60 80 100 m

1:2500 @ A3

Viewport A

Sources: Nearmap (2024), Contours (Beveridge Williams Survey, 2025), Burial Plots (Design Cubicle Architectural Plan, 2025), Site Boundary (Beveridge Williams Survey, 2025. Note: GW levels based on mean levels from limited groundwater monitoring between 07/11/2024 to 20/03/2025.

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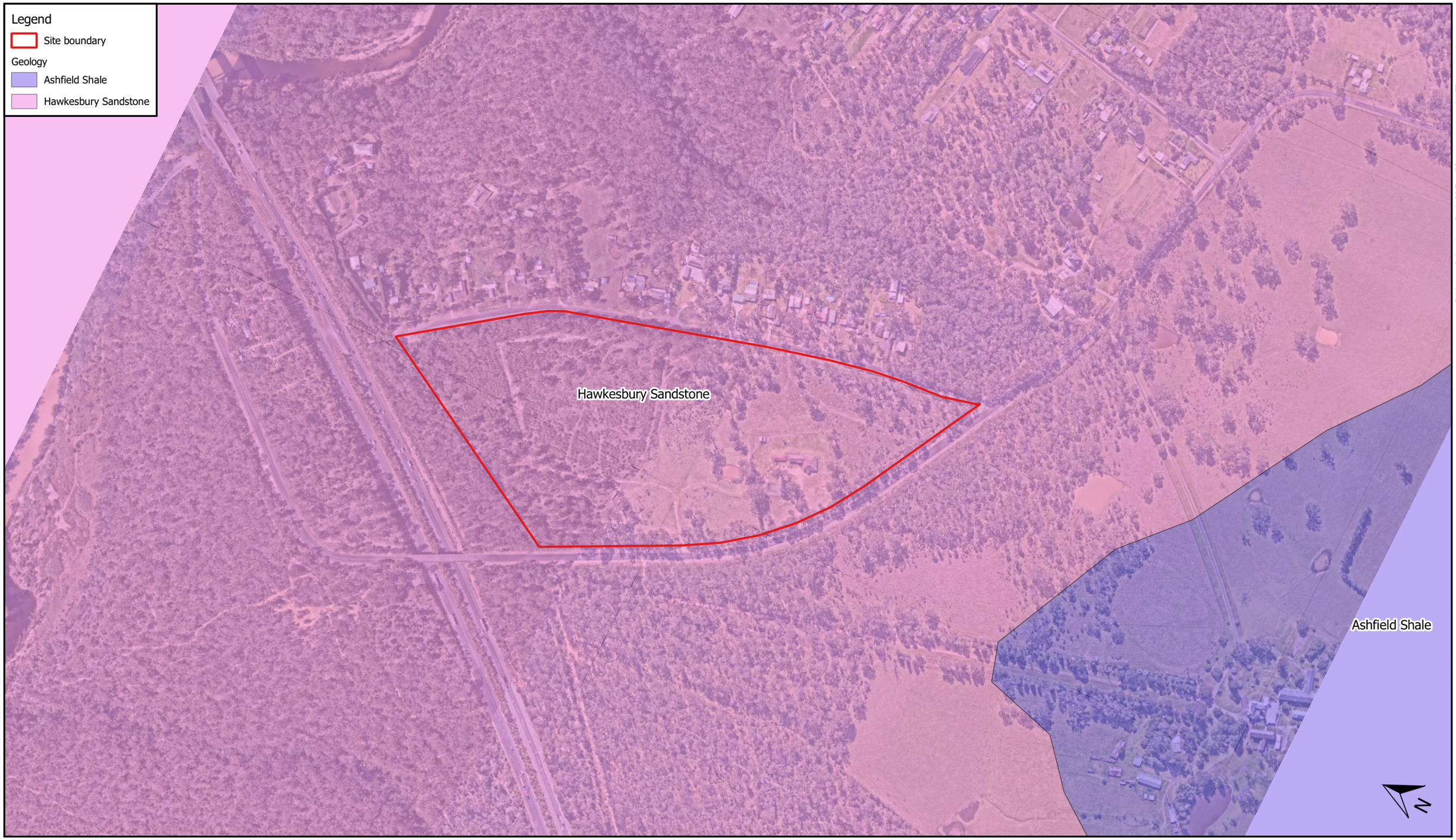
Map Title / Figure:

Mean Groundwater Depths and Preliminary Hydrogeological Zones

Map 04	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

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Project No: P2410607 Map Set: MS01-R09 EPSG: 28356



0 50 100 150 200 250 m

1:5000 @ A3

Viewport B

Sources: Nearmap (2024), Site Boundary (Beveridge Williams Survey, 2025)

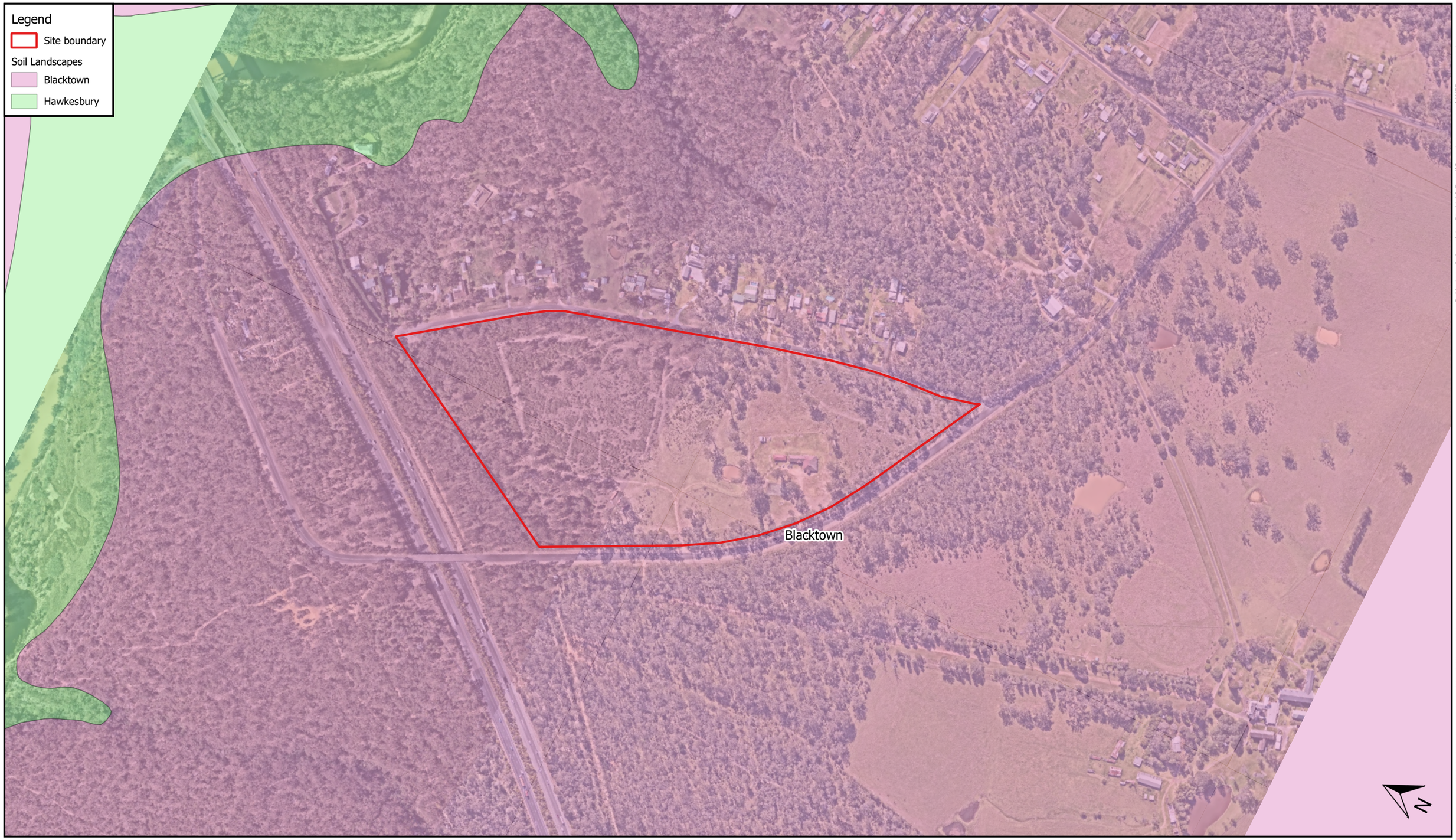
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Map Title / Figure:
Geology

Map 05	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

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0 50 100 150 200 250 m

1:5000 @ A3

Viewport B

Sources: Nearmap (2024), Site Boundary (Beveridge Williams Survey, 2025)

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Project No: P2410607 Map Set: MS01-R09 EPSG: 28356

Map Title / Figure:

Soil Landscape

Map 06	Map
430 - 490 Douglas Park Drive, Douglas Park, NSW	Site
Proposed Douglas Park Cemetery	Project
Hydrogeological Assessment	Sub-Project
Benima Pty Ltd	Client
07/05/2025	Date

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Appendix G – Borehole Logs

CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH201a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71077	RL SURFACE	149.36 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.30 m depth	LATITUDE	-34.201533	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered		*0.20* 149.16				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		TOPSOIL RESIDUAL SOIL
AD/T	M			*0.80* 148.56 *1.30*					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.			WEATHERED ROCK 0.80: V-bit refusal.
									Hole Terminated at 1.30 m			

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH201a/ MW12a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71077	RL SURFACE	149.36 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.30 m depth	LATITUDE	-34.201533	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW12a	
AD/V	L	Not Encountered		0.20 149.16				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		MW12a	Concrete Bentonite Casing.
AD/T	M			0.80 148.56 1.30					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.				Sand Screen.
									Hole Terminated at 1.30 m				

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH201b**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71071	RL SURFACE	149.6 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 9.27 m depth	LATITUDE	-34.201522	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				0.20 149.40				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<<PL)		TOPSOIL RESIDUAL SOIL
AD/T				0.80 148.80					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.			WEATHERED ROCK 0.80: V-bit refusal.
RAB		Not Encountered	2									
				3.00 146.60					Pale grey; inferred medium to high strength.			
			4									
			6									
			8									
				9.27					Hole Terminated at 9.27 m			
			10									
			12									

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CLIENT	Benima Pty Ltd	COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH201b/ MW12b**
PROJECT	Groundwater Assessment for SSDA	LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71071	RL SURFACE	149.6 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 9.27 m depth	LATITUDE	-34.201522	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW13b
AD/V		Not Encountered	0	0.20 149.40				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<<PL)		MW12b: Concrete; Bentonite; Casing
AD/T				0.80 148.80					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.			
RAB			2	3.00 146.60					Pale grey; inferred medium to high strength.			Sand; Screen
			4									
			6									
			8	9.27					Hole Terminated at 9.27 m			
			10									
			12									

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH202a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70923	RL SURFACE	148.89 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.30 m depth	LATITUDE	-34.200049	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered		***0.20*** 148.69				CL	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets.			TOPSOIL
								CI	Silty Sandy CLAY; medium plasticity; orange, brown.	M (<<PL)		RESIDUAL SOIL
				1.00								
AD/T				147.89 *1.30*					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium to high strength.			WEATHERED ROCK 1.00: V-bit refusal.
									Hole Terminated at 1.30 m			

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH202a/ MW13a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70923	RL SURFACE	148.89 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.30 m depth	LATITUDE	-34.200049	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW13a	
AD/V		Not Encountered		0.20 148.69				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<<PL)		MW13a	Concrete Bentonite Casing Sand Screen
AD/T				1.00 147.89 1.30					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium to high strength. Hole Terminated at 1.30 m				

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH202b**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70933	RL SURFACE	148.36 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 9.27 m depth	LATITUDE	-34.200009	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				*0.20* 148.16				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		TOPSOIL RESIDUAL SOIL
AD/T		Not Encountered	2 4 6 8	*1.00* 147.36 *2.00* 146.36 *9.27*					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength. Pale grey; inferred medium to high strength.			WEATHERED ROCK 1.00: V-bit refusal.
			10 12						Hole Terminated at 9.27 m			

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CLIENT	Benima Pty Ltd	COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH202b/ MW13b**
PROJECT	Groundwater Assessment for SSDA	LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70933	RL SURFACE	148.36 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 9.27 m depth	LATITUDE	-34.200009	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW13b
AD/V				0.20 148.16				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		
				1.00 147.36					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.			
AD/T		Not Encountered	2	2.00 146.36					Pale grey; inferred medium to high strength.			
			4									
			6									
			8	9.27								
			10						Hole Terminated at 9.27 m			
			12									

Concrete
Bentonite
Casing
Sand
Screen

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH203a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70959	RL SURFACE	142.13 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.40 m depth	LATITUDE	-34.19796	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered		***0.20*** 141.93				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets.	M (<PL)		TOPSOIL
									Silty Sandy CLAY; medium plasticity; orange, brown.			RESIDUAL SOIL
				1.00								
AD/T				141.13 *1.40*					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium to high strength.			WEATHERED ROCK 1.00: V-bit refusal.
									Hole Terminated at 1.40 m			

2
4
6
8
10
12

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CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH203a/ MW14a**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70959	RL SURFACE	142.13 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.40 m depth	LATITUDE	-34.19796	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level	
AD/V		Not Encountered		0.20 141.93				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		MW14a	Concrete Bentonite Casing Sand Screen
AD/T				1.00 141.13 1.40					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium to high strength.				
									Hole Terminated at 1.40 m				

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Engineering Log - TEST

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2410607BH201-203V02.GPJ <<DrawingFile>> 11/04/2025 10:44 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH203b**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70972	RL SURFACE	141.83 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 9.11 m depth	LATITUDE	-34.197951	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V				*0.20* 141.63				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		TOPSOIL RESIDUAL SOIL
AD/T		Not Encountered	2 4 6 8	*1.00* 140.83 *6.00* 135.83 *9.11*					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength. Medium to high strength.			WEATHERED ROCK 1.00: V-bit refusal.
			10 12						Hole Terminated at 9.11 m			

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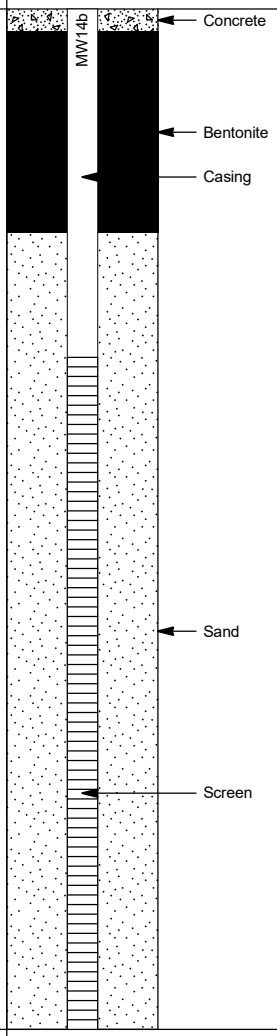
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Engineering Log - BOREHOLE

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2410607BH201-203V2.GPJ <<DrawingFile>> 11/04/2025 10:45 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	Benima Pty Ltd		COMMENCED	20/01/2025	COMPLETED	20/01/2025	**REF BH203b/ MW14b**
PROJECT	Groundwater Assessment for SSDA		LOGGED	WS	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70972	RL SURFACE	141.83 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 9.11 m depth	LATITUDE	-34.197951	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW14b
AD/V				0.20 141.63				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; medium plasticity; orange, brown.	M (<PL)		
				1.00 140.83					SANDSTONE; fine grained; orange, brown, highly weathered; inferred medium strength.			
AD/T		Not Encountered	2									
			4									
			6	6.00 135.83					Medium to high strength.			
			8	9.11								
			10						Hole Terminated at 9.11 m			
			12									



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CLIENT	Benima Pty Ltd		COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH301**
PROJECT	Groundwater Assessment for SSDA		LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71183	RL SURFACE	140.1 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 7.90 m depth	LATITUDE	-34.20062	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	L	Not Encountered	0	140.10 *0.20* 139.90 *0.80* 139.30				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown.	M (<PL)		TOPSOIL RESIDUAL SOIL
AD/T	L-M		1						SANDSTONE; fine to medium grained; orange, yellow; reddish brown; inferred medium to high strength.			WEATHERED ROCK 0.80: V-bit refusal.
RAB			2									2.00: TC-bit refusal.
				2.80 137.30					Pale grey; grey; inferred medium strength.			
			3									
			4									
			5									
			6									
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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Engineering Log - BOREHOLE

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CLIENT	Benima Pty Ltd	COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH301/ MW15**
PROJECT	Groundwater Assessment for SSDA	LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71183	RL SURFACE	140.1 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 7.90 m depth	LATITUDE	-34.20062	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW15
AD/V	L	Not Encountered	0	140.10 *0.20* 139.90				CL	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets.			Concrete
								CI	Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown.	M (<PL)		Cuttings
AD/T	L-M			*0.80* 139.30					SANDSTONE; fine to medium grained; orange, yellow; reddish brown; inferred medium to high strength.			Casing
			1									Bentonite
			2									
RAB				*2.80* 137.30					Pale grey; grey; inferred medium strength.			
			3									
			4									
			5									Sand
			6									Screen
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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CLIENT	Benima Pty Ltd		COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH302**
PROJECT	Groundwater Assessment for SSDA		LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71116	RL SURFACE	135.8 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 7.80 m depth	LATITUDE	-34.19841	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L-M			135.80 *0.20* 135.60 *0.50* 135.30				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown.	M (<PL)		TOPSOIL RESIDUAL SOIL WEATHERED ROCK 0.50: TC-bit refusal.
RAB		Not Encountered	1 2 3	*3.50* 132.30					SANDSTONE; fine to medium grained; yellow, red, brown; inferred medium to high strength.			
			4	*4.30* 131.50					SHALE: Pale grey; grey; inferred medium strength.			
			5 6 7	*7.80*					SANDSTONE; fine to medium grained; yellow, red, brown; inferred medium to high strength.			
			8						Hole Terminated at 7.80 m			

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Engineering Log - BOREHOLE

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CLIENT	Benima Pty Ltd	COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH302/ MW16**
PROJECT	Groundwater Assessment for SSDA	LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71116	RL SURFACE	135.8 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 7.80 m depth	LATITUDE	-34.19841	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description						
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID MW16 Static Water Level	
AD/T	L-M	Not Encountered	0	135.80 *0.20* 135.60 *0.50* 135.30				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown.	M (<PL)		MW16	Concrete
RAB			1						SANDSTONE; fine to medium grained; yellow, red, brown; inferred medium to high strength.				Cuttings
			2										Casing Bentonite
			3	*3.50* 132.30					SHALE: Pale grey; grey; inferred medium strength.				
			4	*4.30* 131.50					SANDSTONE; fine to medium grained; yellow, red, brown; inferred medium to high strength.				
			5										Screen Sand
			6										
			7	*7.80*									
			8						Hole Terminated at 7.80 m				

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CLIENT	Benima Pty Ltd		COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH303**
PROJECT	Groundwater Assessment for SSDA		LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71034	RL SURFACE	143.5 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 7.90 m depth	LATITUDE	-34.19931	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L-M			143.50 *0.20* 143.30				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown, orange.	M (<PL)		TOPSOIL RESIDUAL SOIL
			1	*1.00* 142.50					SANDSTONE; fine grained; orange, brown, red, yellow; inferred medium strength.			WEATHERED ROCK 1.00: TC-bit refusal.
			2	*2.00* 141.50					SHALE; grey, dark grey, inferred medium strength.			
RAB		Not Encountered	3	*3.00* 140.50					SANDSTONE; fine grained; yellow, reddish brown; inferred medium strength.			
			4									
			5									
			6									
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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CLIENT	Benima Pty Ltd	COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH303/ MW17**
PROJECT	Groundwater Assessment for SSDA	LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.71034	RL SURFACE	143.5 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 7.90 m depth	LATITUDE	-34.19931	ASPECT	Northeast	SLOPE < 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW17
AD/T	L-M	Not Encountered	0	143.50				CL	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets.	M (<PL)		Concrete
				0.20 143.30				CI	Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown, orange.			
			1	*1.00* 142.50					SANDSTONE; fine grained; orange, brown, red, yellow; inferred medium strength.			Cuttings
			2	*2.00* 141.50					SHALE; grey, dark grey, inferred medium strength.			Casing
			3	*3.00* 140.50					SANDSTONE; fine grained; yellow, reddish brown; inferred medium strength.			Bentonite
RAB			4									
			5									Screen
			6									Sand
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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CLIENT	Benima Pty Ltd		COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH304**
PROJECT	Groundwater Assessment for SSDA		LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park		GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT		4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70935	RL SURFACE	148.3 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 7.90 m depth	LATITUDE	-34.19998	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L-M			*0.15* 148.15				CL CI	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets. Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown, orange.	M (<PL)		TOPSOIL RESIDUAL SOIL
			1	*1.00* 147.30					SANDSTONE; fine grained; orange, brown, reddish brown, yellow; inferred medium strength.			WEATHERED ROCK 1.00: TC-bit refusal.
			2									
			3									
RAB		Not Encountered	4	*4.00* 144.30					SHALE; grey, dark grey, inferred medium strength.			
			5	*4.80* 143.50					SANDSTONE; fine grained; yellow, reddish brown, orange; inferred medium to high strength.			
			6									
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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Engineering Log - BOREHOLE

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CLIENT	Benima Pty Ltd	COMMENCED	20/02/2025	COMPLETED	20/02/2025	**REF BH304/ MW13b**
PROJECT	Groundwater Assessment for SSDA	LOGGED	RIM	CHECKED	JF	Sheet 1 OF 1
SITE	430 - 490 Douglas Park Drive, Douglas Park	GEOLOGY	Hawkesbury Sandstone	VEGETATION	Grass	PROJECT NO. P2410607
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE	150.70935	RL SURFACE	148.3 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 7.90 m depth	LATITUDE	-34.19998	ASPECT	Northeast	SLOPE 5 %

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS ID Static Water Level MW13b
AD/T	L-M	Not Encountered	0	*0.15* 148.15				CL	TOPSOIL: Silty CLAY; low plasticity; dark brown; trace sand and rootlets.	M (<PL)		MW13b; Concrete
								CI	Silty Sandy CLAY; fine to medium grained; medium plasticity; brown, reddish brown, orange.			
			1	*1.00* 147.30					SANDSTONE; fine grained; orange, brown, reddish brown, yellow; inferred medium strength.			Cuttings; Casing; Bentonite
RAB			2									
			3									
			4	*4.00* 144.30					SHALE; grey, dark grey, inferred medium strength.			
				4.80 143.50					SANDSTONE; fine grained; yellow, reddish brown, orange; inferred medium to high strength.			Screen; Sand
			5									
			6									
			7									
				7.90								
			8						Hole Terminated at 7.90 m			

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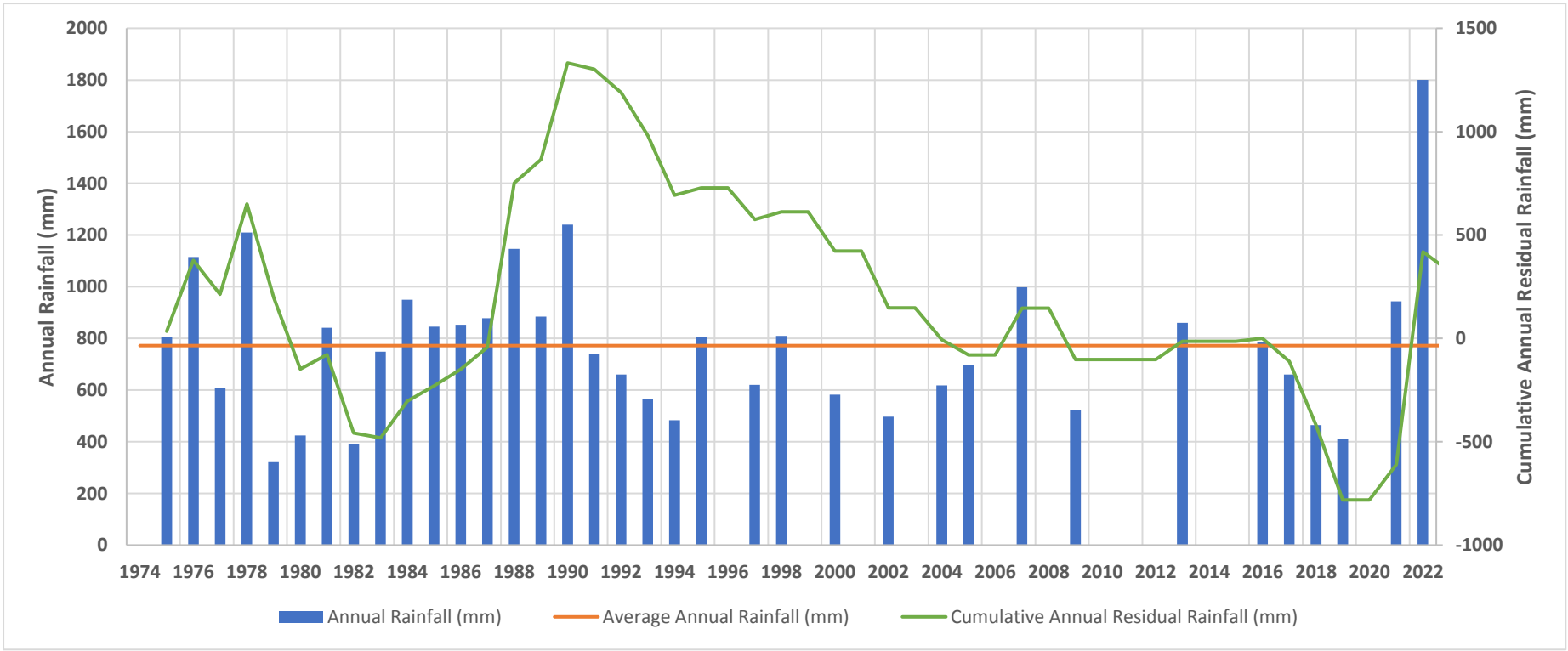
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Engineering Log - TEST

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2410607BH301-304.GPJ <<DrawingFile>> 11/04/2025 10:51 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

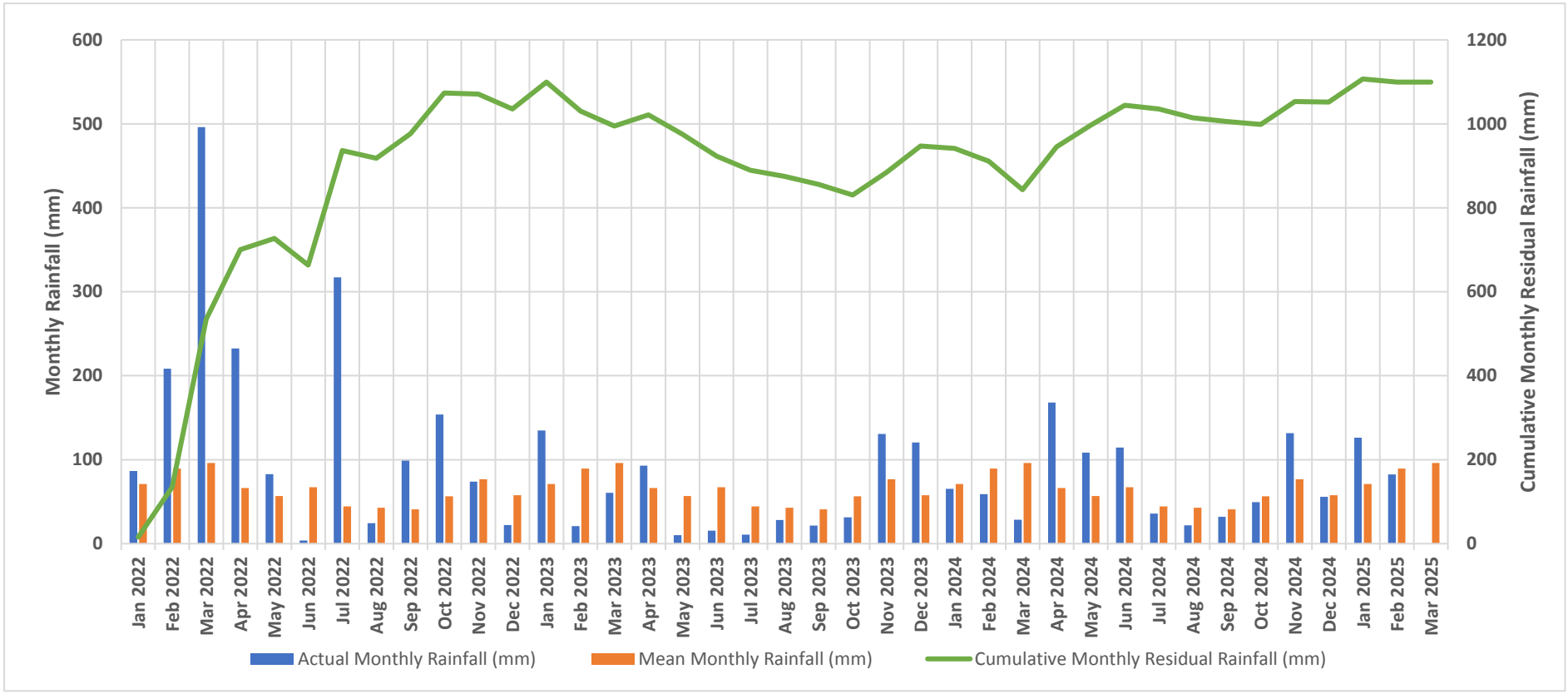
Appendix H – Figures



NOTES:

- Cumulative annual residual rainfall is the running total of recorded annual rainfall minus average annual rainfall.

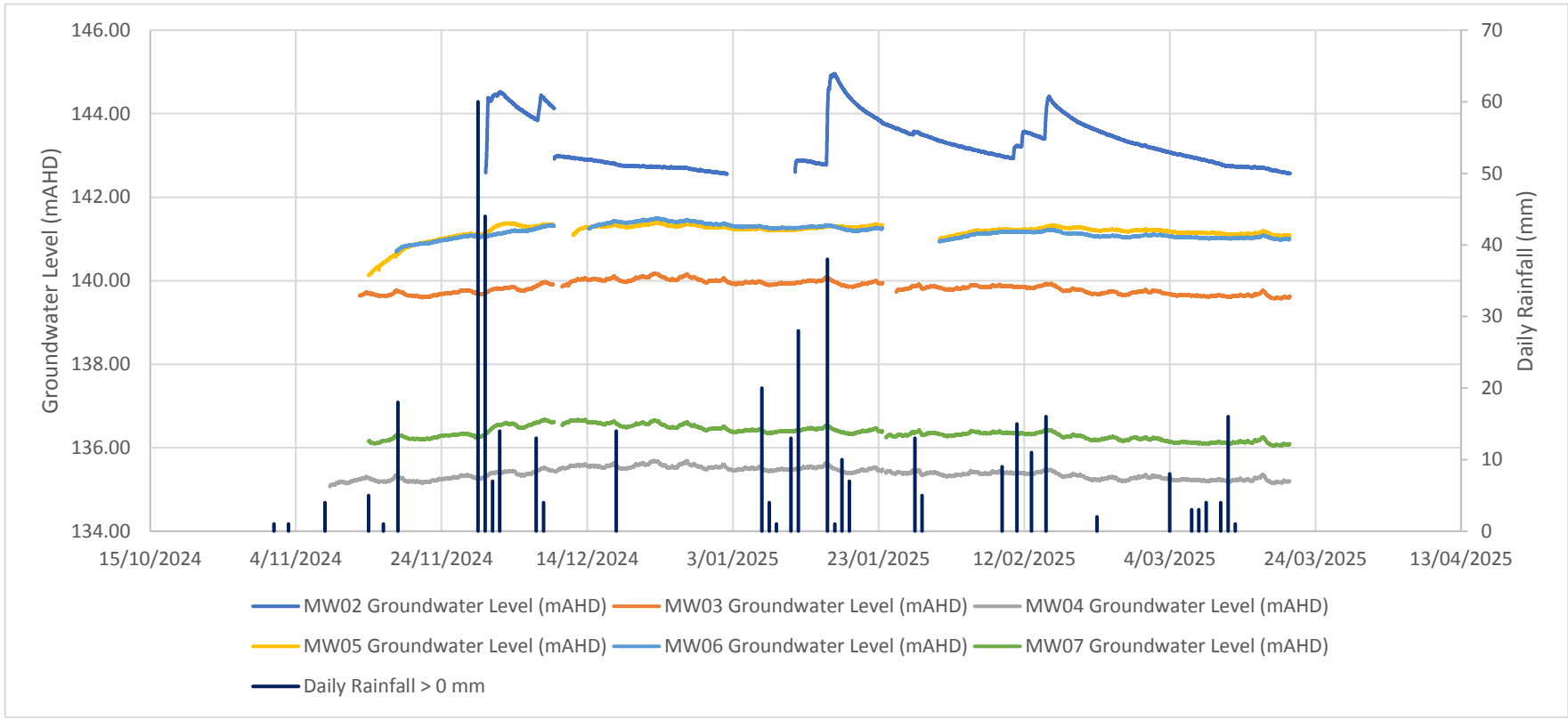
Martens & Associates Pty Ltd		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	RIM	**Figure 1:** Historical annual rainfall and cumulative residual rainfall.	Report: Groundwater Assessment - Douglas Park Memorial Park- Concept Plan and Stage 1
Approved:	JCF		
Date:	23/05/2025		



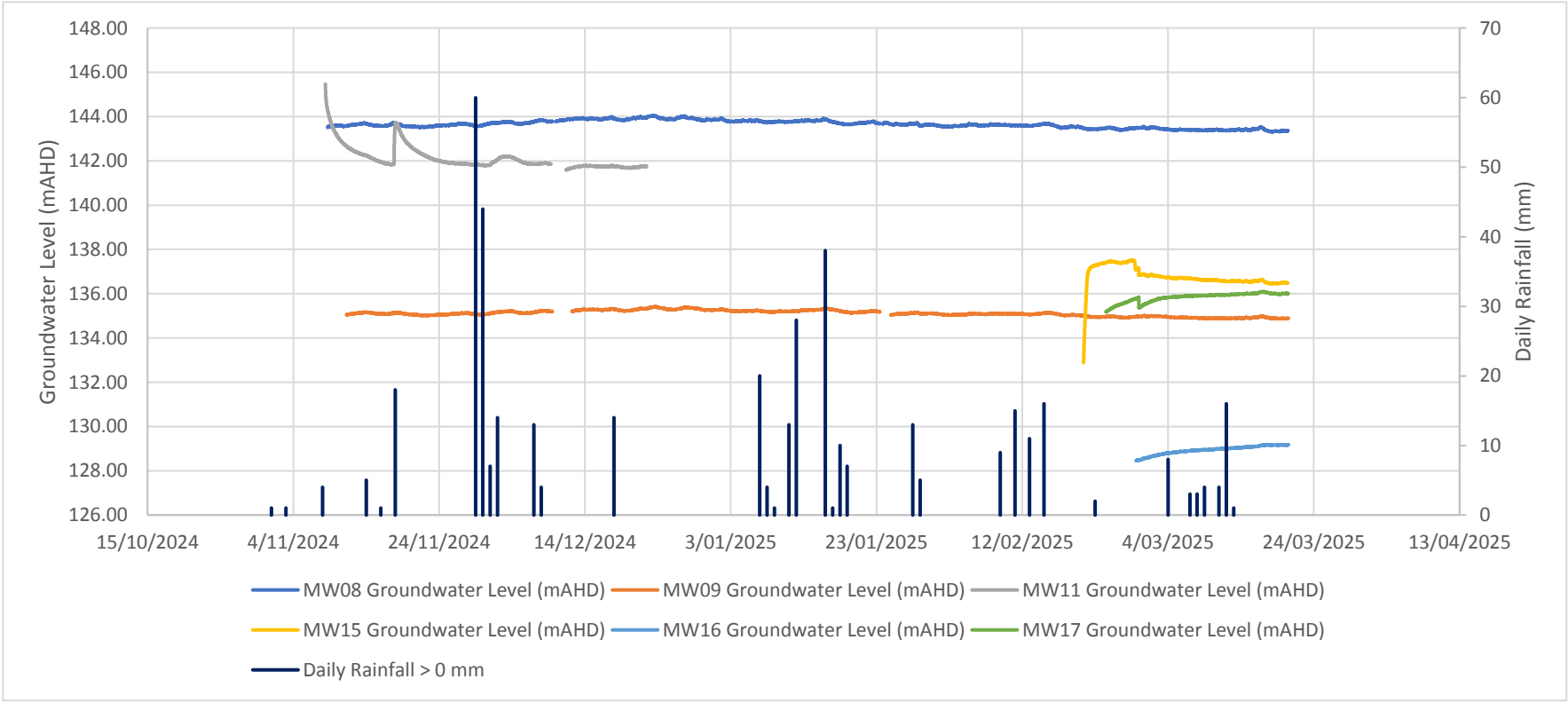
NOTES:

- Cumulative monthly residual rainfall is the running total of recorded monthly rainfall minus average monthly rainfall.

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Drawn: RIM	**Figure 2:** Recorded and average monthly rainfall, and cumulative monthly residual rainfall for the 3 years preceding groundwater monitoring.
Approved: JCF	Report: Groundwater Assessment - Douglas Park Memorial Park- Concept Plan and Stage 1
Date: 23/05/2025	



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	Drawn:	RIM	**Figure 3:** MW02 – MW07 groundwater levels and daily rainfall from 07/11/2024 to 20/03/2025.	Report: Groundwater Assessment - Douglas Park Memorial Park- Concept Plan and Stage 1
	Approved:	JCF		
	Date:	23/05/2025		



	Martens & Associates Pty Ltd		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
	Drawn:	RIM	**Figure 4:** MW08 – MW17 groundwater levels and daily rainfall from 07/11/2025 to 20/03/2025.	Report: Groundwater Assessment - Douglas Park Memorial Park- Concept Plan and Stage 1
	Approved:	DM		
	Date:	23/05/2025		

Appendix I – Slug Test Results

Single Bore Slug Test (Falling)

Method ST-13 Revised 7.3.2007

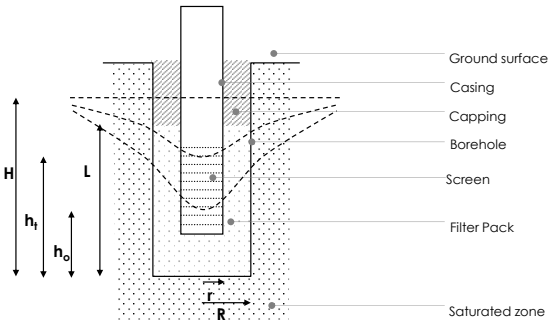
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PROJECT DETAILS

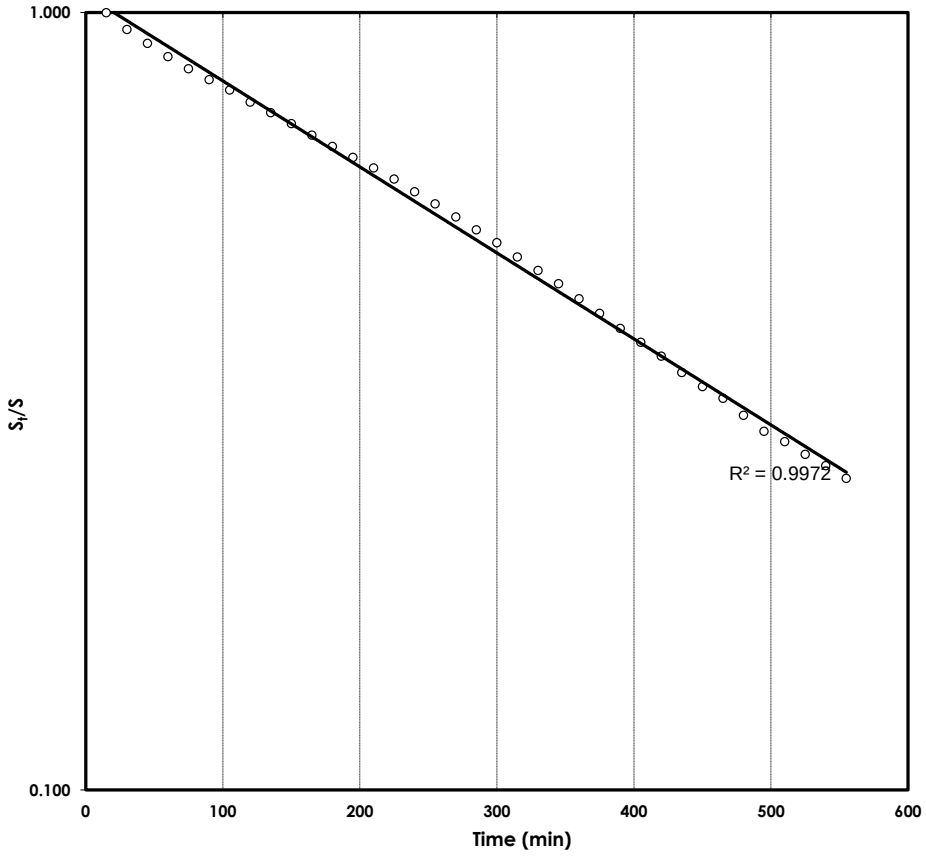
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH103 / MW03	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	2.930	m
h_o - Water level reading at time = 0 (depth)	0.342	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	0.14	m
T_o - Length of characteristic time	410.80	minutes
K_{sat} - Saturated hydraulic conductivity	0.0081	m/d



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Single Bore Slug Test (Falling)

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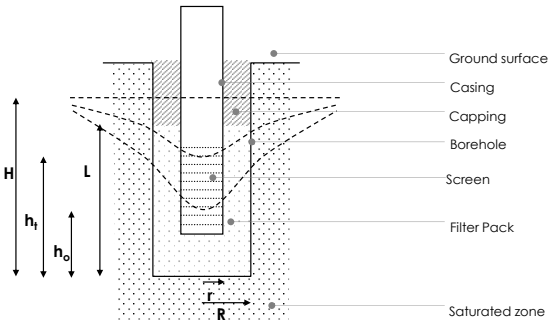
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PROJECT DETAILS

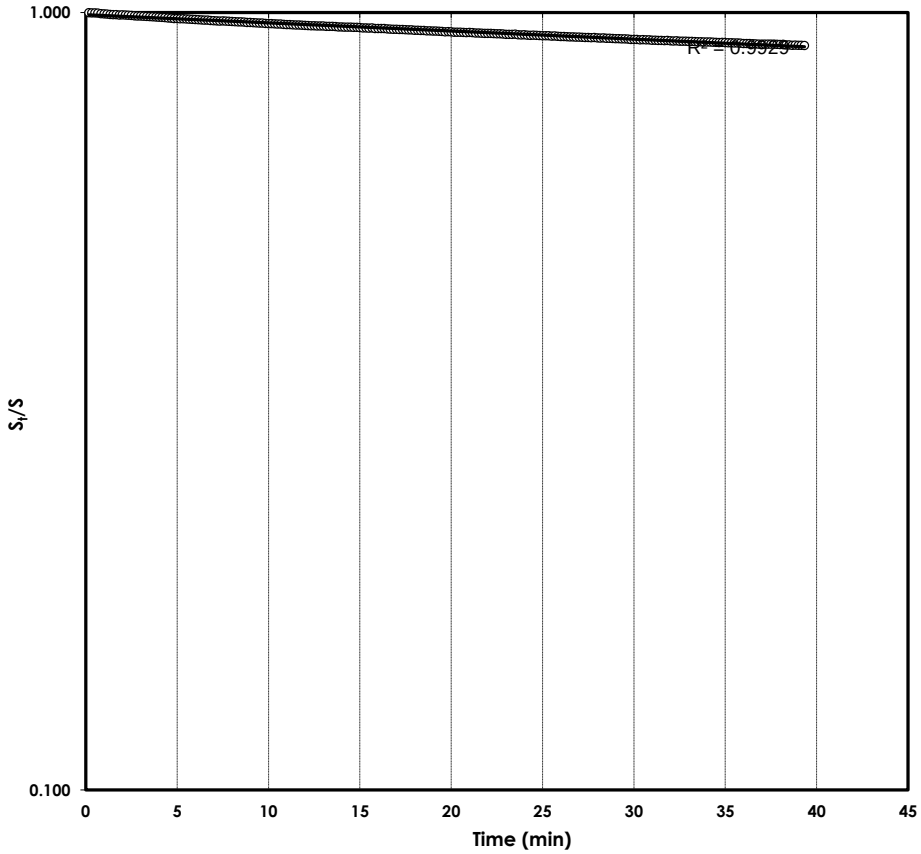
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH103 / MW03	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	4.780	m
h_o - Water level reading at time = 0 (depth)	0.601	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	1.99	m
T_o - Length of characteristic time	409.46	minutes
K_{sat} - Saturated hydraulic conductivity	0.0020	m/d



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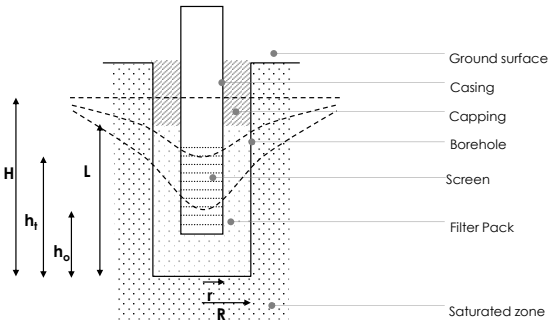
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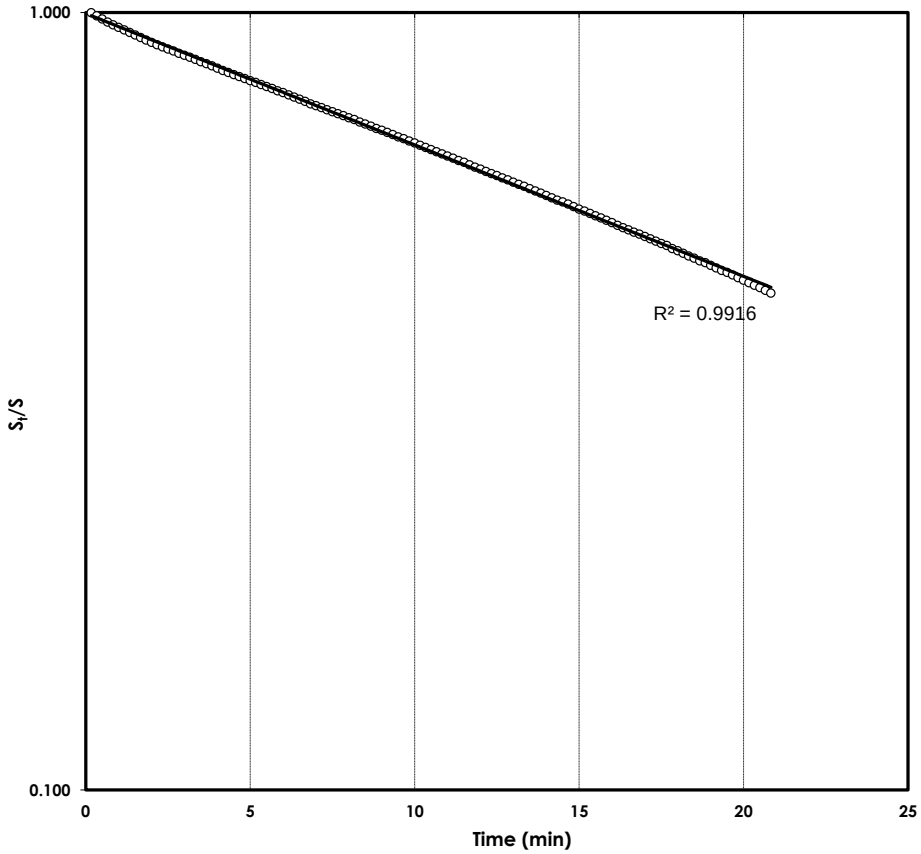
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH104 / MW04	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	2.940	m
h_o - Water level reading at time = 0 (depth)	0.460	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	0.26	m
T_o - Length of characteristic time	25.47	minutes
K_{sat} - Saturated hydraulic conductivity	0.1120	m/d



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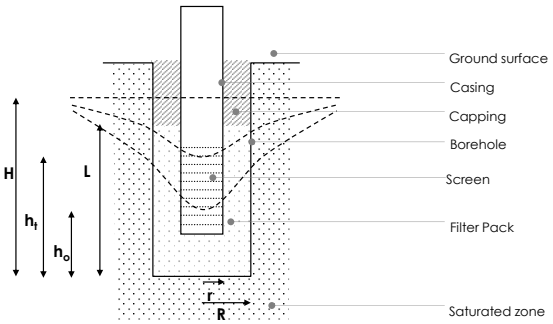
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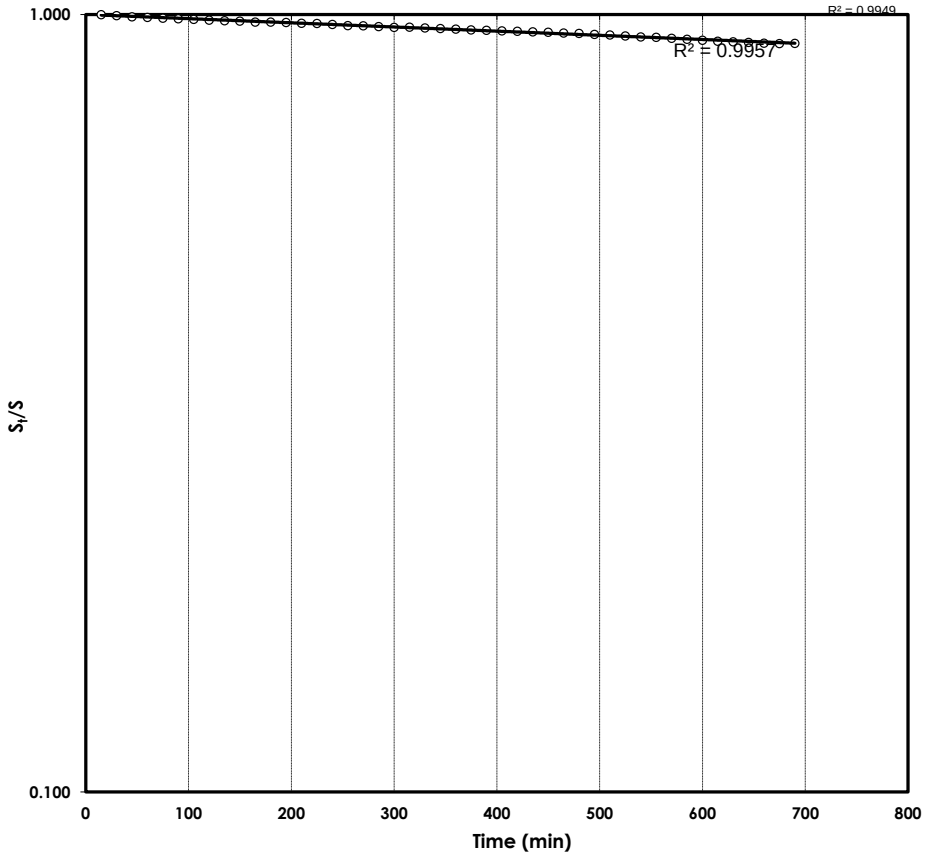
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH105 / MW05	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.200	m
h_o - Water level reading at time = 0 (depth)	0.229	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.44	m
T_o - Length of characteristic time	8055.26	minutes
K_{sat} - Saturated hydraulic conductivity	0.000089	m/d



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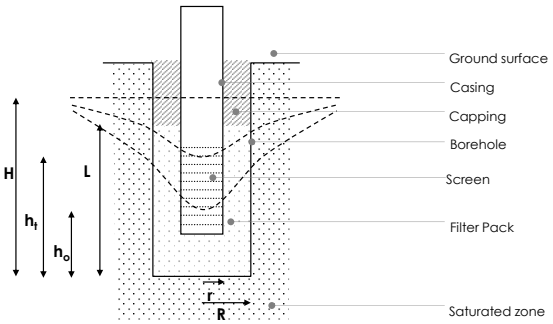
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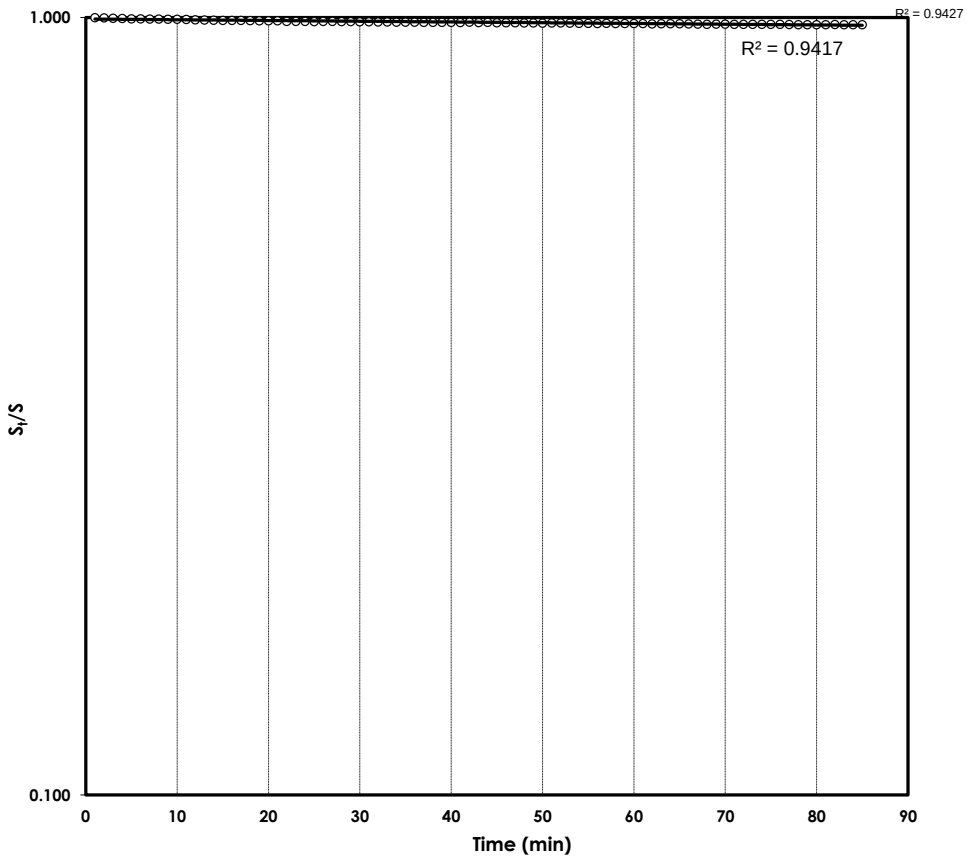
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH105 / MW05	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.170	m
h_o - Water level reading at time = 0 (depth)	0.479	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.41	m
T_o - Length of characteristic time	4483.22	minutes
K_{sat} - Saturated hydraulic conductivity	0.00016	m/d



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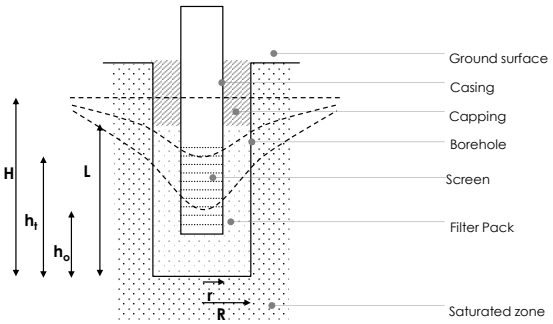
Method ST-13 Revised 7.3.2007

PROJECT DETAILS

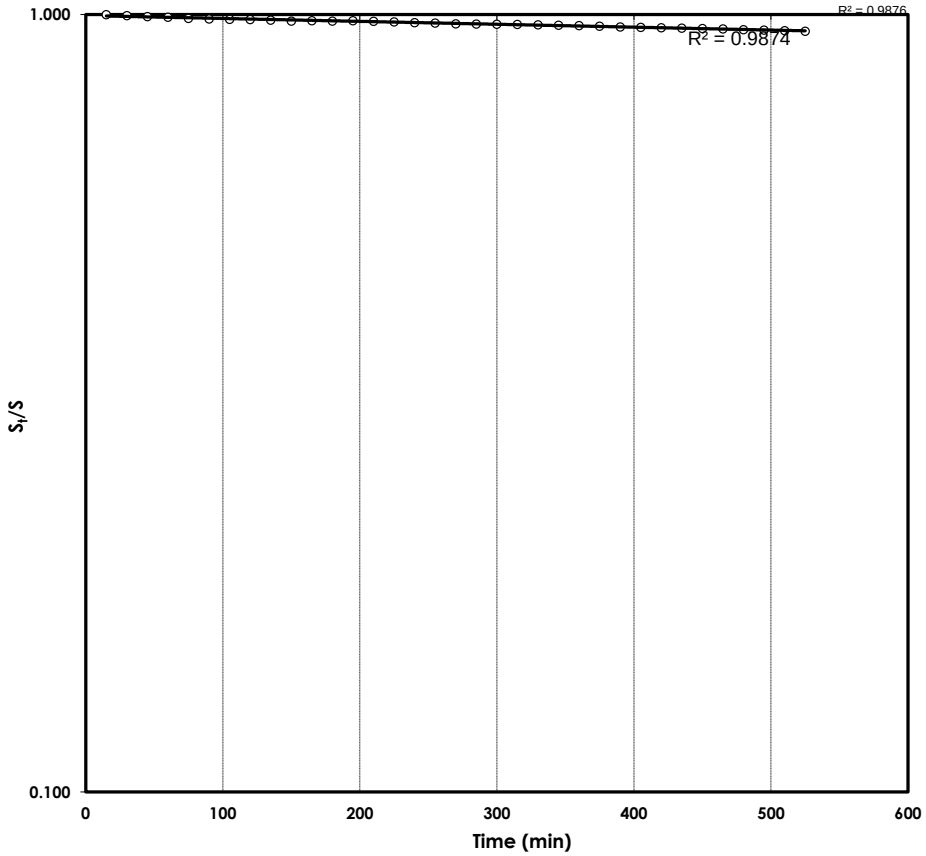
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH106 / MW06	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	4.990	m
h_o - Water level reading at time = 0 (depth)	0.755	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.29	m
T_o - Length of characteristic time	11537.39	minutes
K_{sat} - Saturated hydraulic conductivity	0.000065	m/d



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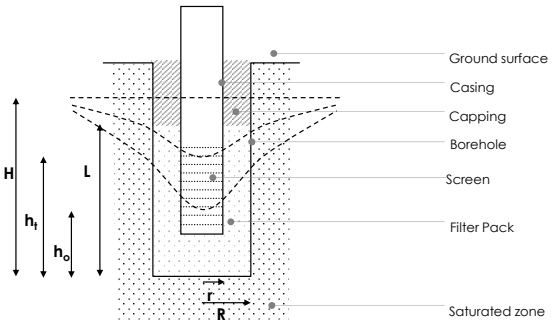
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PROJECT DETAILS

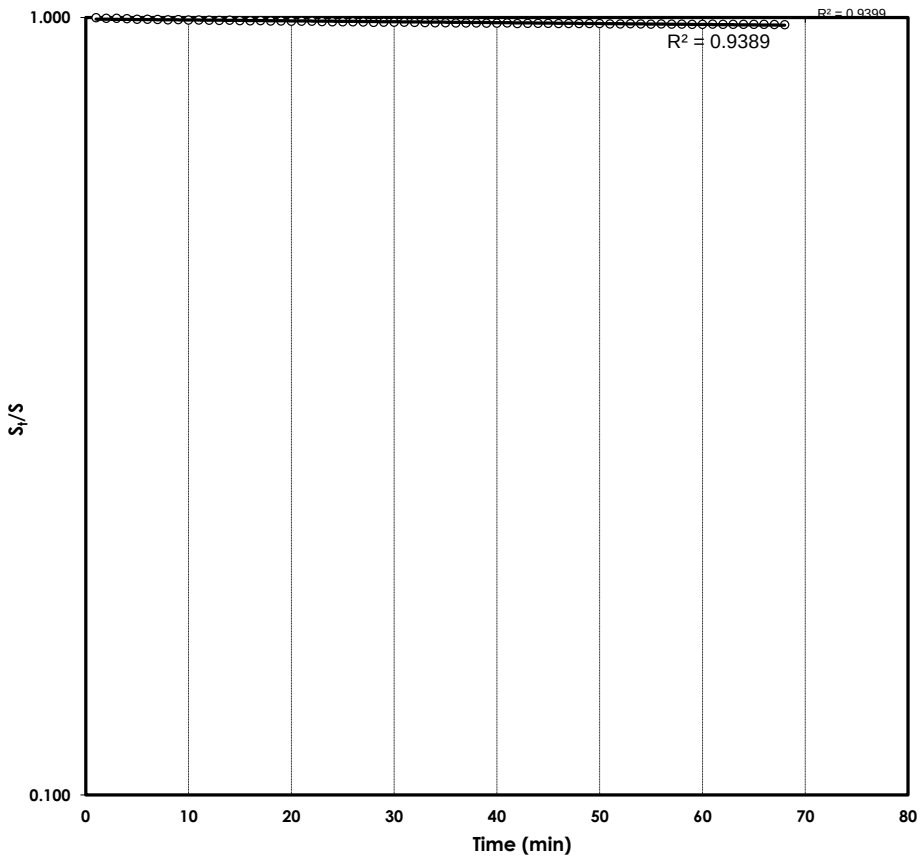
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH106 / MW06	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.010	m
h_o - Water level reading at time = 0 (depth)	0.600	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.31	m
T_o - Length of characteristic time	3706.41	minutes
K_{sat} - Saturated hydraulic conductivity	0.00020	m/d



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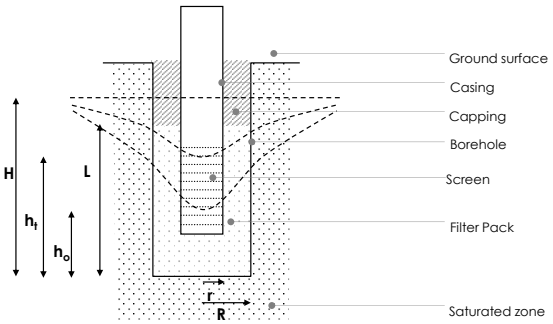
Method ST-13 Revised 7.3.2007

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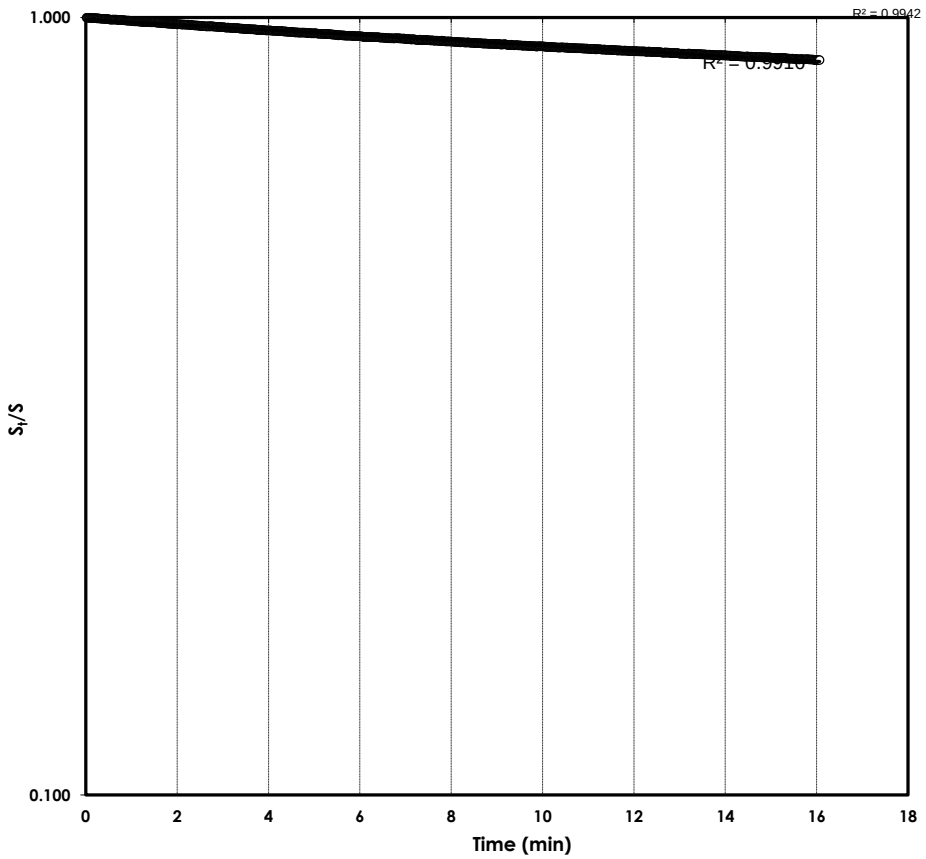
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH107 / MW07	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	3.780	m
h_o - Water level reading at time = 0 (depth)	1.000	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	1.16	m
T_o - Length of characteristic time	127.76	minutes
K_{sat} - Saturated hydraulic conductivity	0.0095	m/d



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Single Bore Slug Test (Falling)

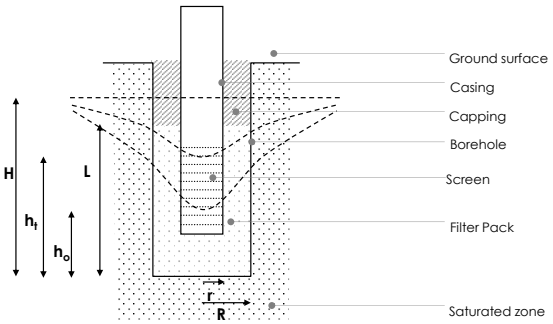
Method ST-13 Revised 7.3.2007

PROJECT DETAILS

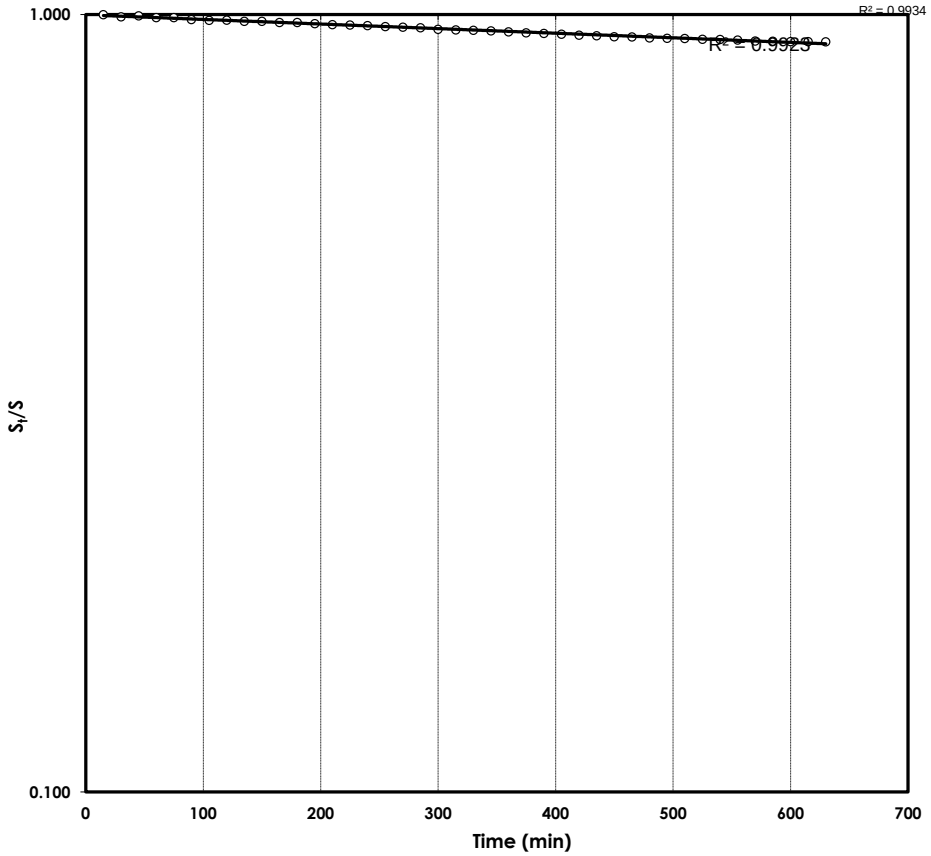
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH107 / MW07	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	4.190	m
h_o - Water level reading at time = 0 (depth)	1.705	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	1.57	m
T_o - Length of characteristic time	7302.03	minutes
K_{sat} - Saturated hydraulic conductivity	0.00014	m/d



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Single Bore Slug Test (Falling)

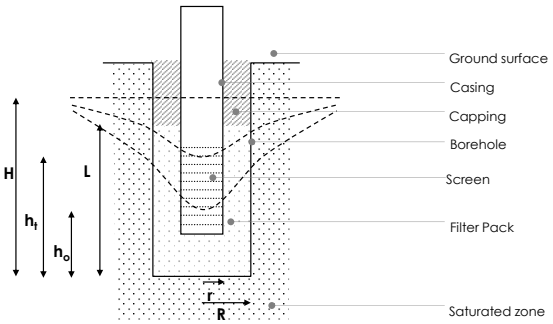
Method ST-13 Revised 7.3.2007

PROJECT DETAILS

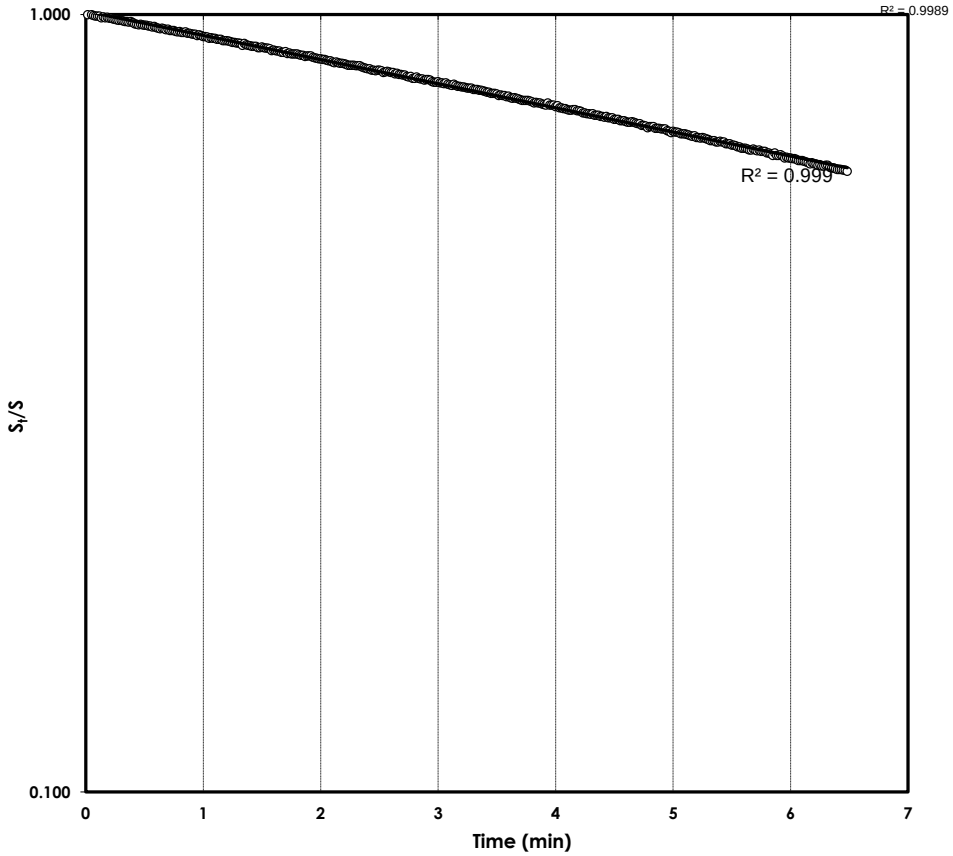
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Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH108 / MW08	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	2.480	m
h_o - Water level reading at time = 0 (depth)	1.654	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.95	m
T_o - Length of characteristic time	14.04	minutes
K_{sat} - Saturated hydraulic conductivity	0.0443	m/d



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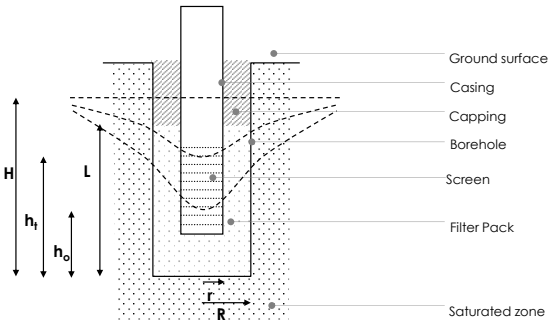
Method ST-13 Revised 7.3.2007

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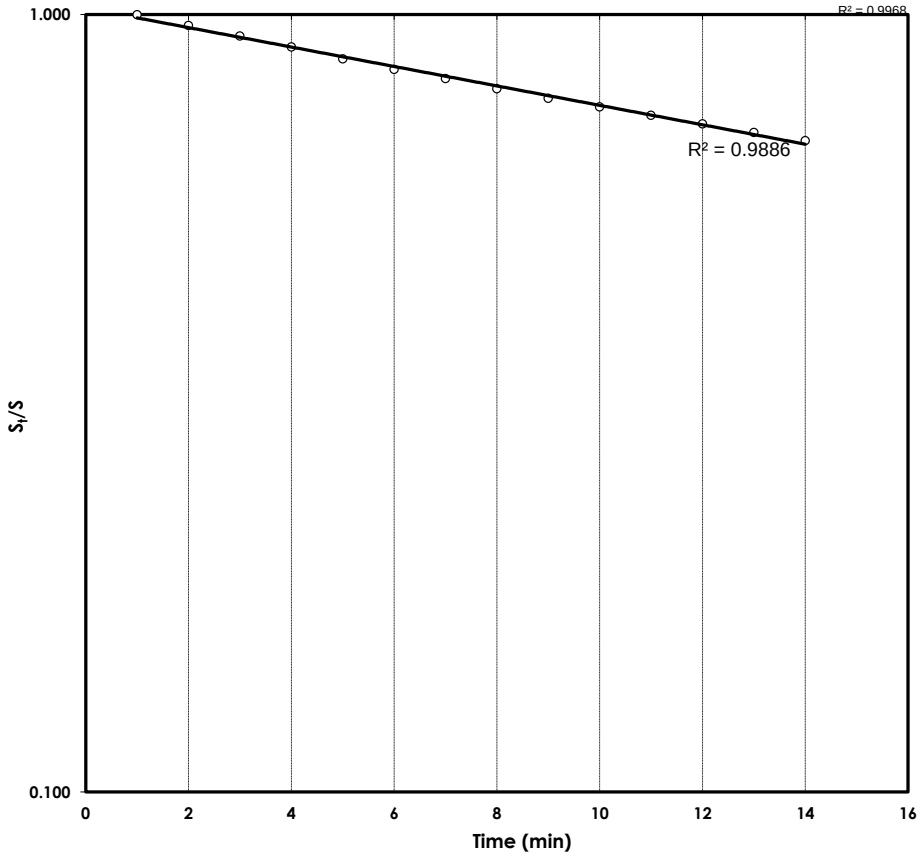
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH108 / MW08	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	2.430	m
h_o - Water level reading at time = 0 (depth)	0.229	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.95	m
T_o - Length of characteristic time	35.20	minutes
K_{sat} - Saturated hydraulic conductivity	0.0177	m/d



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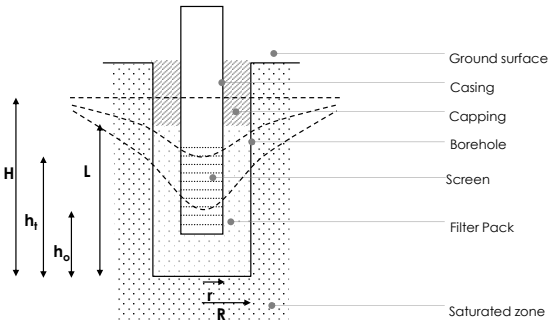
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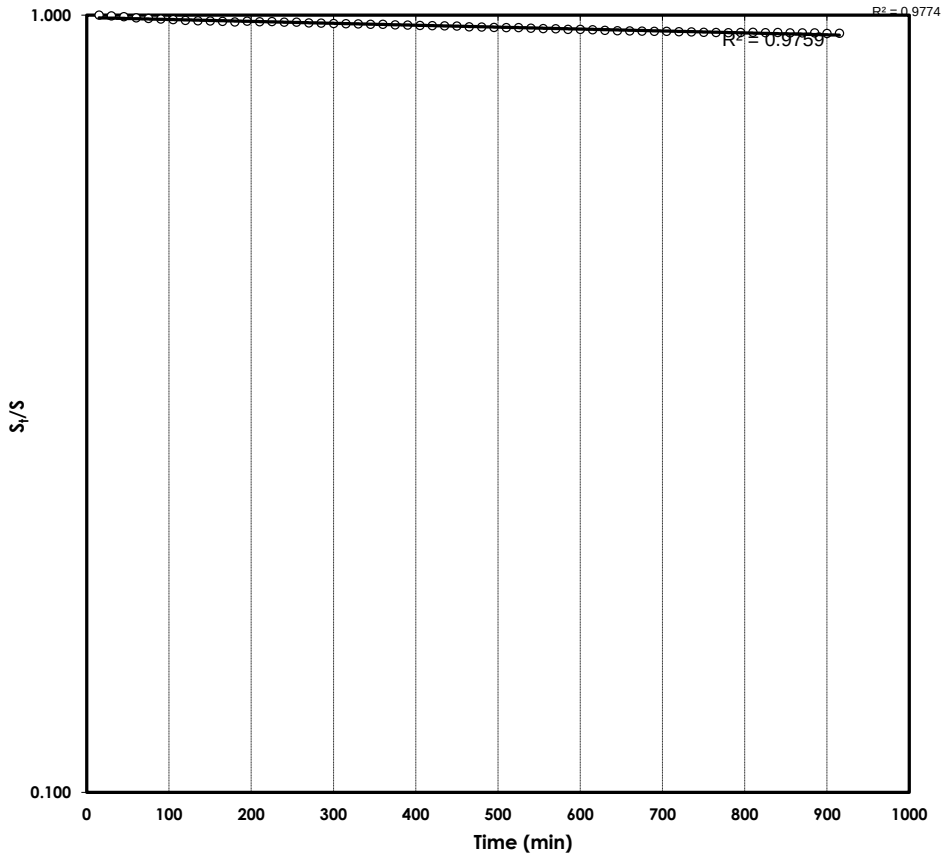
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Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH109 / MW09	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.450	m
h_o - Water level reading at time = 0 (depth)	0.404	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.81	m
T_o - Length of characteristic time	17381.85	minutes
K_{sat} - Saturated hydraulic conductivity	0.000037	m/d



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Single Bore Slug Test (Falling)

Method ST-13 Revised 7.3.2007

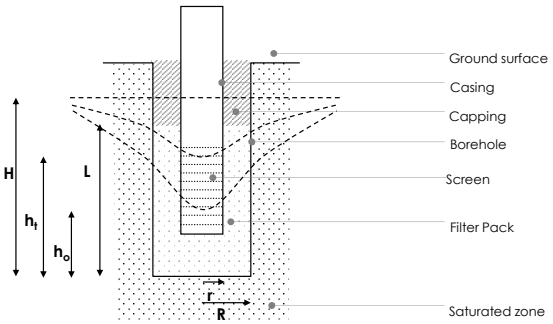
martens consulting engineers

PROJECT DETAILS

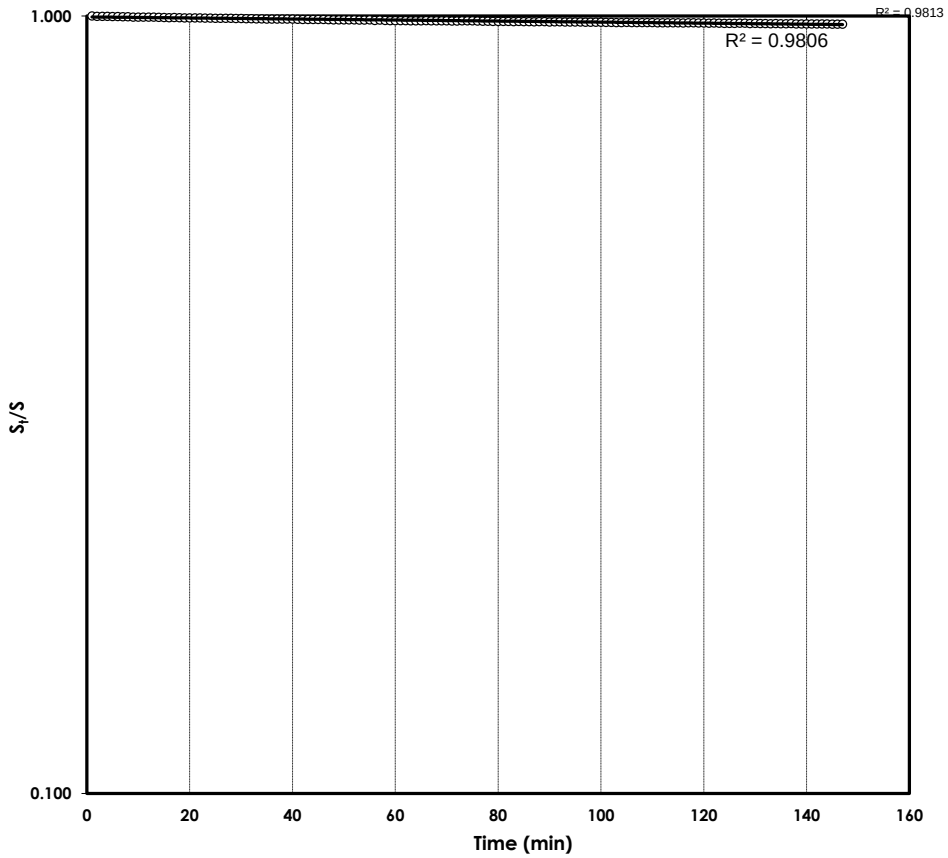
Project	P2410607	Test Date	23.01.2025
Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH109 / MW09	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.350	m
h_o - Water level reading at time = 0 (depth)	0.151	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.71	m
T_o - Length of characteristic time	6450.42	minutes
K_{sat} - Saturated hydraulic conductivity	0.00010	m/d



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Single Bore Slug Test (Rising)

Method ST-13 Revised 7.3.2007

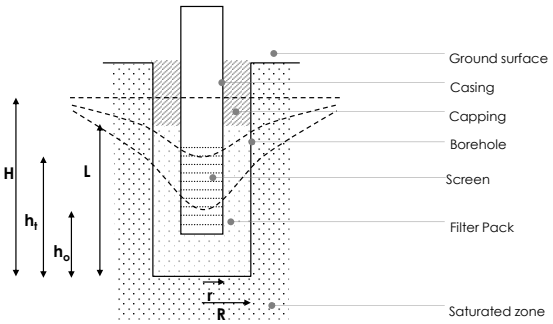
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PROJECT DETAILS

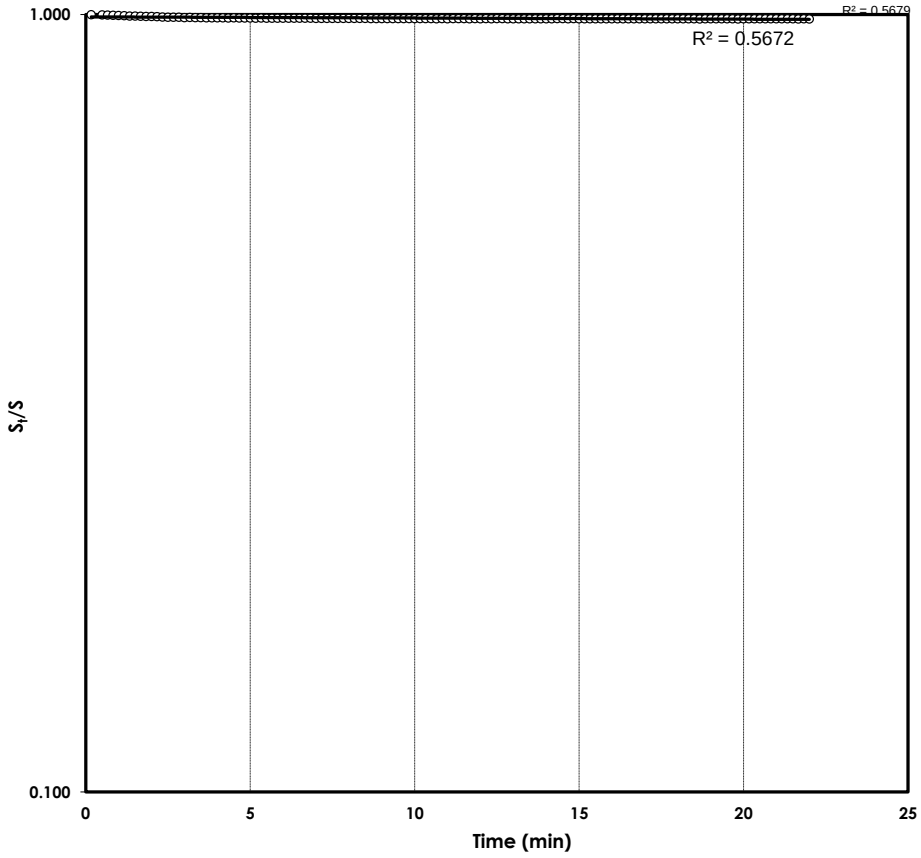
Project	P2410607	Test Date	07.11.2024
Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH11 / MW11	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	7.330	m
h_o - Water level reading at time = 0 (depth)	0.052	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.93	m
T_o - Length of characteristic time	2920.41	minutes
K_{sat} - Saturated hydraulic conductivity	0.00021	m/d



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Single Bore Slug Test (Rising)

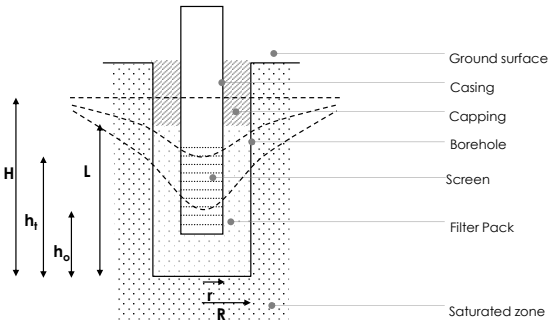
Method ST-13 Revised 7.3.2007

PROJECT DETAILS

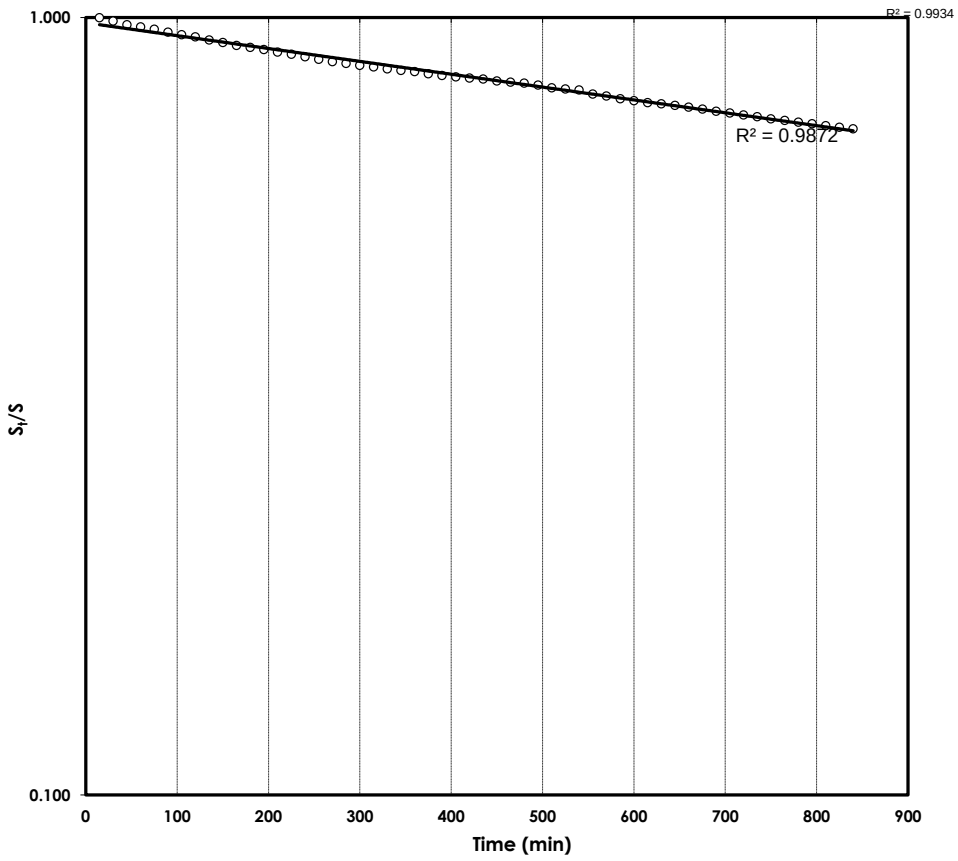
Project	P2410607	Test Date	07.11.2024
Project Ref	P2410607JS03V01	Field Testing	TR
Borehole Ref	BH11 / MW11	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	3.560	m
h_o - Water level reading at time = 0 (depth)	0.702	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	0.85	m
T_o - Length of characteristic time	2569.93	minutes
K_{sat} - Saturated hydraulic conductivity	0.00058	m/d



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Single Bore Slug Test (Rising)

Method ST-13 Revised 7.3.2007

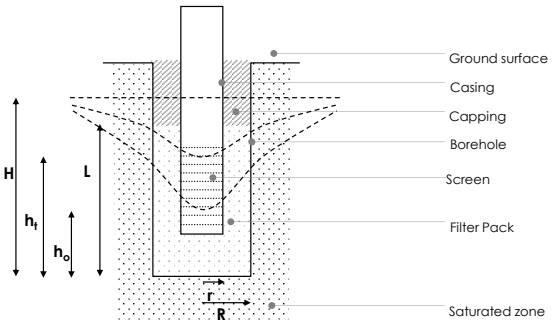
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PROJECT DETAILS

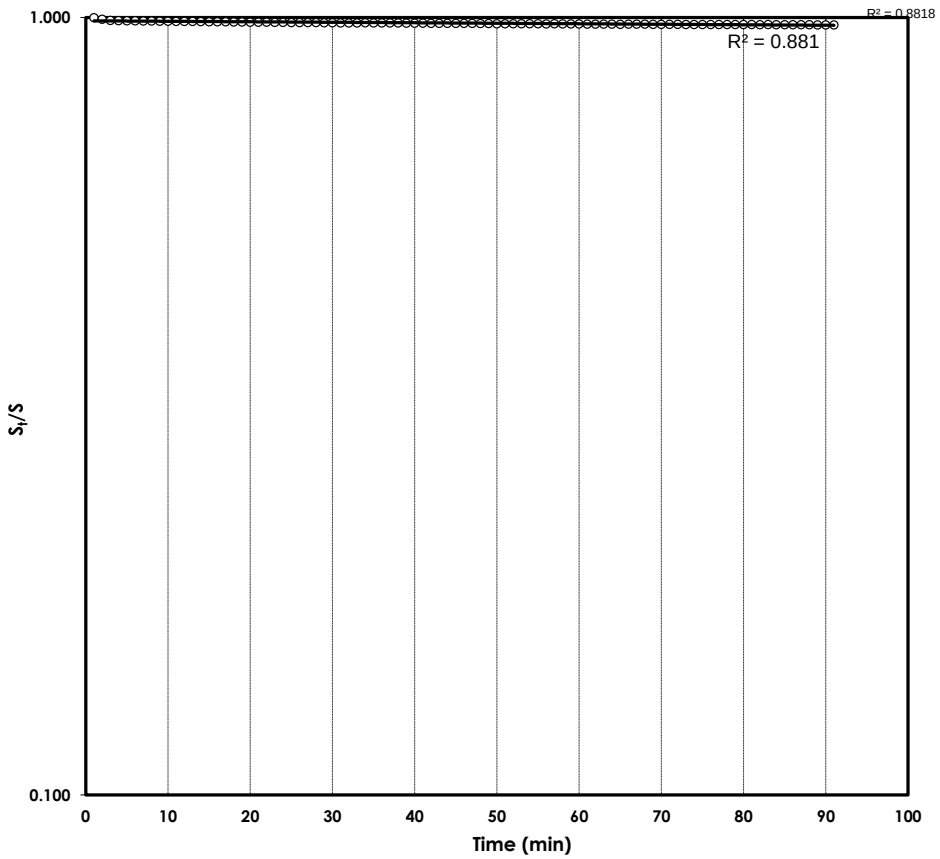
Project	P2410607	Test Date	23.01.2025
Project Ref	P2410607JS03V01	Field Testing	RIM / DS
Borehole Ref	BH11 / MW11	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	5.550	m
h_o - Water level reading at time = 0 (depth)	0.002	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	2.84	m
T_o - Length of characteristic time	6673.38	minutes
K_{sat} - Saturated hydraulic conductivity	0.00010	m/d



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Single Bore Slug Test (Rising)

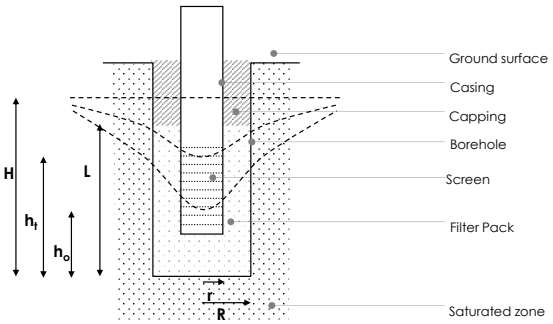
Method ST-13 Revised 7.3.2007

PROJECT DETAILS

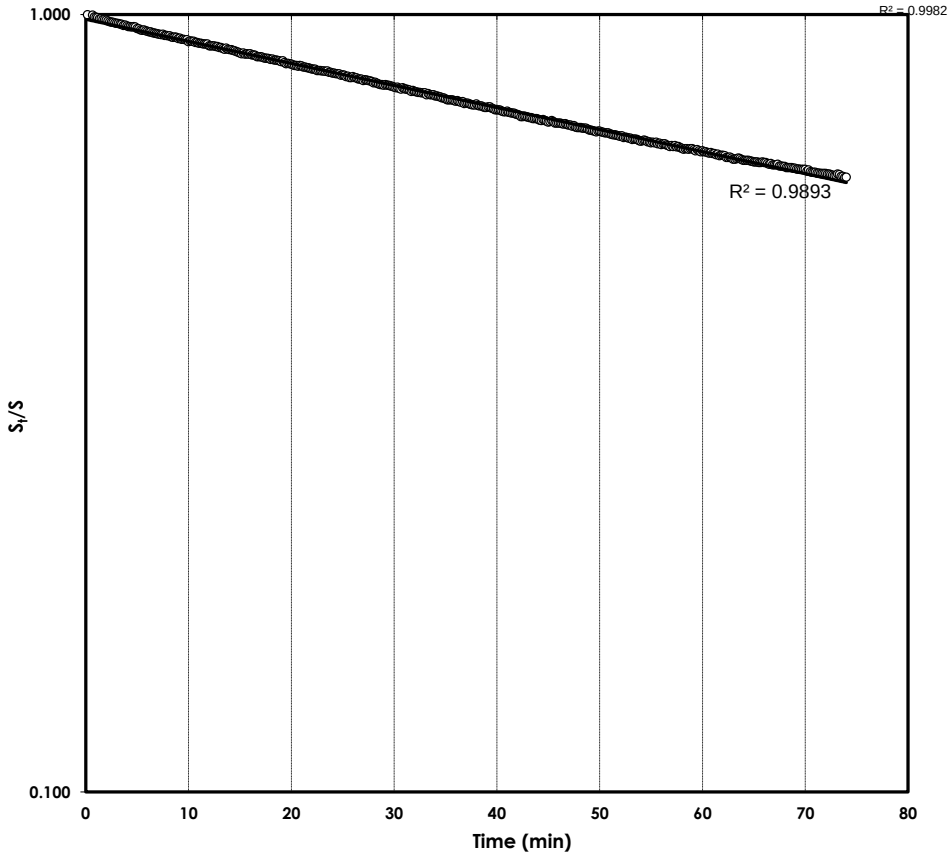
Project	P2410607	Test Date	28.02.2025
Project Ref	P2410607JS03V01	Field Testing	RIM
Borehole Ref	BH301 / MW15	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	4.860	m
h_o - Water level reading at time = 0 (depth)	3.473	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	0.96	m
T_o - Length of characteristic time	150.01	minutes
K_{sat} - Saturated hydraulic conductivity	0.0092	m/d



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Single Bore Slug Test (Rising)

Method ST-13 Revised 7.3.2007

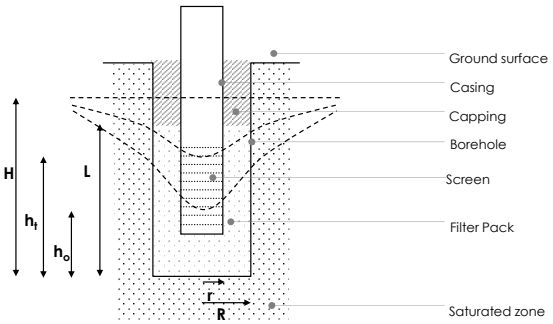
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PROJECT DETAILS

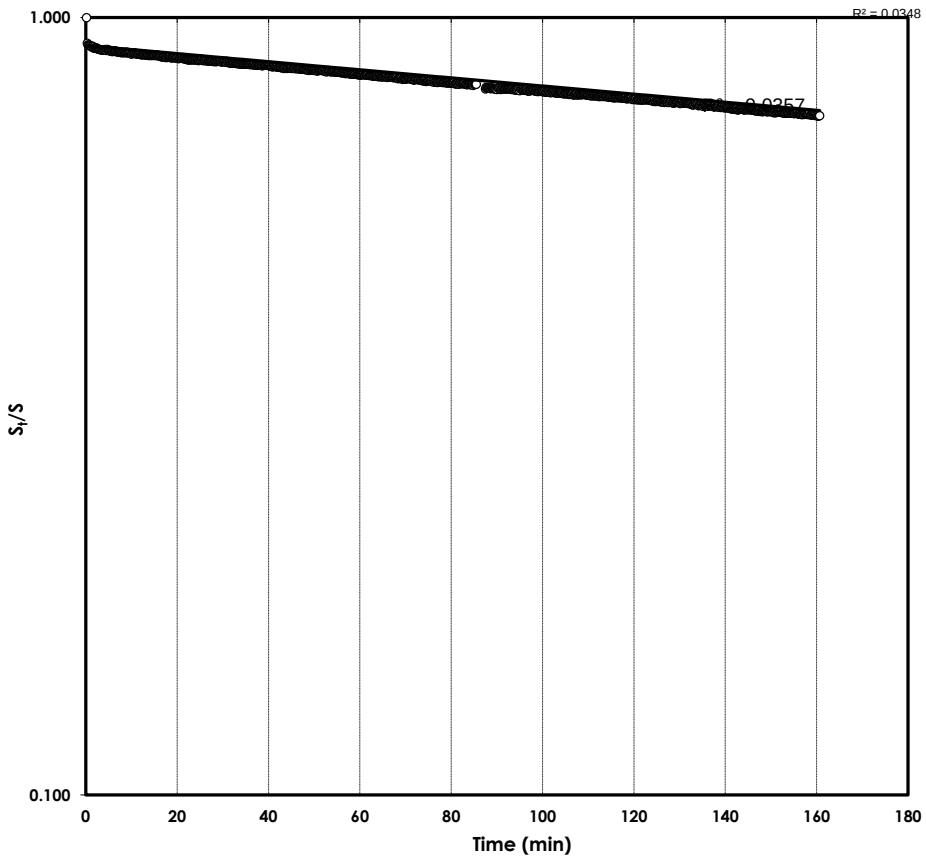
Project	P2410607	Test Date	20.03.2025
Project Ref	P2410607JS03V01	Field Testing	RIM
Borehole Ref	BH301 / MW15	Data Analysis	RIM
Method	Hvorslev (1981)	Reviewed	JCF

FIELD TEST DATA

FACTOR	Enter Data	Unit
H - Initial water level reading (depth)	4.910	m
h_o - Water level reading at time = 0 (depth)	3.377	m
r - Casing radius	0.025	m
R - Bore radius	0.050	m
L - Length of open screen	1.01	m
T_o - Length of characteristic time	759.85	minutes
K_{sat} - Saturated hydraulic conductivity	0.0018	m/d



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Appendix J – Laboratory Summary Tables

					Metals												
					Selenium (filtered)	Arsenic (filtered)	Beryllium (filtered)	Calcium (filtered)	Chromium (III+VI) (filtered)	Cobalt (filtered)	Copper (filtered)	Lead (filtered)	Magnesium (filtered)	Nickel (filtered)	Potassium (filtered)	Tin (filtered)	Zinc (filtered)
					ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					1	0.001	0.0005	0.5	0.001	0.001	0.001	1	0.5	0.001	0.5	0.001	0.001
ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)					11						0.0014	3.4		0.011			0.008
Location Code	**Field ID**	**Date**	**Sample Type**	**Lab Report Number**													
	10607/MW03	**09 Dec 2024**	**Normal**	**368566**	<1	0.008	0.008	58	<0.001	0.59	<0.001	<1	200	0.17	15	<0.001	0.16
	10607/MW04	**09 Dec 2024**	**Normal**	**368566**	2	0.003	0.012	30	0.002	0.34	0.004	87	220	0.11	24	<0.001	0.69
	10607/MW05	**09 Dec 2024**	**Normal**	**368566**	2	0.01	<0.0005	69	0.002	0.017	<0.001	<1	13	0.004	14	<0.001	0.016
	10607/MW06	**09 Dec 2024**	**Normal**	**368566**	<1	0.014	<0.0005	160	<0.001	0.042	<0.001	<1	94	0.023	22	<0.001	0.017
	10607/MW07	**09 Dec 2024**	**Normal**	**368566**	<1	0.002	0.016	26	<0.001	0.16	0.002	26	510	0.13	49	<0.001	0.94
	10607/MW08	**09 Dec 2024**	**Normal**	**368566**	<1	0.005	<0.0005	50	<0.001	0.01	0.001	<1	140	0.008	24	<0.001	0.016
	10607/MW09	**09 Dec 2024**	**Normal**	**368566**	<1	0.003	<0.0005	77	<0.001	0.15	<0.001	<1	330	0.005	47	<0.001	0.012
	10607/MW11	**09 Dec 2024**	**Normal**	**368566**	<1	<0.001	<0.0005	23	<0.001	0.77	0.005	<1	130	0.11	26	<0.001	0.11
	DUP01	**09 Dec 2024**	**Normal**	**368566**	-	0.007	-	-	0.002	-	0.002	<1	-	0.003	-	-	0.019
Statistics																	
Number of Results					**8**	**9**	**8**	**8**	**9**	**8**	**9**	**9**	**8**	**9**	**8**	**8**	**9**
Number of Detects					**2**	**8**	**3**	**8**	**3**	**8**	**5**	**2**	**8**	**9**	**8**	**0**	**9**
Minimum Concentration					**<1**	**<0.001**	**<0.0005**	**23**	**<0.001**	**0.01**	**0.001**	**<1**	**13**	**0.003**	**14**	**<0.001**	**0.012**
Minimum Detect					**2**	**0.002**	**0.008**	**23**	**0.002**	**0.01**	**0.001**	**26**	**13**	**0.003**	**14**	**ND**	**0.012**
Maximum Concentration					**2**	**0.014**	**0.016**	**160**	**0.002**	**0.77**	**0.005**	**87**	**510**	**0.17**	**49**	**<0.001**	**0.94**
Maximum Detect					**2**	**0.014**	**0.016**	**160**	**0.002**	**0.77**	**0.005**	**87**	**510**	**0.17**	**49**	**ND**	**0.94**
Average Concentration *					**0.88**	**0.0058**	**0.0047**	**62**	**0.001**	**0.26**	**0.0018**	**13**	**205**	**0.063**	**28**	**0.0005**	**0.22**
Median Concentration *					**0.5**	**0.005**	**0.00025**	**54**	**0.0005**	**0.155**	**0.001**	**0.5**	**170**	**0.023**	**24**	**0.0005**	**0.019**
Standard Deviation *					**0.69**	**0.0043**	**0.0064**	**45**	**0.00075**	**0.28**	**0.0017**	**29**	**155**	**0.067**	**13**	**0**	**0.35**
95% UCL (Student's-t) *					**1.34**	**0.00852**	**0.00897**	**91.45**	**0.00146**	**0.45**	**0.00282**	**30.93**	**308.4**	**0.104**	**36.53**	**0.0005**	**0.435**
Number of Env Standard Exceedances					**0**	**0**	**0**	**0**	**0**	**0**	**4**	**2**	**0**	**5**	**0**	**0**	**9**
Number of Env Standard Exceedances (Detects Only)					**0**	**0**	**0**	**0**	**0**	**0**	**4**	**2**	**0**	**5**	**0**	**0**	**9**
% of Detects					**25**	**89**	**38**	**100**	**33**	**100**	**56**	**22**	**100**	**100**	**100**	**0**	**100**
% of Non-Detects					**75**	**11**	**62**	**0**	**67**	**0**	**44**	**78**	**0**	**0**	**0**	**100**	**0**
% of Detects at or above Env Standards					**0**	**0**	**0**	**0**	**0**	**0**	**44**	**22**	**0**	**56**	**0**	**0**	**100**
% of Results Below Env Standards or Non-Detect					**100**	**100**	**100**	**100**	**100**	**100**	**56**	**78**	**100**	**44**	**100**	**100**	**0**

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)

					Metals												
					Selenium (filtered)	Arsenic (filtered)	Beryllium (filtered)	Calcium (filtered)	Chromium (III+VI) (filtered)	Cobalt (filtered)	Copper (filtered)	Lead (filtered)	Magnesium (filtered)	Nickel (filtered)	Potassium (filtered)	Tin (filtered)	Zinc (filtered)
					ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					1	0.001	0.0005	0.5	0.001	0.001	0.001	1	0.5	0.001	0.5	0.001	0.001
ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)					11						0.0014	3.4		0.011			0.008
Location Code	**Field ID**	**Date**	**Sample Type**	**Lab Report Number**													
	10607/MW03	**23 Jan 2025**	**Normal**	**371315**	<1	0.004	0.002	94	<0.001	0.42	<0.001	<1	250	0.12	22	<0.001	0.007
	10607/MW04	**23 Jan 2025**	**Normal**	**371315**	<1	0.006	0.002	36	<0.001	0.38	<0.001	<1	210	0.097	22	<0.001	0.24
	10607/MW05	**23 Jan 2025**	**Normal**	**371315**	1	0.002	<0.0005	65	0.001	0.041	<0.001	<1	14	0.006	13	<0.001	0.004
	10607/MW06	**23 Jan 2025**	**Normal**	**371315**	<1	0.013	<0.0005	140	<0.001	0.027	<0.001	<1	95	0.011	22	<0.001	0.004
	10607/MW07	**23 Jan 2025**	**Normal**	**371315**	<1	0.002	0.023	8.3	0.001	0.18	0.002	16	580	0.13	52	<0.001	0.74
	10607/MW08	**23 Jan 2025**	**Normal**	**371315**	<1	0.031	<0.0005	70	<0.001	0.021	<0.001	<1	230	0.011	35	<0.001	0.009
	10607/MW09	**23 Jan 2025**	**Normal**	**371315**	<1	0.001	<0.0005	85	<0.001	0.16	0.007	<1	350	0.005	41	<0.001	0.023
	10607/MW11	**23 Jan 2025**	**Normal**	**371315**	<1	<0.001	<0.0005	28	0.001	1.2	0.002	<1	210	0.16	31	<0.001	0.1

Statistics

Number of Results	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**
Number of Detects	**1**	**7**	**3**	**8**	**3**	**8**	**3**	**1**	**8**	**8**	**8**	**0**	**8**
Minimum Concentration	**1**	**0.001**	**<0.0005**	**8.3**	**0.001**	**0.021**	**<0.001**	**<1**	**14**	**0.005**	**13**	**<0.001**	**0.004**
Minimum Detect	**1**	**0.001**	**0.002**	**8.3**	**0.001**	**0.021**	**0.002**	**16**	**14**	**0.005**	**13**	**ND**	**0.004**
Maximum Concentration	**1**	**0.031**	**0.023**	**140**	**0.001**	**1.2**	**0.007**	**16**	**580**	**0.16**	**52**	**<0.001**	**0.74**
Maximum Detect	**1**	**0.031**	**0.023**	**140**	**0.001**	**1.2**	**0.007**	**16**	**580**	**0.16**	**52**	**ND**	**0.74**
Average Concentration *	**0.56**	**0.0074**	**0.0035**	**66**	**0.00069**	**0.3**	**0.0017**	**2.4**	**242**	**0.068**	**30**	**0.0005**	**0.14**
Median Concentration *	**0.5**	**0.003**	**0.00025**	**67.5**	**0.0005**	**0.17**	**0.0005**	**0.5**	**220**	**0.054**	**26.5**	**0.0005**	**0.016**
Standard Deviation *	**0.18**	**0.01**	**0.0079**	**42**	**0.00026**	**0.39**	**0.0023**	**5.5**	**170**	**0.066**	**13**	**0**	**0.26**
95% UCL (Student's-t) *	**0.681**	**0.0144**	**0.00883**	**93.88**	**0.00086084**	**0.567**	**0.0032**	**6.108**	**356.1**	**0.111**	**38.19**	**0.0005**	**0.312**
Number of Env Standard Exceedances	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**4**	**0**	**0**	**5**
Number of Env Standard Exceedances (Detects Only)	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**4**	**0**	**0**	**5**
% of Detects	**12**	**88**	**38**	**100**	**38**	**100**	**38**	**12**	**100**	**100**	**100**	**0**	**100**
% of Non-Detects	**88**	**12**	**62**	**0**	**62**	**0**	**62**	**88**	**0**	**0**	**0**	**100**	**0**
% of Detects at or above Env Standards	**0**	**0**	**0**	**0**	**0**	**0**	**38**	**12**	**0**	**50**	**0**	**0**	**62**
% of Results Below Env Standards or Non-Detect	**100**	**100**	**100**	**100**	**100**	**100**	**62**	**88**	**100**	**50**	**100**	**100**	**38**

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)

					Metals												
					Selenium (filtered)	Arsenic (filtered)	Beryllium (filtered)	Calcium (filtered)	Chromium (III+VI) (filtered)	Cobalt (filtered)	Copper (filtered)	Lead (filtered)	Magnesium (filtered)	Nickel (filtered)	Potassium (filtered)	Tin (filtered)	Zinc (filtered)
					ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					1	0.001	0.0005	0.5	0.001	0.001	0.001	1	0.5	0.001	0.5	0.001	0.001
ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)					11						0.0014	3.4		0.011			0.008
Location Code	**Field ID**	**Date**	**Sample Type**	**Lab Report Number**													
	10607/MW15	**21 Mar 2025**	**Normal**	**376240**	<1	0.004	0.009	26	0.002	0.15	0.003	4	81	0.081	6.9	<0.001	0.45
Statistics																	
Number of Results					**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Number of Detects					**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**
Minimum Concentration					**<1**	**0.004**	**0.009**	**26**	**0.002**	**0.15**	**0.003**	**4**	**81**	**0.081**	**6.9**	**<0.001**	**0.45**
Minimum Detect					**ND**	**0.004**	**0.009**	**26**	**0.002**	**0.15**	**0.003**	**4**	**81**	**0.081**	**6.9**	**ND**	**0.45**
Maximum Concentration					**<1**	**0.004**	**0.009**	**26**	**0.002**	**0.15**	**0.003**	**4**	**81**	**0.081**	**6.9**	**<0.001**	**0.45**
Maximum Detect					**ND**	**0.004**	**0.009**	**26**	**0.002**	**0.15**	**0.003**	**4**	**81**	**0.081**	**6.9**	**ND**	**0.45**
Average Concentration *																	
Median Concentration *					**0.5**	**0.004**	**0.009**	**26**	**0.002**	**0.15**	**0.003**	**4**	**81**	**0.081**	**6.9**	**0.0005**	**0.45**
Standard Deviation *																	
95% UCL (Student's-t) *																	
Number of Env Standard Exceedances					**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**1**
Number of Env Standard Exceedances (Detects Only)					**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**1**
% of Detects					**0**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**0**	**100**
% of Non-Detects					**100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**100**	**0**
% of Detects at or above Env Standards					**0**	**0**	**0**	**0**	**0**	**0**	**100**	**100**	**0**	**100**	**0**	**0**	**100**
% of Results Below Env Standards or Non-Detect					**100**	**100**	**100**	**100**	**100**	**100**	**0**	**0**	**100**	**0**	**100**	**100**	**0**

* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards
ANZG, July 2023, ANZG Freshwater Toxicant DGVs LOSP 95% (July 2023)

Appendix K - Groundwater Quality Results Lab Report

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customerservice@envirolab.com.au
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CERTIFICATE OF ANALYSIS 368566

Client Details

Client	Martens & Associates Pty Ltd
Attention	Trystan Richards
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2410607 - 430-490 Douglas Park Drive,Douglas Park**
Number of Samples	9 Water
Date samples received	10/12/2024
Date completed instructions received	10/12/2024

Analysis Details

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

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

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

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

Report Details

Date results requested by	17/12/2024
Date of Issue	17/12/2024

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Jenny He, Inorganic Team Leader
Nick Sarlamis, Assistant Operation Manager

Authorised By
Nancy Zhang, Laboratory Manager

HM in water - dissolved						
Our Reference		368566-1	368566-2	368566-3	368566-4	368566-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		09/12/2024	09/12/2024	09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Date analysed	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Arsenic-Dissolved	µg/L	8	3	10	14	2
Boron-Dissolved	µg/L	<20	<20	30	<20	<20
Beryllium-Dissolved	µg/L	8	12	<0.5	<0.5	16
Barium-Dissolved	µg/L	640	70	37	310	200
Cadmium-Dissolved	µg/L	<0.1	2.0	<0.1	<0.1	0.4
Chromium-Dissolved	µg/L	<1	2	2	<1	<1
Copper-Dissolved	µg/L	<1	4	<1	<1	2
Cobalt-Dissolved	µg/L	590	340	17	42	160
Manganese-Dissolved	µg/L	27,000	9,000	300	1,500	260
Molybdenum-Dissolved	µg/L	2	2	15	22	<1
Selenium-Dissolved	µg/L	<1	2	2	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1	<1	<1
Silver-Dissolved	µg/L	<1	<1	<1	<1	<1
Lead-Dissolved	µg/L	<1	87	<1	<1	26
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	170	110	4	23	130
Zinc-Dissolved	µg/L	160	690	16	17	940

HM in water - dissolved					
Our Reference		368566-6	368566-7	368566-8	368566-9
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11	DUP01
Date Sampled		09/12/2024	09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water	Water
Date prepared	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Date analysed	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Arsenic-Dissolved	µg/L	5	3	<1	7
Boron-Dissolved	µg/L	20	50	30	[NA]
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	[NA]
Barium-Dissolved	µg/L	83	170	110	[NA]
Cadmium-Dissolved	µg/L	<0.1	<0.1	0.7	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	2
Copper-Dissolved	µg/L	1	<1	5	2
Cobalt-Dissolved	µg/L	10	150	770	[NA]
Manganese-Dissolved	µg/L	690	2,500	5,500	[NA]
Molybdenum-Dissolved	µg/L	7	84	2	[NA]
Selenium-Dissolved	µg/L	<1	<1	<1	[NA]
Tin-Dissolved	µg/L	<1	<1	<1	[NA]
Silver-Dissolved	µg/L	<1	<1	<1	[NA]
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	8	5	110	3
Zinc-Dissolved	µg/L	16	12	110	19

Miscellaneous Inorganics						
Our Reference		368566-1	368566-2	368566-3	368566-4	368566-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		09/12/2024	09/12/2024	09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	10/12/2024	10/12/2024	10/12/2024	10/12/2024	10/12/2024
Date analysed	-	10/12/2024	10/12/2024	10/12/2024	10/12/2024	10/12/2024
pH	pH Units	6.4	5.1	6.7	6.8	5.5
Electrical Conductivity	µS/cm	8,600	9,500	2,400	7,900	13,000
Ammonia as N in water	mg/L	0.13	0.072	0.079	0.038	0.024
Nitrate as N in water	mg/L	0.12	0.04	<0.005	<0.005	2.3
Nitrite as N in water	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
NOx as N in water	mg/L	0.1	0.05	<0.005	<0.005	2.3
Total Nitrogen in water	mg/L	0.6	0.4	0.4	0.3	2.5
Phosphate as P in water	mg/L	<0.005	<0.005	0.01	0.009	<0.005
TKN in water	mg/L	0.4	0.3	0.4	0.3	0.2
Organic Nitrogen as N	mg/L	0.3	0.3	0.3	0.2	<0.2

Miscellaneous Inorganics				
Our Reference		368566-6	368566-7	368566-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water
Date prepared	-	10/12/2024	10/12/2024	10/12/2024
Date analysed	-	10/12/2024	10/12/2024	10/12/2024
pH	pH Units	7.1	7.4	6.0
Electrical Conductivity	µS/cm	6,500	13,000	6,600
Ammonia as N in water	mg/L	0.39	0.13	0.25
Nitrate as N in water	mg/L	0.01	0.78	0.13
Nitrite as N in water	mg/L	<0.005	0.005	0.008
NOx as N in water	mg/L	0.02	0.79	0.1
Total Nitrogen in water	mg/L	0.5	1.1	1
Phosphate as P in water	mg/L	0.02	0.006	0.01
TKN in water	mg/L	0.5	0.3	0.8
Organic Nitrogen as N	mg/L	<0.2	0.2	0.6

Metals in Waters - Acid extractable						
Our Reference		368566-1	368566-2	368566-3	368566-4	368566-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		09/12/2024	09/12/2024	09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024
Date analysed	-	12/12/2024	12/12/2024	12/12/2024	12/12/2024	12/12/2024
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Metals in Waters - Acid extractable				
Our Reference		368566-6	368566-7	368566-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water
Date prepared	-	12/12/2024	12/12/2024	12/12/2024
Date analysed	-	12/12/2024	12/12/2024	12/12/2024
Phosphorus - Total	mg/L	<0.05	<0.05	0.3

Ion Balance						
Our Reference		368566-1	368566-2	368566-3	368566-4	368566-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		09/12/2024	09/12/2024	09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Date analysed	-	11/12/2024	11/12/2024	11/12/2024	11/12/2024	11/12/2024
Calcium - Dissolved	mg/L	58	30	69	160	26
Potassium - Dissolved	mg/L	15	24	14	22	49
Sodium - Dissolved	mg/L	1,500	1,600	420	1,400	2,400
Magnesium - Dissolved	mg/L	200	220	13	94	510
Hardness (calc) equivalent $CaCO_3$	mg/L	980	980	230	790	2,200
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	460	25	420	460	55
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	460	25	420	460	55
Sulphate, SO4	mg/L	58	360	150	92	110
Chloride, Cl	mg/L	2,800	3,300	440	2,700	4,800
Ionic Balance	%	-2.0	-5.0	-2.0	-6.0	5.0

Ion Balance				
Our Reference		368566-6	368566-7	368566-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		09/12/2024	09/12/2024	09/12/2024
Type of sample		Water	Water	Water
Date prepared	-	11/12/2024	11/12/2024	11/12/2024
Date analysed	-	11/12/2024	11/12/2024	11/12/2024
Calcium - Dissolved	mg/L	50	77	23
Potassium - Dissolved	mg/L	24	47	26
Sodium - Dissolved	mg/L	1,100	2,400	1,100
Magnesium - Dissolved	mg/L	140	330	130
Hardness (calc) equivalent $CaCO_3$	mg/L	710	1,600	580
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	990	680	52
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	990	680	52
Sulphate, SO4	mg/L	120	370	210
Chloride, Cl	mg/L	1,600	4,300	2,000
Ionic Balance	%	-3.0	-2.0	-1.0

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date prepared	-			11/12/2024	1	11/12/2024	11/12/2024		11/12/2024	[NT]
Date analysed	-			11/12/2024	1	11/12/2024	11/12/2024		11/12/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	8	[NT]		102	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	1	<20	[NT]		101	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	8	[NT]		102	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	1	640	[NT]		98	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		100	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		99	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	590	[NT]		94	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	27000	[NT]		95	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		103	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		101	[NT]
Tin-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		107	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		103	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		100	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	101	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	170	[NT]		98	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	160	[NT]		99	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	11/12/2024	11/12/2024		[NT]	[NT]
Date analysed	-			[NT]	2	11/12/2024	11/12/2024		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	2	3	3	0	[NT]	[NT]
Boron-Dissolved	µg/L	20	Metals-022	[NT]	2	<20	<20	0	[NT]	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	[NT]	2	12	12	0	[NT]	[NT]
Barium-Dissolved	µg/L	1	Metals-022	[NT]	2	70	70	0	[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	2	2.0	2.0	0	[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	2	2	1	67	[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	2	4	4	0	[NT]	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	[NT]	2	340	340	0	[NT]	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	[NT]	2	9000	9200	2	[NT]	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	[NT]	2	2	2	0	[NT]	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	[NT]	2	2	2	0	[NT]	[NT]
Tin-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	<1	0	[NT]	[NT]
Silver-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	<1	0	[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	2	87	87	0	[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	2	<0.05	[NT]		[NT]	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	2	110	110	0	[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	2	690	680	1	[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/12/2024	8	10/12/2024	10/12/2024		10/12/2024	[NT]
Date analysed	-			10/12/2024	8	10/12/2024	10/12/2024		10/12/2024	[NT]
pH	pH Units		Inorg-001	[NT]	8	6.0	6.0	0	99	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	8	6600	6600	0	90	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	8	0.25	0.25	0	106	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	8	0.13	0.14	7	109	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	8	0.008	0.008	0	91	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	8	0.1	0.1	0	109	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	8	1	[NT]		83	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	8	0.01	0.007	35	96	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	8	0.8	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	8	0.6	[NT]		[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			12/12/2024	1	12/12/2024	12/12/2024		12/12/2024	[NT]
Date analysed	-			12/12/2024	1	12/12/2024	12/12/2024		12/12/2024	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	<0.05	<0.05	0	101	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			10/12/2024	2	11/12/2024	11/12/2024		10/12/2024	[NT]
Date analysed	-			10/12/2024	2	11/12/2024	11/12/2024		10/12/2024	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	2	30	30	0	104	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	2	24	24	0	99	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	2	1600	1700	6	100	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	2	220	220	0	100	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	2	980	990	1	[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	2	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	2	25	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	2	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	2	25	[NT]		105	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	2	360	[NT]		117	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	2	3300	[NT]		108	[NT]
Ionic Balance	%		Inorg-040	[NT]	2	-5.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	6	11/12/2024	11/12/2024		[NT]	[NT]
Date analysed	-			[NT]	6	11/12/2024	11/12/2024		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	6	50	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	6	24	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	6	1100	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	6	140	[NT]		[NT]	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	6	710	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	[NT]	6	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	6	990	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	6	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	6	990	[NT]		[NT]	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	[NT]	6	120	120	0	[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	6	1600	1600	0	[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	6	-3.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	8	11/12/2024	11/12/2024		[NT]	[NT]
Date analysed	-			[NT]	8	11/12/2024	11/12/2024		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	8	23	[NT]		[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	8	26	[NT]		[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	8	1100	[NT]		[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	8	130	[NT]		[NT]	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	8	580	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	[NT]	8	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	8	52	53	2	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	8	<5	<5	0	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	8	52	53	2	[NT]	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	[NT]	8	210	[NT]		[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	8	2000	[NT]		[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	8	-1.0	[NT]		[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Dissolved Metals:
- no filtered, preserved sample was received for #8, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.
- The preserved sample provided for #6 was not identified as either total or dissolved, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.
Note: there is a possibility some elements may be underestimated.

Total Metals: The preserved sample provided for #6 was not identified as either total or dissolved, therefore the analysis was conducted from the unpreserved sample.
Note: there is a possibility some elements may be underestimated

Phosphorus in Waters - Total metals: no unfiltered, preserved sample was received for #1-5,7&8, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

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CERTIFICATE OF ANALYSIS 371315

Client Details

Client	Martens & Associates Pty Ltd
Attention	Dean Shi
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2410607 - 430-490 Douglas Park Drive,Douglas Park**
Number of Samples	8 Water
Date samples received	24/01/2025
Date completed instructions received	24/01/2025

Analysis Details

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

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

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

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

Report Details

Date results requested by	03/02/2025
Date of Issue	03/02/2025

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

Results Approved By
Diego Bigolin, Inorganics Supervisor
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

HM in water - dissolved						
Our Reference		371315-1	371315-2	371315-3	371315-4	371315-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		23/01/2025	23/01/2025	23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	30/01/2025	30/01/2025	30/01/2025	30/01/2025	30/01/2025
Date analysed	-	30/01/2025	30/01/2025	30/01/2025	30/01/2025	30/01/2025
Arsenic-Dissolved	µg/L	4	6	2	13	2
Boron-Dissolved	µg/L	<20	<20	30	20	30
Beryllium-Dissolved	µg/L	2	2	<0.5	<0.5	23
Barium-Dissolved	µg/L	530	66	22	220	180
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	0.3
Chromium-Dissolved	µg/L	<1	<1	1	<1	1
Copper-Dissolved	µg/L	<1	<1	<1	<1	2
Cobalt-Dissolved	µg/L	420	380	41	27	180
Manganese-Dissolved	µg/L	24,000	9,500	450	1,300	400
Molybdenum-Dissolved	µg/L	1	3	10	18	<1
Selenium-Dissolved	µg/L	<1	<1	1	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1	<1	<1
Silver-Dissolved	µg/L	<1	<2	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	16
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	120	97	6	11	130
Zinc-Dissolved	µg/L	7	240	4	4	740

HM in water - dissolved				
Our Reference		371315-6	371315-7	371315-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water
Date prepared	-	30/01/2025	30/01/2025	30/01/2025
Date analysed	-	30/01/2025	30/01/2025	30/01/2025
Arsenic-Dissolved	µg/L	31	1	<1
Boron-Dissolved	µg/L	20	60	40
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5
Barium-Dissolved	µg/L	170	120	68
Cadmium-Dissolved	µg/L	<0.1	0.1	1
Chromium-Dissolved	µg/L	<1	<1	1
Copper-Dissolved	µg/L	<1	7	2
Cobalt-Dissolved	µg/L	21	160	1,200
Manganese-Dissolved	µg/L	740	2,200	8,600
Molybdenum-Dissolved	µg/L	9	57	2
Selenium-Dissolved	µg/L	<1	<1	<1
Tin-Dissolved	µg/L	<1	<1	<1
Silver-Dissolved	µg/L	<1	<1	8
Lead-Dissolved	µg/L	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	11	5	160
Zinc-Dissolved	µg/L	9	23	100

Miscellaneous Inorganics						
Our Reference		371315-1	371315-2	371315-3	371315-4	371315-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		23/01/2025	23/01/2025	23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/01/2025	28/01/2025	28/01/2025	28/01/2025	28/01/2025
Date analysed	-	28/01/2025	28/01/2025	28/01/2025	28/01/2025	28/01/2025
pH	pH Units	6.8	5.7	6.9	6.8	5.7
Electrical Conductivity	µS/cm	11,000	9,800	2,500	8,400	17,000
Ammonia as N in water	mg/L	0.13	0.083	0.062	0.041	0.095
Nitrate as N in water	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite as N in water	mg/L	0.016	0.009	<0.005	0.007	0.009
NOx as N in water	mg/L	0.02	0.01	0.006	0.01	0.01
Total Nitrogen in water	mg/L	0.5	0.3	0.4	0.2	0.3
Phosphate as P in water	mg/L	0.01	0.007	0.02	0.03	0.01
TKN in water	mg/L	0.5	0.3	0.4	0.2	0.3
Organic Nitrogen as N	mg/L	0.4	0.2	0.3	<0.2	0.2

Miscellaneous Inorganics				
Our Reference		371315-6	371315-7	371315-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water
Date prepared	-	28/01/2025	28/01/2025	28/01/2025
Date analysed	-	28/01/2025	28/01/2025	28/01/2025
pH	pH Units	7.2	7.4	5.9
Electrical Conductivity	µS/cm	9,500	14,000	11,000
Ammonia as N in water	mg/L	0.41	0.13	0.23
Nitrate as N in water	mg/L	0.02	0.057	0.15
Nitrite as N in water	mg/L	<0.005	0.005	0.009
NOx as N in water	mg/L	0.02	0.06	0.2
Total Nitrogen in water	mg/L	0.4	0.3	0.7
Phosphate as P in water	mg/L	0.03	0.02	0.01
TKN in water	mg/L	0.4	0.2	0.6
Organic Nitrogen as N	mg/L	<0.2	<0.2	0.3

Metals in Waters - Acid extractable						
Our Reference		371315-1	371315-2	371315-3	371315-4	371315-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		23/01/2025	23/01/2025	23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	29/01/2025	29/01/2025	29/01/2025	29/01/2025	29/01/2025
Date analysed	-	29/01/2025	29/01/2025	29/01/2025	29/01/2025	29/01/2025
Phosphorus - Total	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Metals in Waters - Acid extractable				
Our Reference		371315-6	371315-7	371315-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water
Date prepared	-	29/01/2025	29/01/2025	29/01/2025
Date analysed	-	29/01/2025	29/01/2025	29/01/2025
Phosphorus - Total	mg/L	0.64	0.08	<0.05

Ion Balance						
Our Reference		371315-1	371315-2	371315-3	371315-4	371315-5
Your Reference	UNITS	10607/MW03	10607/MW04	10607/MW05	10607/MW06	10607/MW07
Date Sampled		23/01/2025	23/01/2025	23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	28/01/2025	28/01/2025	28/01/2025	28/01/2025	28/01/2025
Date analysed	-	28/01/2025	28/01/2025	28/01/2025	28/01/2025	28/01/2025
Calcium - Dissolved	mg/L	94	36	65	140	8.3
Potassium - Dissolved	mg/L	22	22	13	22	52
Sodium - Dissolved	mg/L	1,700	1,500	390	1,300	2,600
Magnesium - Dissolved	mg/L	250	210	14	95	580
Hardness (calc) equivalent $CaCO_3$	mg/L	1,300	970	220	750	2,400
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	600	48	490	470	64
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	600	48	490	470	64
Sulphate, SO4	mg/L	110	330	420	160	220
Chloride, Cl	mg/L	3,400	3,400	120	2,600	6,600
Ionic Balance	%	-5.0	-9.0	0	-8.0	-9.0

Ion Balance				
Our Reference		371315-6	371315-7	371315-8
Your Reference	UNITS	10607/MW08	10607/MW09	10607/MW11
Date Sampled		23/01/2025	23/01/2025	23/01/2025
Type of sample		Water	Water	Water
Date prepared	-	28/01/2025	28/01/2025	28/01/2025
Date analysed	-	28/01/2025	28/01/2025	28/01/2025
Calcium - Dissolved	mg/L	70	85	28
Potassium - Dissolved	mg/L	35	41	31
Sodium - Dissolved	mg/L	1,500	2,200	1,700
Magnesium - Dissolved	mg/L	230	350	210
Hardness (calc) equivalent $CaCO_3$	mg/L	1,100	1,700	920
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	1,200	880	45
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	1,200	880	45
Sulphate, SO4	mg/L	190	320	370
Chloride, Cl	mg/L	2,900	4,600	3,800
Ionic Balance	%	-10	-9.0	-12

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
	Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.
	Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	371315-2
Date prepared	-			30/01/2025	1	30/01/2025	30/01/2025		30/01/2025	30/01/2025
Date analysed	-			30/01/2025	1	30/01/2025	30/01/2025		30/01/2025	30/01/2025
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	4	4	0	96	99
Boron-Dissolved	µg/L	20	Metals-022	<20	1	<20	<20	0	86	77
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	2	2	0	93	85
Barium-Dissolved	µg/L	1	Metals-022	<1	1	530	570	7	92	102
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	97	100
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	115
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	96	96
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	420	420	0	96	97
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	24000	23000	4	97	#
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	93	108
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	94	87
Tin-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	95	94
Silver-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	93	##
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	97	78
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	[NT]		115	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	120	120	0	96	95
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	7	7	0	97	107

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	3	30/01/2025	30/01/2025		[NT]	[NT]
Date analysed	-			[NT]	3	30/01/2025	30/01/2025		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	3	2	[NT]		[NT]	[NT]
Boron-Dissolved	µg/L	20	Metals-022	[NT]	3	30	[NT]		[NT]	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	[NT]	3	<0.5	[NT]		[NT]	[NT]
Barium-Dissolved	µg/L	1	Metals-022	[NT]	3	22	[NT]		[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	3	<0.1	[NT]		[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	3	1	[NT]		[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	3	<1	[NT]		[NT]	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	[NT]	3	41	[NT]		[NT]	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	[NT]	3	450	[NT]		[NT]	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	[NT]	3	10	[NT]		[NT]	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	[NT]	3	1	[NT]		[NT]	[NT]
Tin-Dissolved	µg/L	1	Metals-022	[NT]	3	<1	[NT]		[NT]	[NT]
Silver-Dissolved	µg/L	1	Metals-022	[NT]	3	<1	[NT]		[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	3	<1	[NT]		[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	3	<0.05	<0.05	0	[NT]	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	3	6	[NT]		[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	3	4	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	371315-5
Date prepared	-			28/01/2025	1	28/01/2025	28/01/2025		28/01/2025	28/01/2025
Date analysed	-			28/01/2025	1	28/01/2025	28/01/2025		28/01/2025	28/01/2025
pH	pH Units		Inorg-001	[NT]	1	6.8	7.1	4	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	11000	11000	0	102	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.13	[NT]		103	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		95	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.016	[NT]		86	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.02	[NT]		95	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.5	[NT]		88	89
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.01	[NT]		105	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	0.5	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	0.4	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	3	28/01/2025	28/01/2025		[NT]	[NT]
Date analysed	-			[NT]	3	28/01/2025	28/01/2025		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	3	6.9	[NT]		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	3	2500	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	3	0.062	0.054	14	[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	3	<0.005	<0.005	0	[NT]	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	[NT]	3	<0.005	<0.005	0	[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	3	0.006	0.006	0	[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	3	0.4	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	3	0.02	0.02	0	[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	[NT]	3	0.4	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	[NT]	3	0.3	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	4	28/01/2025	28/01/2025		[NT]	[NT]
Date analysed	-			[NT]	4	28/01/2025	28/01/2025		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	4	6.8	[NT]		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	4	8400	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	4	0.041	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	4	<0.005	[NT]		[NT]	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	[NT]	4	0.007	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	4	0.01	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	4	0.2	0.2	0	[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	4	0.03	[NT]		[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	[NT]	4	0.2	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	[NT]	4	<0.2	[NT]		[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	371315-3
Date prepared	-			29/01/2025	2	29/01/2025	29/01/2025		29/01/2025	29/01/2025
Date analysed	-			29/01/2025	2	29/01/2025	29/01/2025		29/01/2025	29/01/2025
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	2	<0.05	<0.05	0	103	105

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	371315-2
Date prepared	-			28/01/2025	1	28/01/2025	28/01/2025		28/01/2025	28/01/2025
Date analysed	-			28/01/2025	1	28/01/2025	28/01/2025		28/01/2025	28/01/2025
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	94	[NT]		100	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	22	[NT]		88	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	1700	[NT]		97	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	250	[NT]		95	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	1	1300	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	600	560	7	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	<5	<5	0	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	1	600	560	7	97	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	1	110	78	34	107	#
Chloride, Cl	mg/L	1	Inorg-081	<1	1	3400	3700	8	108	#
Ionic Balance	%		Inorg-040	[NT]	1	-5.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	2	28/01/2025	28/01/2025		[NT]	[NT]
Date analysed	-			[NT]	2	28/01/2025	28/01/2025		[NT]	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	[NT]	2	36	36	0	[NT]	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	[NT]	2	22	22	0	[NT]	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	[NT]	2	1500	1500	0	[NT]	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	[NT]	2	210	210	0	[NT]	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	2	970	960	1	[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	[NT]	2	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	2	48	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	2	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	[NT]	2	48	[NT]		[NT]	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	[NT]	2	330	[NT]		[NT]	[NT]
Chloride, Cl	mg/L	1	Inorg-081	[NT]	2	3400	[NT]		[NT]	[NT]
Ionic Balance	%		Inorg-040	[NT]	2	-9.0	[NT]		[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

Dissolved Metals: no filtered, preserved sample was received for #1,3,7 & 8, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.
Note: there is a possibility some elements may be underestimated.

MISC_INORG: # Percent recovery not reported due to the high concentration of the analyte/s in the sample/s. However, an acceptable recovery was obtained for the LCS.

8 HM in water - dissolved - ## Low (or High) spike recovery was obtained for this sample. Sample matrix interference is suspected. However, an acceptable recovery was obtained for the LCS

The PQL(s) for Ag of 371315-2 has been raised due to the low spike recovery/recoveries. This may reflect other samples where similar in matrix and similar analytical interferences occur.

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CERTIFICATE OF ANALYSIS 376240

Client Details

Client	Martens & Associates Pty Ltd
Attention	r mariathasan
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2410607-430-490 Douglas Park Drive, Douglas Park**
Number of Samples	1 Water
Date samples received	21/03/2025
Date completed instructions received	21/03/2025

Analysis Details

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

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

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

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

Report Details

Date results requested by	28/03/2025
Date of Issue	28/03/2025

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

Results Approved By
Diego Bigolin, Inorganics Supervisor
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

HM in water - dissolved		
Our Reference		376240-1
Your Reference	UNITS	10607/MW15
Date Sampled		21/03/2025
Type of sample		Water
Date prepared	-	24/03/2025
Date analysed	-	24/03/2025
Arsenic-Dissolved	µg/L	4
Boron-Dissolved	µg/L	50
Beryllium-Dissolved	µg/L	9
Barium-Dissolved	µg/L	71
Cadmium-Dissolved	µg/L	0.4
Chromium-Dissolved	µg/L	2
Copper-Dissolved	µg/L	3
Cobalt-Dissolved	µg/L	150
Manganese-Dissolved	µg/L	2,300
Molybdenum-Dissolved	µg/L	<1
Selenium-Dissolved	µg/L	<1
Tin-Dissolved	µg/L	<1
Silver-Dissolved	µg/L	<1
Lead-Dissolved	µg/L	4
Mercury-Dissolved	µg/L	<0.05
Nickel-Dissolved	µg/L	81
Zinc-Dissolved	µg/L	450

Miscellaneous Inorganics		
Our Reference		376240-1
Your Reference	UNITS	10607/MW15
Date Sampled		21/03/2025
Type of sample		Water
Date prepared	-	21/03/2025
Date analysed	-	21/03/2025
pH	pH Units	6.1
Electrical Conductivity	µS/cm	5,100
Ammonia as N in water	mg/L	0.021
Nitrate as N in water	mg/L	0.11
Nitrite as N in water	mg/L	0.006
NOx as N in water	mg/L	0.1
Total Nitrogen in water	mg/L	0.4
Phosphate as P in water	mg/L	<0.005
TKN in water	mg/L	0.3
Organic Nitrogen as N	mg/L	0.3

Metals in Waters - Acid extractable		
Our Reference		376240-1
Your Reference	UNITS	10607/MW15
Date Sampled		21/03/2025
Type of sample		Water
Date prepared	-	25/03/2025
Date analysed	-	25/03/2025
Phosphorus - Total	mg/L	<0.05

Ion Balance		
Our Reference		376240-1
Your Reference	UNITS	10607/MW15
Date Sampled		21/03/2025
Type of sample		Water
Date prepared	-	21/03/2025
Date analysed	-	21/03/2025
Calcium - Dissolved	mg/L	26
Potassium - Dissolved	mg/L	6.9
Sodium - Dissolved	mg/L	750
Magnesium - Dissolved	mg/L	81
Hardness (calc) equivalent $CaCO_3$	mg/L	400
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	63
Carbonate Alkalinity as $CaCO_3$	mg/L	<5
Total Alkalinity as $CaCO_3$	mg/L	63
Sulphate, SO4	mg/L	110
Chloride, Cl	mg/L	1,300
Ionic Balance	%	0

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES. Total Phosphate determined stochiometrically from Phosphorus (assumed to be present as Phosphate). Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date prepared	-			24/03/2025	[NT]	[NT]	[NT]	[NT]	24/03/2025	[NT]
Date analysed	-			24/03/2025	[NT]	[NT]	[NT]	[NT]	24/03/2025	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	87	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	91	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Tin-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			21/03/2025	[NT]	[NT]	[NT]	[NT]	21/03/2025	[NT]
Date analysed	-			21/03/2025	[NT]	[NT]	[NT]	[NT]	21/03/2025	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	[NT]	[NT]	88	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	89	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	103	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	91	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	[NT]	[NT]	[NT]	[NT]	102	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/03/2025	[NT]	[NT]	[NT]	[NT]	25/03/2025	[NT]
Date analysed	-			25/03/2025	[NT]	[NT]	[NT]	[NT]	25/03/2025	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			21/03/2025	[NT]	[NT]	[NT]	[NT]	21/03/2025	[NT]
Date analysed	-			21/03/2025	[NT]	[NT]	[NT]	[NT]	21/03/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	93	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	108	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.