



Groundwater Investigations

Devon Meadows DSS and Five Ways Road DSS

Melbourne Water Corporation

4 November 2024

→ The Power of Commitment



Project name		Devon Meadows – GW Investigation					
Document title		Groundwater Investigations Devn Meadows DSS and Five Ways Road DSS					
Project number		12568833					
File name		12568833-REP-Devon Meadows_GW_Investigation.docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	0						04/11/24

GHD Pty Ltd | ABN 39 008 488 373

Contact: , Technical Director - Hydrogeology | GHD

Melbourne, Victoria 3000, Australia

T +61 | F +61 | E | ghd.com

© GHD 2024

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Executive summary

To inform the potential locations of retarding basins and/or drainage channels for stormwater management as part of the Devon Meadows and Clyde Five Ways Road Development Services Schemes (DSS) (the study area), GHD undertook groundwater investigations to understand the depth to groundwater and groundwater quality across the study area. Results of the groundwater investigation have been used to inform groundwater related risks associated with the DSS investigation.

The investigation program included the installation of nine groundwater monitoring bores at key locations within the study area during March 2024. These bores were subject to groundwater sampling and the deployment of groundwater level loggers in April 2024 as part of the groundwater monitoring program. During a subsequent site visit in August 2024, GHD downloaded the available groundwater data (along with completing hydraulic conductivity testing to be incorporated into GHD's preliminary dewatering assessment – to be reported separately). From investigations to date the following observations have been identified:

- Groundwater levels are shallow in both the Devon Meadows DSS and Clyde Five Ways Road DSS. Based on available bore data:
 - Groundwater levels are generally <2 m below ground level (bgl) at the Devon Meadows DSS
 - Groundwater levels are generally >2.7 m bgl at the Clyde Five Ways Road DSS
 - Groundwater levels respond to rainfall events or rainfall periods through rainfall recharge
 - During the monitoring period (April to August 2024), groundwater levels fluctuations range from 0.3 m (MB04) to 0.8 m (MB02). MB04 shows the deepest groundwater level, with an average of 9.0 m bgl, whereas MB02 shows a shallow groundwater level with an average of 1.5 m bgl. This indicates that the water table is most susceptible to rainfall influence where it occurs at shallow depths
 - Groundwater salinity in the study area is fresh to brackish and has a range of environmental values in the Segment B classification of the Environmental Reference Standard (ERS)
 - Exceedances of the ANZG (2018) guideline criteria for slightly to moderately modified ecosystems include:
 - Nitrate (as N) in bores MB04, MB06, MB07, MB08 and MB09 exceed the guideline criteria of 2.4 mg/L
 - Several bores exceed the guideline criteria for aluminium, arsenic, chromium, copper, nickel and/or zinc
 - Exceedances of the ANZECC long term irrigation trigger values were identified in a number of bores for parameters including pH, EC, chloride, nitrogen (total), phosphorus (total), and/or iron
- Exceedances of the ANZECC short term irrigation trigger values were identified for nitrogen (total) (MB08, MB09) and phosphorus (total) (MB02)

The following **High** groundwater related risks have been identified for the design and planning phase:

- Southern Rural Water not endorsing/approving the DSS concept design as part of the design and planning phase due to potential groundwater interception/extraction and infiltration of surface water to the water table – **High** for both DSS areas
- The DSS concept design needing to be modified, leading to larger footprints than has been allowed for in the PSP place-based plan at public exhibition – **High** for both DSS areas

The following risks have been identified as **Medium** during the construction and operation phases for both DSS areas:

- Shallow (potentially contaminated) groundwater encountered during the construction and operational phase of the retarding basins:
 - Encountered shallow groundwater during the construction phase may require temporary dewatering, potentially resulting in changes (declines) to surrounding groundwater levels (further assessment of potential dewatering requirements will be carried out by GHD as part of the pending preliminary dewatering assessment)
 - If encountered, potential contaminated groundwater during the construction phase will need to be managed and disposed of appropriately (further assessment of disposal options is to be carried out by

GHD as part of the pending preliminary dewatering assessment, however, analysis of a broader range of chemical parameters may be required)

- Shallow groundwater connected to the retarding basins/stormwater management assets during operation resulting in inflow of groundwater to retarding basins
- If encountered, potential contaminated groundwater during the operation phase will need to be managed appropriately. However, the event is uncertain and pending sampling and analysis of a broader range of chemical parameters

Based on the findings of the groundwater investigation to date, GHD recommends the following:

- Ongoing groundwater monitoring to establish baseline groundwater level trends across all seasons. This proposed monitoring should continue during project construction and for a period during project operation
- A second groundwater monitoring event (GME) should be undertaken to provide a further understanding of groundwater quality expanded to include a broad range of chemicals of potential concern

The following further groundwater investigations have been carried out by GHD in August 2024 and will be reported separately:

- Hydraulic conductivity testing of all groundwater monitoring bores, which was completed in August 2024 to obtain site specific data on permeability to be used to inform the GHD's preliminary dewatering assessment

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.4 and the assumptions and qualifications contained throughout the report.

Contents

Glossary of abbreviations	6
1. Introduction	8
1.1 Background	8
1.2 Purpose of this report	8
1.3 Scope of work	8
1.3.1 GHD scope of work	8
1.4 Limitations	9
1.5 Assumptions and data sources	9
2. Site inspection	10
3. Drilling program	11
3.1 Bore locations	11
3.2 Monitoring bore survey	11
3.3 Groundwater bore licensing	11
3.4 Clearances	14
3.5 Tendering	14
3.6 Environmental and site safety plans	14
3.7 Drilling program	14
3.7.1 Drilling	14
3.7.2 Lithology intersected	14
3.8 Bore construction	15
3.9 Headworks	15
3.10 Bore development	15
4. Groundwater monitoring	18
4.1 Groundwater levels	18
4.2 Groundwater quality	24
4.2.1 Sampling methodology	24
4.2.2 Laboratory parameters	26
4.2.3 Laboratory results	26
4.2.4 Sampling Program QA/QC	26
4.2.4.1 Quality control procedures	26
4.2.4.2 Discussion of QA/QC	26
4.2.4.3 Conclusion of QA/QC program	27
5. Assessment of water quality impacts	28
5.1 Groundwater quality objectives	28
5.1.1 Classification of groundwater	28
5.1.2 Groundwater quality indicators and objectives	29
5.2 Groundwater quality	30
5.2.1 Background groundwater quality	30
5.2.2 Site groundwater quality	30
5.3 Environmental values relevant to the study area	31
5.3.1 Protected environmental values	31
5.3.2 Relevance of environmental value	32

6.	Groundwater risk assessment	33
6.1	Risk assessment	33
6.1.1	Overview of risk assessment method	33
6.1.2	Risk assessment process	33
6.1.3	Assigning a consequence level	33
6.1.4	Assigning a likelihood level	36
6.1.5	Assigning a level of risk	36
6.2	Risk register	37
7.	Conclusions	44
8.	Recommendations	45
9.	References	46

Table index

Table 1	Monitoring bore locations	12
Table 2	Summary lithological log	15
Table 3	Summary of bore construction	16
Table 4	Summary of bore development	17
Table 5	Groundwater level summary	20
Table 6	Summary of stabilised field parameters	25
Table 7	Sampling QA/QC results, April 2024	27
Table 8	Protected environmental values and groundwater segments	28
Table 9	Groundwater indicators and objectives	29
Table 10	Nitrate concentrations in neighbouring bores	31
Table 11	Relevance of environmental values	32
Table 12	Guide to consequence levels	35
Table 13	Guide to likelihood levels	36
Table 14	Risk matrix	36
Table 15	Risk rating acceptability	36
Table 16	Devon Meadows DSS Water Risk register	38
Table 17	Clyde-Five Ways Road DSS Water Risk register	41

Figure index

Figure 1	Groundwater monitoring bore location plan	13
Figure 2	Hydrograph – Devon Meadows DSS (rainfall data from Bonbeach (086210) weather station.	21
Figure 3	Hydrograph – Clyde Five Ways Road DS (rainfall data from Bonbeach (086210) weather station.	22
Figure 4	Groundwater elevation contour map (April 2024 and July 2024)	23

Appendices

Appendix A	Monitoring bore survey report
Appendix B	Bore construction license and bore completion reports
Appendix C	Borehole photographs
Appendix D	Lithological logs and bore construction
Appendix E	Hydrographs
Appendix F	Groundwater sampling purge sheets (April 2024)
Appendix G	Tabulated laboratory results
Appendix H	Certified Laboratory Report (April 2024)
Appendix I	Field equipment and logger calibration records and sampling QA results

Glossary of abbreviations

Acronym	Definition
AHD	Australian Height Datum
ADWG	Australian Drinking Water Guidelines
ANZG	Australian and New Zealand Guidelines
BCL	Bore Construction Licence
BCR	Bore Completion Report
BYDA	Before You Dig Australia
CFWR	Clyde Five Ways Road
COC	Chain of custody
DEECA	(Victorian) Department of Environment, Energy and Climate Action
DM	Devon Meadows
DO	Dissolved Oxygen
DSS	Development Services Schemes
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPR	Environment Protection Regulations
ERS	Environment Reference Standard
GIS	Geographic Information System
GME	Groundwater Monitoring Event
GPS	Global Positioning System
JSEA	Job Safety & Environment Analysis
L/min	Litres per minute
LOR	Limit of Reporting
m	Metres
m agl	Metres Above Ground Level
m AHD	Metres Above Height Datum
mm	Millimetres
m btoc	Metres below top of casing
NATA	National Association of Testing Authorities
NUDLC	National Uniform Drillers Licensing Commission
ORP	Oxidation Reduction Potential
RPD	Relative Percent Difference
RB	Retarding Basin
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
SRW	Southern Rural Water
SWL	Standing Water Level
TDS	Total Dissolved Solids

Acronym	Definition
WMIS	Water Measurement Information System
WSPA	Water Supply Protection Area
μS/cm	Micro siemens per centimetre

1. Introduction

1.1 Background

On behalf of Melbourne Water, GHD is in the process investigating the potential locations of stormwater management assets, including retarding basins and water quality treatment assets, for the Devon Meadows (DM) and Clyde Five Ways Road (CFWR) Development Services Schemes (DSS) (the study area). GHD (2023)¹ completed a desktop hydrogeological assessment of the area which identified that groundwater levels are likely within 5 m of the ground surface. Shallow groundwater can have implications for the siting of retarding basins and water quality treatment assets such as:

- Influencing the depth of construction, and integrity of lining systems
- Creating or exacerbating water logging, due to mounding/leakage from the operation of this infrastructure
- Compliance with EP Act 2017 (general environmental duty)
- Compliance with Water Act 1989

To better understand the hydrogeological setting of the study area, an intrusive groundwater investigation has been undertaken by GHD through this study. Based on the findings, groundwater related risks to the design and planning, construction and operational phases of the proposed stormwater management assets were identified and ranked and could be used as a basis to identify potential future mitigation options and inform the conceptual design of the DSS.

1.2 Purpose of this report

The purpose of this report is to:

- Broadly characterise the groundwater levels and groundwater quality based on sampling at No. 9 bores across the study area
- Document the results of the groundwater investigation
- Assess groundwater risk to the proposed project

1.3 Scope of work

1.3.1 GHD scope of work

GHD's scope of work comprised:

- A preliminary site visit with Melbourne Water to identify groundwater borehole locations
- The drilling and installation of No. 9 groundwater monitoring bores to inform the hydrogeological conceptualisation
- Groundwater sampling and deployment of groundwater level loggers into each of the nine monitoring bores
- Collection/download of groundwater level loggers in August 2024
- Development and implementation of a groundwater risk assessment framework
- Preparation of a technical hydrogeological assessment documenting the above (this report)

¹ GHD (2023) Drainage Strategy for 3 PSP's in South east Melbourne – Hydrogeological Desktop Assessment

1.4 Limitations

This report: has been prepared by GHD for Melbourne Water Corporation and may only be used and relied on by Melbourne Water Corporation for the purpose agreed between GHD and Melbourne Water Corporation as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Melbourne Water Corporation arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

1.5 Assumptions and data sources

This investigation has relied on several data sources including:

- Published geological and hydrogeological mapping
- Government produced literature including land use planning information, meteorological, and topographical data
- State drilling records: Geological, Exploration and Development Information System (GEDIS) and the Water Measurement Information System (WMIS)
- GIS files provided by Melbourne Water

These data sources have been referenced, where relevant, throughout this report. A complete list of references is provided in Section 9 of this report.

2. Site inspection

Melbourne Water and GHD carried out a site visit on 24 February 2024 to identify groundwater monitoring borehole locations. Borehole locations were selected based on the following criteria:

- Proximity to proposed Melbourne Water assets i.e., RBs
- Ease of access to the proposed borehole location
- Positioned to least affect the property owner and to ensure longevity of the bore i.e., along fence line, outside of areas of operation

Originally ten bores were proposed to be installed. However, following the site inspection and consultation with Melbourne Water, nine bores were agreed upon. This was due to the uncertainty of the location of the asset that the tenth bore would be monitoring, and restrictions surrounding the tenth bore's location, being on a narrow road reserve along a busy road (requiring traffic management to drill/install and for ongoing monitoring).

3. Drilling program

3.1 Bore locations

The Devon Meadows and Clyde Five Ways Road DSS areas are located approximately 50 km south-east of Melbourne, within the City of Casey. The overall site is bounded by Craig Road in the west, Ballarto Road in the north, Manks Road in the south and west of Yallambee Road in the east. The South Gippsland Highway intersects the boundary of the Devon Meadows and Five Ways Road DSS.

The locations of new monitoring bores were initially measured using a handheld global positioning system (GPS). The co-ordinates of the bores have been summarised in Table 1 and the bore locations are shown in Figure 1.

3.2 Monitoring bore survey

GHD engaged Beveridge Williams to survey the new monitoring bores to determine their location and relative level (m AHD). These coordinates have been included in Table 1.

The monitoring bore survey report, provided by Beveridge Williams to GHD, is included as Appendix A.

3.3 Groundwater bore licensing

Before a bore can be drilled in Victoria, a Bore Construction Licence (BCL) must be obtained from the designated Authority. This is a mandatory requirement of the *Water Act 1989*. For this project, GHD made application to Southern Rural Water (SRW) on behalf of Melbourne Water to obtain a BCL for the monitoring bores. As part of the BCL application process, written confirmation from each landowner was obtained and included within the BCL application.

SRW subsequently issued works licence WLE087395 for the drilling and construction of the monitoring bores (WRK143257 to WRK143265). The licence included some typical conditions which were adhered to during the drilling and installation process.

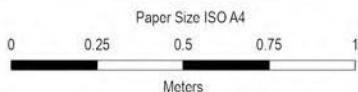
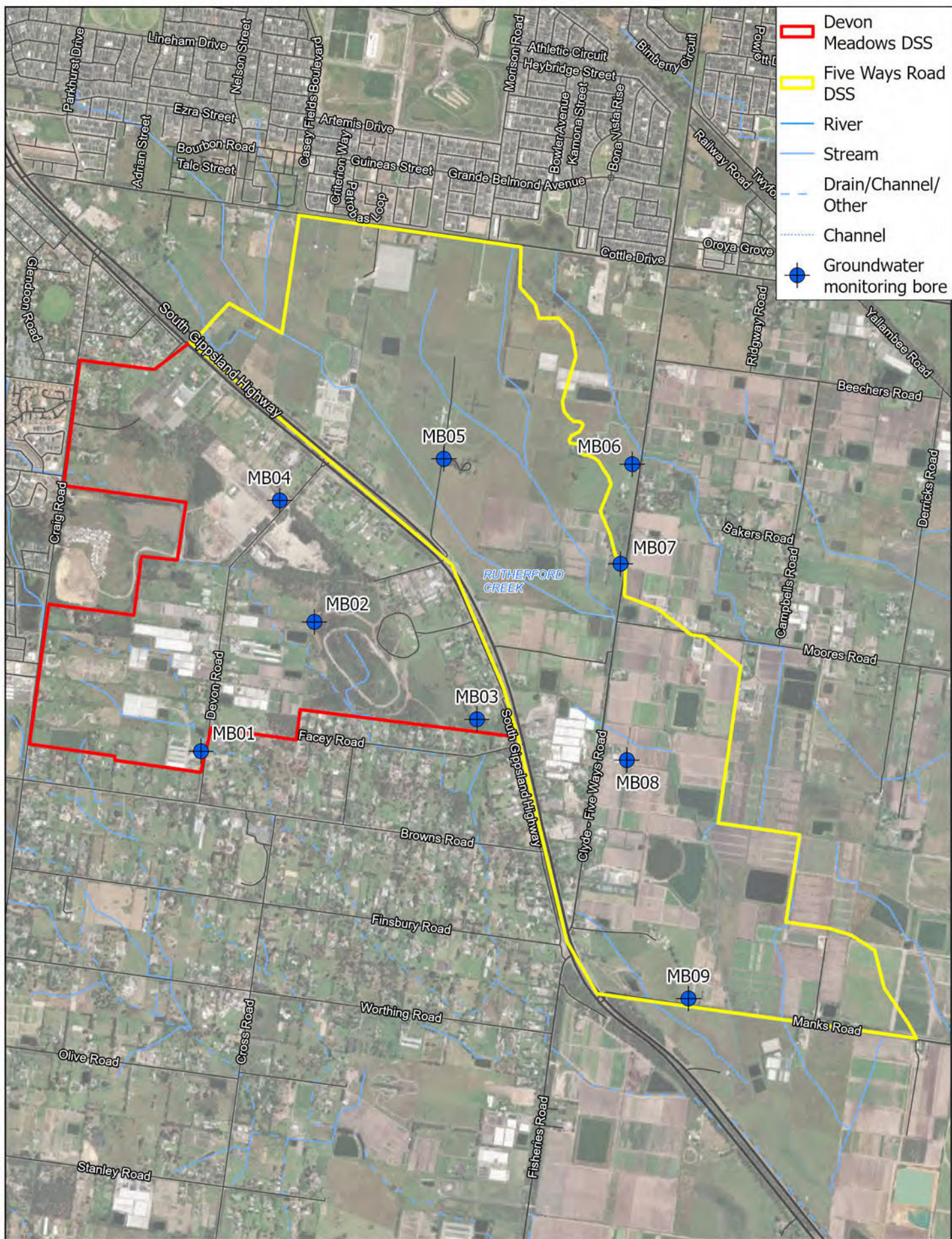
Following the drilling and installation of the monitoring bores, the drilling contractor (Star Drilling) submitted a Bore Completion Report² (BCR) for each of the monitoring bores.

A copy of the BCL and BCR has been attached as Appendix B.

² It is noted that there are some inconsistencies in the bore completion reports relating to the final depths for some of the bores. These inconsistencies do not affect any interpretation of this report.

Table 1 *Monitoring bore locations*

Bore ID	Bore ID (Works licence)	Location	Surveyed coordinates (GDA94 Z55)			Bore Depth (m bgl)
			Easting	Northing	m AHD	
MB01	WRK143257	[REDACTED]	351070.0	5775905.5	34.32	7.5
MB02	WRK143262	[REDACTED]	351570.6	5776476.6	36.20	5.1
MB03	WRK143258	[REDACTED]	352288.7	5776046.2	26.74	8.0
MB04	WRK143265	[REDACTED]	351418.2	5777012.6	46.48	15.0
MB05	WRK143263	[REDACTED]	352142.3	5777196.3	32.16	7.4
MB06	WRK143261	[REDACTED]	352974.4	5777172.6	31.60	11.5
MB07	WRK143264	[REDACTED]	352922.1	5776732.7	29.30	10.75
MB08	WRK143260	[REDACTED]	352950.9	5775866.5	25.34	8.0
MB09	WRK143259	[REDACTED]	353222.9	5774813.1	15.89	9.0
Notes: Coordinates an elevation in m Australian Height Datum (AHD) measured at top of PVC casing Works licence as issued by SRW (refer Section 3.3)						



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Melbourne Water
Groundwater Investigations
Devon Meadows DSS
and Five Ways Road DSS
**Groundwater Monitoring
Bore Location Plan**

Project No. 31-12568833
Revision No. 0
Date 01/11/2024

FIGURE 1

3.4 Clearances

Each monitoring bore was installed on private property. A review of Before You Dig Australia (BYDA) plans was carried out by GHD which identified a number of services in the vicinity of the majority of borehole locations. As such, GHD engaged services clearance contractor Qest to clear a 5 m x 5 m area around each bore using electronic detection and Ground Penetrating Radar (GPR) equipment in conjunction with the BYDA documentation. Furthermore, prior to drilling, each bore was hand cleared using a hand auger to one metre depth.

The exception to the above was at property 1930 South Gippsland Highway, at which access to the borehole location was not available during the time of the service clearance. Due to the remote location of the bore at this property (naturally vegetated area approximately 300 m from the closest dwelling), review of BYDA plans by Qest and verbal confirmation that the area is clear of services by the property manager, hand clearing the first metre using a hand auger was deemed sufficient for this location.

3.5 Tendering

A drilling specification was prepared by GHD and released to Star Drilling Pty Ltd to enable the cost for the drilling program to be estimated and the likely timing of works to be confirmed.

Star Drilling is a suitably qualified and experienced water bore drilling contractor, is locally based and has significant experience in drilling and bore construction in the expected soft soil drilling conditions.

3.6 Environmental and site safety plans

GHD prepared site specific Pre Work Safety Assessment Plans and a Job Safety and Environmental Analysis (JSEA) for the site investigation works, and co-ordinated pre-starts and inspections with the drilling contractor. These plans were formulated to identify health and safety hazards and potential environmental impacts that could occur during the project. They also enabled risk ratings and risk control measures/safe work methods to be developed to minimise risk or impact to both, operators, supervisors, and the environment.

3.7 Drilling program

3.7.1 Drilling

Star Drilling was engaged by GHD to complete the monitoring bore drilling and construction. The drilling works was undertaken between 18 to 22 March 2024. Star Drilling mobilised and demobilised a track mounted Geoprobe drilling rig to and from site each day.

Drilling was undertaken using a Solid Flight Auger. This method is a fast and effective way of drilling in soft soils and requires no fluids to be introduced during the drilling process. Soils samples during drilling were obtained at one-meter intervals and recorded by GHD.

Selected photographs from the drilling program have been attached as Appendix C.

3.7.2 Lithology intersected

A GHD hydrogeologist attended site each day to co-ordinate the drilling activities, undertake lithological logging of the boreholes, and design the monitoring bore construction. Lithological logs for each of the monitoring bores have been included in Appendix D. The majority of bores exhibited soft soils, consisting of a mixture of interbedded clays, silts, and sands. The exception to this was in bores WRK143263 (MB05) and WRK143264 (MB07), at which inferred residual (extremely weathered) basalt was intersected at 7 m and 10 m depth below ground level (bgl), respectively. Lithology intersected across the borehole locations is consistent with regionally mapped geology (unconsolidated sediments), as outlined in GHD (2023). A summary lithological log from the drilling has been provided in Table 2.

There was no obvious visual or olfactory evidence of contamination identified during the drilling program.

Table 2 *Summary lithological log*

Bore ID	Lithological Summary
MB01	Sandy SILTs, with silty CLAY at 1 m to 2 m and sandy gravelly CLAY at 7 m to 9 m
MB02	Silty SAND, with minor amounts of clay from 5 m to 7.5 m
MB03	Silty CLAY to 3 m depth, followed by silty clayey SAND from 3 m to 8 m
MB04	Silty SAND to 5 m depth, followed by a mixture of silty sandy CLAY from 5 m to 15 m
MB05	SILT and CLAY to 7 m depth, followed by inferred residual basalt rock (7 m to 7.4 m)
MB06	SAND to 2 m depth, followed by a mixture of SILT and CLAY from 2 m to 11.5 m
MB07	Silty SAND to 3 m, followed by a mixture of SILT and CLAY to 10 m, then into inferred residual basalt rock (10 m to 10.75 m)
MB08	Silty SAND to 6 m depth, followed by a mixture clayey sandy SILT from 6 m to 10 m
MB09	Silty CLAY to 3 m depth, sandy SILT from 3 m to 5 m follow by silty SAND from 5 m to 9 m

3.8 Bore construction

The monitoring bore construction is summarised in Table 3 and the monitoring bore logs shown in Appendix D. Bores were constructed with a 50 mm diameter Pressure Nominal (PN) 18 PVC casing, with a 3 m machine slotted (0.4 mm aperture) screen casing. The exception to this was bore WRK143265 (MB04), which was installed with a 6 m screen. Gravel pack comprised 8/16 (2 mm) filter sand and was generally extended one metre above the uppermost screen interval, followed by a 1 m bentonite plug and then cement bentonite (~3%) grout to surface.

During the installation process for borehole WRK143262 (MB02) the hole collapsed up to 3 m bgl. The hole was then cleared back out using the Solid Flight Augers, however, during borehole installation the hole collapsed around the screen to 2.5 m bgl. This occurred during the installation of WRK143259 (MB09), where the hole collapsed around the screen from 8 m to 9 m bgl. Both bores were installed to the target depth, however, a portion of the screen is installed within the collapsed material, with gravel pack for the remainder of the screen.

3.9 Headworks

All bores were completed with high visibility lockable plastic monument covers, which were cemented in place. The exception to this was bore WRK143262 (MB02), which due to the property manager's request, was finished with a metal flush mounted gatic cover, cemented in place.

Due to the presence of livestock at the locations of bores WRK143257 (MB01), WRK143263 (MB05) and WRK143259 (MB09), three protective wooden bollards were placed around each bore.

Photographs of the finished bores have been attached as Appendix C.

3.10 Bore development

Following the installation of the bore casing and screens, and annular materials, each monitoring bore was developed using air-lifting methods. As no drilling fluids are used during Solid Flight Auguring, water quality parameters remained relatively stable during bore development. The sediment content for each bore decreased as development progressed.

A summary of the development undertaken for the new bores is provided in Table 4. Note that groundwater quality parameters measured during bore development are used to assess stabilisation of groundwater (i.e., to confirm stable inflow of aquifer water).

Table 3 *Summary of bore construction*

Bore ID	Date drilled	Total depth (m)	Casing (m)		Screen			Gravel pack depth (m)	Bentonite seal (m)	Grout interval (m)	Stick up (m)
			From	To	From	To	Lithology				
MB01	21/03/2024	7.5	0	4.5	4.5	7.5	sandy SILT/sandy gravelly CLAY	3.7 – 7.5	2 – 3.7	0 – 2	0.89
MB02	22/03/2024	5.1	0	2.1	2.1	5.1	silty SAND	1.6 – 2.5 ²	0.7 – 1.6	0 – 0.7	-0.08 ³
MB03	18/03/2024	8	0	5	5	8	clayey SAND/silty SAND	2.8 - 8	1.5 – 2.8	0 – 1.5	0.96
MB04	19/03/2024	15	0	9	9	15	sandy SILT/silty CLAY	8 - 15	6.5 - 8	0 – 6.5	0.84
MB05	20/03/2024	7.4	0	4.4	4.4	7.4	SILT/CLAY (weathered rock)	3.4 – 7.4	2.4 – 3.4	0 – 2.4	0.80
MB06	18/03/2024	11.5	0	8.5	8.5	11.5	SILT/CLAY	7 – 11.5	5.5 - 7	0 – 5.5	0.86
MB07	20/03/2024	10.75	0	7.75	7.75	10.75	Silty CLAY/clayey gravelly SILT (weathered rock)	6.5 – 10.75	5 – 6.5	0 – 5	0.93
MB08	19/03/2024	8	0	5	5	8	silty SAND/clayey SILT	4 - 8	3 - 4	0 – 3	1.02
MB09	21/03/2024	9	0	6	6	9	silty SAND	5 - 8 ¹	4 - 5	0 – 4	0.86
Notes: ¹ Hole collapsed around screen from 8 m to 9 m ² Hole collapsed around screen from 2.5 m to 5.1 m ³ Bore finished with flush mounted gatic cover. All bores comprise 50 mm diameter PVC casing and screens Drilled depths are below the ground surface at the time of drilling											

Table 4 *Summary of bore development*

Bore ID (Works licence)	Yield (L/min)	Temperature (°C)	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (%s)	Oxidation – Reduction Potential (mV)	Comment
MB01	2.5	17.2	7.62	3,943	90	68	Light brown. Moderate sediment load
MB02	<1	17.7	7.09	324	73	50	Light brown. Light sediment load
MB03	2.5	17.0	7.06	1,366	86	67	Light grey. Light sediment load
MB04	<1	22.2	5.71	311	72	32	Light brown. Light sediment load
MB05	<1	21.9	7.22	2,300	82	104	Light brown. Light sediment load
MB06	1.5	22.5	7.28	2,800	77	87	Light brown. Light sediment load
MB07	1	17.4	7.25	2,263	86	84	Light brown. Moderate sediment load
MB08	<1	19.0	8.12	1,319	78	57	Light brown. Light sediment load
MB09	<1	18.5	8.2	1,281	81	51	Light grey. Light sediment load

4. Groundwater monitoring

4.1 Groundwater levels

As part of the groundwater level monitoring program, Rugged TROLL 100 groundwater level data loggers were installed in each of the monitoring bores following groundwater sampling in April 2024. These loggers have been set to measure water levels on a 6-hourly basis in order to understand seasonal behaviour of groundwater and response to rainfall events. The groundwater level logger data was downloaded during August 2024. Furthermore, manual groundwater levels have been gauged as part of the monitoring program as follows:

- Prior to groundwater sampling in April 2024
- Prior to aquifer (hydraulic conductivity) testing in August 2024

A summary of the groundwater level data is presented in Table 5. Hydrographs for bores within each DSS area is presented in Figure 2 (Devon Meadows DSS) and Figure 3 (Clyde Five Ways Road DSS). Individual hydrographs for each bore are presented in Appendix E. Groundwater elevation contours based on April 2024 (autumn) and July 2024 (winter) data are presented in Figure 4 (note that due to the size of the study area and limited number of monitoring bores, groundwater elevations have been extrapolated to develop inferred groundwater contours and are therefore indicative only).

Observations from the groundwater level data are summarised below:

General

- Groundwater levels respond to rainfall events, i.e., temporarily elevated (shallower) groundwater levels following rainfall/winter months, usually with a lag period of approximately 4 days
- Groundwater elevations generally reduce in a southeasterly direction across the study area, reflective of a decrease in topography from the northwest to southeast. The inferred regional groundwater flow direction is southeasterly, towards Western Port
- Groundwater level fluctuations range from 0.3 m (MB04) to 0.8 m (MB02), with the deepest levels measured at MB04 (9.1 m bgl) and the shallowest at MB01 (0.7 m bgl)

Devon Meadows DSS

- The deepest groundwater level was measured at bore MB04, located at a topographic high within the study area. The depth to water table at the remaining three DM DSS bores is <2 m bgl.
- Bore MB01 and MB02 levels indicate rainfall recharge following rainfall events in July 2024. However, MB02 has recorded a decline in water level once rainfall has ceased; this indicates the temporal/dynamic nature of rainfall recharge. Both bores are located close to surface water dams and may be representative of localised surface water to groundwater interactions through seepage of surface water to groundwater when dams store a greater head of water.
- Bores MB03 and MB04 show a stable groundwater level trend, with minor rainfall induced temporary fluctuation in groundwater levels
- The land occupier at MB02 (1934 South Gippsland Highway) notes that the area southeast of the bore floods during winter months

Clyde Five Ways Road DSS

- Depth to water table is deeper in the CFWR DSS than compared to the DM DSS. CFWR groundwater levels are generally >2.7 m bgl (with the exception of MB09, with an average groundwater level of 1.4 m bgl)
- Depth to water table in bores located along Clyde-Five Ways Road (MB06, MB07, MB08) become shallower as the topography decreases from north to south
- Bores MB05, MB06 and MB08 show a stable groundwater trend, influenced temporarily by rainfall recharge events

- Bores MB07 and MB09 show an overall increasing groundwater level trend following rainfall events from July 2024
- Bore MB09, located at the topographic low within the study area, recorded the shallowest depth to water table within the CFWR DSS (and DM DSS), with depth to groundwater ranging from 0.9 m bgl to 1.6 m bgl
- The land occupier at MB06 (215 Clyde-Five Ways Road) notes that during rainfall events in July 2024, surface water was ponding in adjacent property 235 Clyde-Five Ways Road and spilling across the road

Table 5 *Groundwater level summary*

Bore ID	Ground AHD	From (m bgl)	To (m bgl)	Average (m bgl)	From (m AHD)	To (m AHD)	Average (m AHD)	Range
Devon Meadows DSS								
MB01	33.43	0.66	1.32	1.11	32.77	32.10	32.32	0.66
MB02	36.28	0.95	1.74	1.51	35.33	34.54	34.77	0.79
MB03	25.79	1.50	1.95	1.70	24.29	23.83	24.09	0.46
MB04	45.64	8.82	9.08	8.95	36.82	36.56	36.69	0.26
Clyde Five Ways Rd DSS								
MB05	31.36	3.83	4.11	3.97	27.53	27.25	27.38	0.28
MB06	30.75	6.68	6.98	6.84	24.07	23.77	23.91	0.30
MB07	28.37	5.26	5.77	5.58	23.10	22.60	22.79	0.51
MB08	24.32	2.71	3.11	2.92	21.61	21.21	21.40	0.41
MB09	15.02	0.92	1.61	1.36	14.10	13.42	13.66	0.68

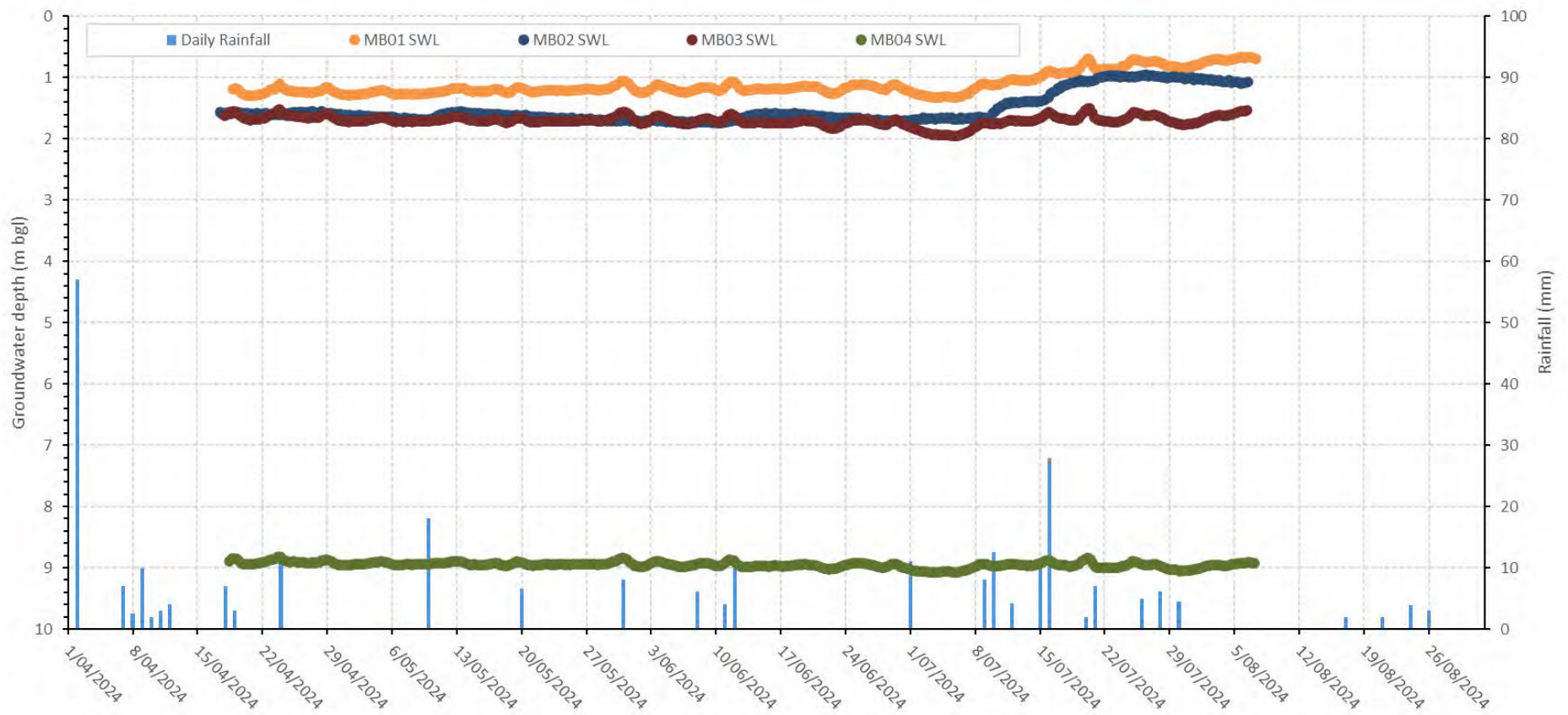


Figure 2 Hydrograph – Devon Meadows DSS (rainfall data from Bonbeach (086210) weather station.

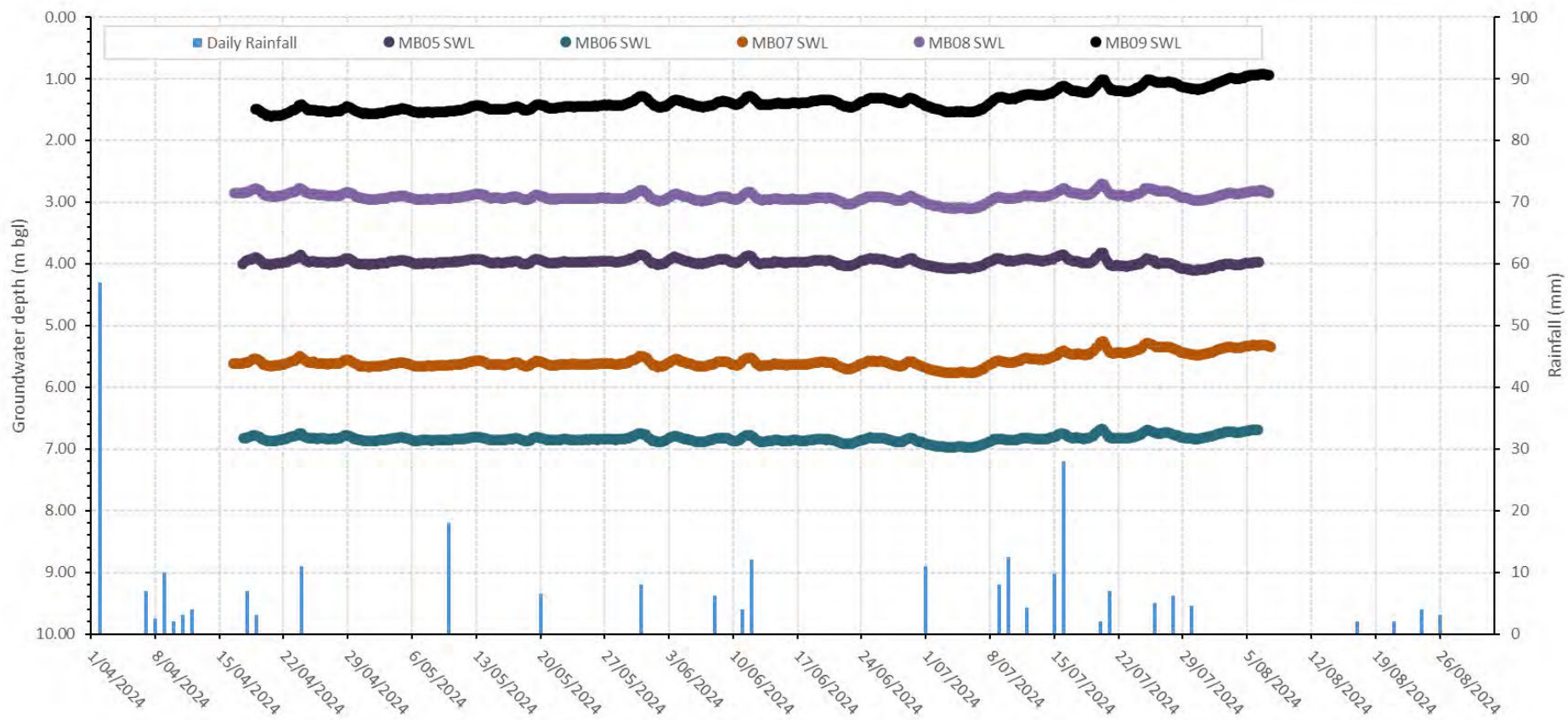
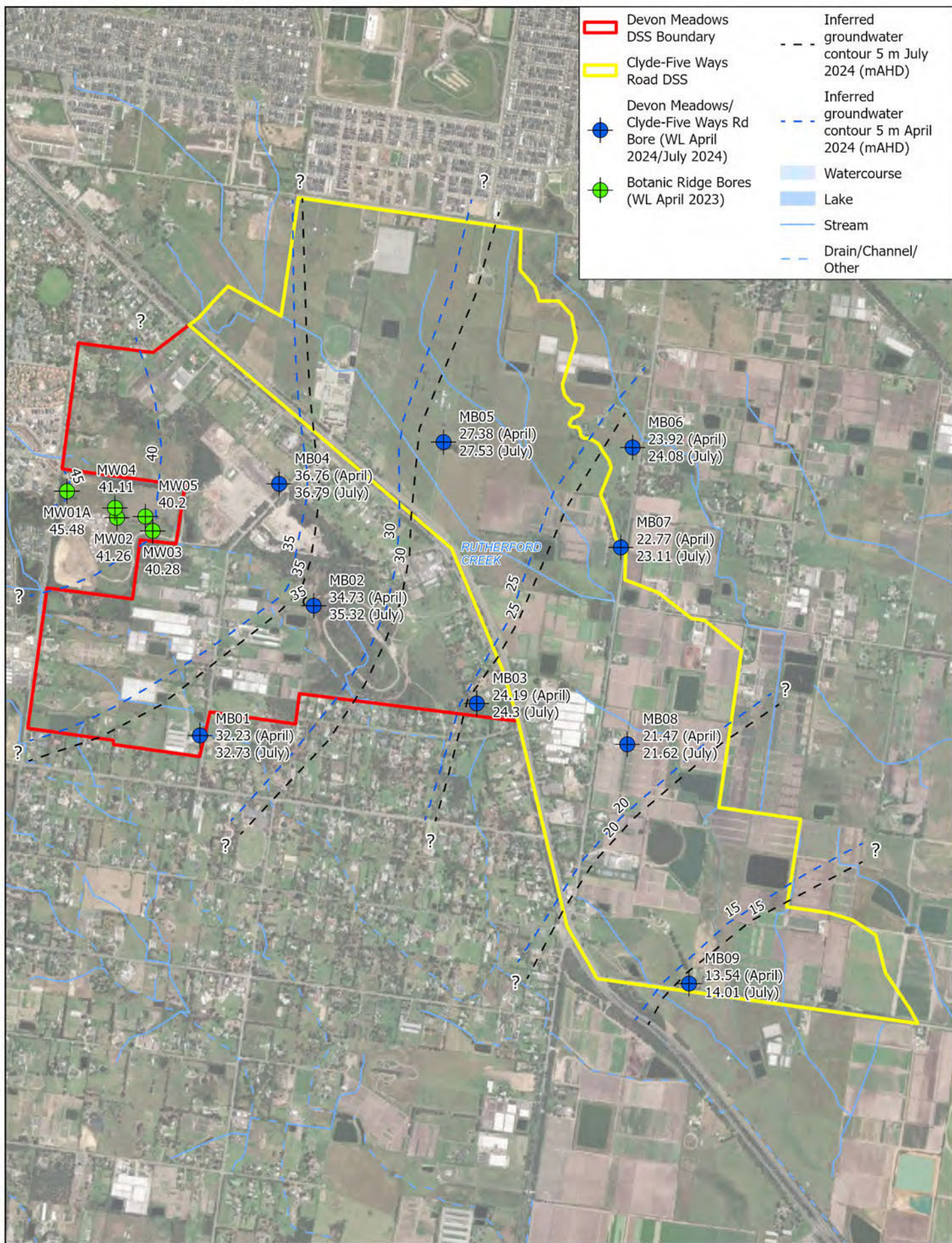


Figure 3 Hydrograph – Clyde Five Ways Road DS (rainfall data from Bonbeach (086210) weather station).



4.2 Groundwater quality

4.2.1 Sampling methodology

Following monitoring bore installation, GHD completed a Groundwater Monitoring Event (GME). Groundwater sampling was completed in accordance with Victoria EPA Publication 669.1 (EPA 2022) and IWRG701 (EPA 2009), and recognised industry practice.

Sampling was completed following stabilisation of the field water quality parameters to limits as defined by EPA (2022). The following field parameters were measured during groundwater purging and sampling:

- pH
- Oxidation – Reduction Potential (ORP)
- Dissolved Oxygen (DO)
- Electrical Conductivity (EC)
- Temperature
- Turbidity
- Water level (under low flow sampling conditions)

These parameters have been recorded in the field purge sheets, attached as Appendix F. In addition, to monitoring of the field parameters, field staff also documented comments about the olfactory and visual observation of the purged groundwater.

The stabilised field water quality parameters have been summarised in Table 6.

Table 6 *Summary of stabilised field parameters*

Parameter	MB01	MB02	MB03	MB04	MB05	MB06	MB07	MB08	MB09
SWL (m btoc)	2.09	1.47	2.56	9.73	4.78	7.69	6.53	3.87	2.34
Volume Purged	5.0	7.5	4.5	5.0	6.5	5.5	7.0	6.0	4.0
Temperature (°C)	17.6	16.9	17.2	17.5	16.9	16.2	15.7	17.5	16.6
pH (pH unit)	5.67	5.01	5.34	5.03	6.43	6.48	6.74	6.79	6.99
Electrical Conductivity (µS/cm)	3,648	288	1,500	242	2,028	2,810	2,370	1,543	1,279
Dissolved Oxygen (mg/L)	2.29	0.77	5.34	1.28	7.08	7.74	6.27	0.87	2.50
Oxidation – Reduction Potential (mV)	179	150	202	225	155	172	161	150	160
Description	Very light brown, low sediments	Light brown, low to moderate sediments	Light brown, low to moderate sediments, cloudy	Light brown/orange, low to moderate sediments	Very light grey/brown, no sediments	Light brown, low sediments	Clear, no sediments	Very light grey/brown, no sediments	Tint of grey, low sediments, cloudy
Note: Standing Water Level (SWL) in metres below top of casing (m btoc) measured prior to sampling disturbance									

4.2.2 Laboratory parameters

Groundwater samples were placed in ice filled coolers and submitted by GHD with accompanying Chain of Custody (COC) documentation to Eurofins for analysis. Eurofins is accredited with the National Association of Testing Authorities (NATA) for the nominated analyses.

Three sample bottles per bore were collected, consisting of a 500 mL unpreserved bottle, 60 mL plastic bottle preserved with nitric acid, and 60 mL plastic bottle preserved with H₂SO₄.

The analytical suite for each bore comprised:

- Salinity (measured as mg/L TDS), EC, pH and total hardness
- Major anion and cations – Ca, Mg, Na, K, Cl, SO₄, Alkalinity
- Metals (dissolved): As, Cd, Cr, Cu, Pb, Ni, Zn, Al, Fe, Se, Hg
- Speciated nutrients: Total Nitrogen, NO₂, NO₃, NH₃ and Total P

4.2.3 Laboratory results

The groundwater quality results have been tabulated in Appendix G. Certified laboratory results for the April 2024 sampling are included as Appendix H.

A discussion of the results is provided in Section 5.

4.2.4 Sampling Program QA/QC

4.2.4.1 Quality control procedures

GHD implemented a rigorous quality assurance/quality control (QA/QC) program as part of our field procedure, based on relevant Australian Standards and industry common practice. The QA/QC program undertaken as part of the assessment by GHD included the following:

- Implementation of GHD field procedures including sampling equipment decontamination between sampling points
- Calibration of water quality and water level equipment
- Preservation of samples with ice during transport from the field to the laboratory
- Transportation of samples with accompanying COC documentation
- Collection of a duplicate sample and calculated Relative Percentage Differences (RPD)
- Collection of rinsate/equipment blank to ensure correct cleaning of field equipment
- Comparison of field and analytical data
- Compliance with sample holding times
- Review of internal analysis of QC and laboratory duplicates
- Review of groundwater sampling and purging records

Laboratory results for the field duplicates are included in Appendix I, together with the calibration certificates for the water quality and water level meters used during the sampling, as well as the calibration certificates for the deployed loggers as part of the groundwater monitoring program.

4.2.4.2 Discussion of QA/QC

During the April 2024 groundwater quality monitoring, GHD implemented a rigorous QA/QC program as part of our field procedure, based on relevant Australian Standards (AS4482.1-2005), Victoria EPA guidelines (EPA, 2022) and industry common practice.

The QA/C program included:

- Collection of one field duplicate sample for analysis by Eurofins, and calculation and review of the RPD between the samples
- Collection of one field blank (rinsate) sample for analysis by Eurofins

QA and QC results for the April GME is summarised in Table 7.

Table 7 *Sampling QA/QC results, April 2024*

Item	Sample	Lab	Objective	Summary	Comments
Field duplicate	MB05 and QA_01	Eurofins	RPDs within 50%	Iron (filtered) 54%, Chromium (filtered) 67% Remaining RPDs within 50%	Chromium considered acceptable as results near LOR Most criteria met
Field blank	QA_2	Eurofins	No contamination	All tested parameters below <LOR	All criteria met
Note: LOR – Limit of Reporting					

4.2.4.3 Conclusion of QA/QC program

Based on the results of the QA/QC program as detailed above, the following is concluded:

- The field sampling procedure was carried out in accordance with the GHD QA/QC program
- The RPDs for field duplicate groundwater and blank samples were within mostly acceptable ranges
- The laboratories used is NATA accredited for the analyses performed and deemed acceptable

It is concluded that the sampling and analytical programs were acceptable, and the QA/QC results obtained are of reliable quality to support the conclusions made in this report.

5. Assessment of water quality impacts

5.1 Groundwater quality objectives

5.1.1 Classification of groundwater

The *Environment Protection Act 2017* (the Act) was enacted on 1 July 2021 and specifies new objectives of the EPA and consequential amendments to the former *Environment Protection Act 1970*. The Act changes Victoria's focus to a prevention based approach, rather than preventing waste and pollution impacts and managing these after they have occurred. Central to the Act is the general environmental duty (GED) which requires Victorians to reduce the risk of their activities potentially harming the environment or human health through waste and pollution.

The Act introduces two subordinate instruments:

- Environment Protection Regulations (EPR)
- Environment Reference Standard (ERS)

Under section 93 of the Act, an ERS is used to assess and report on the environmental conditions throughout Victoria. The ERS:

- Identifies environmental values (human health and the environment) to be achieved or maintained in Victoria
- Specifies indicators and objectives used to measure, determine, or assess whether those environmental values are being achieved, maintained, or threatened

The ERS is not meant to represent a compliance standard, but rather has a primary function to provide an environmental assessment and reporting benchmark. The ERS contains environmental values for each element of the environment in separate parts, i.e., air, land, water (surface and groundwater), however, the different elements of the environment can impact each other and the interactions between them need to be considered.

The ERS (2021) provides that groundwater is categorised into segments, with each segment having particular identified values. The segments and their environmental values are summarised in Table 8.

Table 8 Protected environmental values and groundwater segments

Environmental value	Segment (TDS mg/L)						
	A1 (0-600)	A2 (601-1,200)	B (1,201-3,100)	C (3,101-5,400)	D (5,401-7,100)	E (7,101-10,000)	F (>10,000)
Water dependent ecosystems and species	✓	✓	✓	✓	✓	✓	✓
Potable water supply (desirable)	✓						
Potable water supply (acceptable)		✓					
Potable mineral water supply	✓	✓	✓	✓			
Agriculture and irrigation (irrigation)	✓	✓	✓				
Agriculture and irrigation (stock watering)	✓	✓	✓	✓	✓	✓	
Industrial and commercial use	✓	✓	✓	✓	✓		
Water-based recreation (primary contact recreation)	✓	✓	✓	✓	✓	✓	✓
Traditional Owner cultural values	✓	✓	✓	✓	✓	✓	✓
Buildings and structures	✓	✓	✓	✓	✓	✓	✓
Geothermal properties	✓	✓	✓	✓	✓	✓	✓
Note: TDS – Total Dissolved Solids (mg/L). Source: ERS (2021).							

5.1.2 Groundwater quality indicators and objectives

The indicators and objectives for groundwater, for each environmental value have been summarised in Table 9. The environmental values may not apply to groundwater if:

- There is insufficient aquifer yield to sustain the environmental value, having regard to variations within the aquifer and reasonable bore development techniques to improve yield; or
- The application of that groundwater, such as for irrigation, may be a risk to the environmental values of land or the broader environment due to the soil properties; or
- The background water quality level exceeds (or is less than, in the case of indicators such as pH, dissolved oxygen and many biological indicators) the relevant objective specified in Table 9 and as a result the environmental value cannot be achieved

Table 9 Groundwater indicators and objectives

Environmental value	Indicators	Objectives
Water dependent ecosystems and species (in surface waters)	For groundwater that discharges to surface water, the indicators are the indicators applicable to the relevant surface water as specified in Division 3 of Part 5 of this ERS	The level that ensures the groundwater does not affect receiving waters to the extent that the level of any indicator in the receiving waters: – Exceeds the level of that indicator (if specified as an upper limit); or – Is less than the level of that indicator (if specified as a lower limit), – Specified for surface water in Division 3 of Part 5 of this ERS
Water dependent ecosystems and species (in subterranean waters with a hydrogeological setting conducive to the presence of troglofauna and stygofauna)	Indicators that are relevant to the subterranean species of troglofauna and stygofauna, which may include TSS, salinity, toxicants in water, toxicants in sediment and dissolved oxygen	The level that ensures the groundwater quality does not adversely affect the troglofauna and stygofauna that depend on the groundwater.
Potable water supply	Indicators specified in the Australian Drinking Water Guideline (ADWG)	Health-related guideline value for each indicator specified in the ADWG. Aesthetic guideline value for each indicator specified in the ADWG.
Potable mineral water supply	Indicators specified in the ADWG	Health guideline values for each indicator specified in the ADWG. Aesthetic guideline values for each indicator set out in the ADWG.
Agriculture and irrigation (irrigation)	Indicators specified for irrigation and water for general on-farm use in ANZG	Level of that indicator specified in the ANZG
Agriculture and irrigation (stock watering)	Indicators specified for livestock drinking water quality in the ANZG	Level of that indicator specified in the ANZG
Industrial and commercial	Indicators specific to the particular industrial or commercial activity and their use of water	Groundwater quality that is suitable for its industrial or commercial use
Water-based recreation	E. coli	10 E. coli/100mL (if no human faecal contamination sources identified) 0 E. coli/100mL (if human faecal contamination sources identified)
	Chemical hazards, aesthetic effects	Level of indicators (where specified) and descriptions in applicable guidance, in the Recreational Water Guidelines

Environmental value	Indicators	Objectives
Buildings and structures	pH, sulphate, chloride, redox potential, salinity or any chemical substance or waste that may have a detrimental impact on the structural integrity of buildings or other structures	Groundwater that is not corrosive to or otherwise adversely affecting structures or building
Geothermal	Temperature between 30°C and 70°C.	Geothermal properties of groundwater to be maintained for current and future users of the resource

Note: ANZG - means the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018)

The background water quality level is the objective for an indicator if:

- The objective is not able to be attained due to the background water quality level of that indicator
- The background water quality level better protects the environmental values than the objective specified in Table 9

The ERS (2021) requires that occupational health and safety, odour and amenity also be considered, due to the fact that vapours sourced from impacted groundwater may present a potential risk to workers, and that odours or discolouration may result in degradation of overall environmental values of groundwater.

5.2 Groundwater quality

5.2.1 Background groundwater quality

Based on neighbouring bore information, GHD (2023) documented that the groundwater salinity in bores developing the water table aquifer (bores with depths less than 30 m) ranged from 62 mg/L to 8,190 mg/L TDS, with an average of 1,414 mg/L TDS. However, a number of the bores had limited sample results, with the most recent data starting from the 1990s and earlier in some cases (the sampling method is not known for some of the bores and the quality of the data has not been verified). A wider salinity range was reported from DEECA's Groundwater Resource Report, which indicated a salinity range from 1,000 to 3,500 mg/L.

5.2.2 Site groundwater quality

Groundwater quality results from the April 2024 GME are tabulated in Appendix G.

Salinity

Based upon the GHD's sampling in April 2024, the groundwater salinity ranges from 250 mg/L to 2,400 mg/L with an average of approximately 1,257 mg/L TDS, which mostly corresponds with environmental value Segment B. This is within the salinity range identified in the neighbouring bores (refer section 5.2.1).

pH

pH values ranged from 5.5 pH units (MB02) to 7.2 pH units (MB08), indicating groundwater at the sampling locations is slightly acidic. pH laboratory results and field pH recorded during the time of sampling are consistent.

Nitrogen compounds

Nitrogen can be introduced into groundwater through anthropogenic activities, such as historical land use practices, e.g., grazing, application of fertilisers.

Based upon the groundwater sampling completed by GHD, total nitrogen concentrations range from <0.2 mg/L (MB01) to 42 mg/L (MB08). It is noted that bore MB08 is located within a market garden, at which fertilisers are likely applied.

In most bores, the bulk of the nitrogen is present in the form of nitrate. Nitrate (as N) concentrations in the bores range from <0.02 mg/L (MB01) to 36 mg/L (MB08), with an average of approximately 11 mg/L. Nitrate (as N) exceeds the ANZG (2018) guidelines for freshwater slightly to moderately modified ecosystems (2.4 mg/L) for bores MB04, MB06, MB07, MB08 and MB09.

A review of the available chemistry data for neighbouring bores identified on the DEECA WMIS was undertaken to characterise nitrate concentrations. The groundwater quality data is usually collected from bores upon installation, and although it does not reflect current concentrations, may provide an understanding of background concentrations near the study area. The nitrate data is summarised in Table 10 and suggests that the identified nitrate concentrations within the study area are slightly higher in range for bores in the broader area.

Table 10 Nitrate concentrations in neighbouring bores

Statistic	Value
Count	45
Minimum	0.01 mg/L (as N)
Maximum	24.61 mg/L (as N)
Average	2.94 mg/L (as N)

Heavy Metals

All monitoring bores were analysed for a suite of 11 heavy metals. The sampling identified concentrations above the laboratory limits of reporting for the majority of the heavy metals tested, with a number of bores exceeding the ANZG (2018) guidelines for freshwater, for slightly to moderately modified ecosystems for aluminium, arsenic, chromium, copper, nickel, and zinc. It is suspected, however, that these concentrations are naturally occurring as they are not likely to be introduced by the farming/market garden activities.

Summary

Based on water quality sampling to date and the relevant groundwater indicators and objectives presented in Table 9, the following is noted:

- Exceedances of the ANZG (2018) guideline criteria for slightly to moderately modified ecosystems include:
 - Nitrate (as N) in bores MB04, MB06, MB07, MB08 and MB09 exceed the guideline criteria of 2.4 mg/L
 - Several bores exceed the guideline criteria for aluminium, arsenic, chromium, copper, nickel and/or zinc
- Exceedances of the ANZECC long term irrigation trigger values are recorded in several bores for a range of parameters including pH, EC, chloride, nitrogen (total), phosphorus (total), and/or iron
- Exceedances of the ANZECC short term irrigation trigger values are recorded for nitrogen (total) (MB08, MB09) and phosphorus (total) (MB02)
- There are currently no exceedances of the ADWG for recreational water quality (relevant if dewatering is required)
- There are currently no exceedances of the ANZECC 2000 – stock watering guideline (relevant for potential dewatering disposal options)

Additional chemicals of concern

A comprehensive suite of parameters has not been analysed (e.g., hydrocarbons). August 2024 monitoring undertaken has identified a potential contamination source area (rubbish dumping/burning) at bore location MB08, which could result in chemical leaching and impact to groundwater.

5.3 Environmental values relevant to the study area

5.3.1 Protected environmental values

EPA takes a conservative approach and classifies groundwater as per the lowest TDS identified to protect all potential environmental values. This assessment adopts EPA's conservative approach and as such, the water table aquifer relevant to the project area is considered **Segment B** (based on the April 2024 GME) for the purposes of this assessment, and in identifying environmental values of groundwater to be protected (refer Table 8). Within Segment B, groundwater quality needs to be maintained to protect all the environmental values listed previously in Table 8.

5.3.2 Relevance of environmental value

The existing and relevant environmental values to the site are summarised in Table 11. The relevance of each environmental value has largely been inferred from the hydrogeological desktop assessment (GHD, 2023) as well as site observations made during this study.

Table 11 *Relevance of environmental values*

Environmental value	Comment	Relevance to assessment
Water dependent ecosystems and species	Scattered areas of moderate and/or high potential vegetation GDEs were identified surrounding the study area, they are also present within the site boundaries.	This environmental value is considered relevant.
Potable mineral water supply	The area is not within a designated mineral spring area and no mineral water supply bores were identified within 2 km of the site.	This environmental value has been excluded from further assessment.
Agriculture and irrigation (irrigation)	Several bores within the study area have been identified as irrigational bore use. Furthermore, site observations and aerial imagery indicates lands within the study area is used for agricultural purposes.	This environmental value is considered relevant.
Agriculture and irrigation (stock watering)	Multiple stock and/or domestic bores or diary bores have been identified within the study area. Furthermore, site observations and aerial imagery indicates lands within the study area is used for agricultural purposes.	This environmental value is considered relevant.
Industrial and commercial water use	One industrial bore has been identified within the Devon Meadows DSS. Furthermore, site observations and aerial imagery indicates lands within the study area is used for agricultural purposes.	This environmental value is considered relevant.
Water-based recreation (primary contact recreation)	No recreational water bodies have been identified within 2 km of the site.	This environmental value is considered relevant.
Traditional Owner cultural values	An internal cultural heritage assessment was carried out by Melbourne Water in which a number of cultural heritage sensitivity areas within the study area have been identified. Furthermore, we have considered this environmental value through current use of groundwater and via groundwater dependent ecosystems.	This environmental value is considered relevant.
Buildings and structures	Shallow groundwater levels occur across the study area and have the potential to interact with buildings and structures.	This environmental value is considered relevant.
Geothermal properties	Groundwater thermal properties have not been identified but are unlikely.	This environmental value is considered not relevant.

6. Groundwater risk assessment

6.1 Risk assessment

6.1.1 Overview of risk assessment method

An environmental risk assessment for each DSS has been completed to identify environmental risks associated with construction and operation of the retarding basins. A risk-based approach is integral to an impact assessment and has the objectives to:

- Provide a consistent evaluation tool that is used for all assessments to systematically rate the key issues associated with the project
- Identify key risks associated with the project that may require further examination
- Inform project development and/or development of measures to avoid, mitigate and manage environmental impacts

Note – A design and planning phase does not typically fit into a risk assessment framework for potential impacts to groundwater. This phase has been included to provide Melbourne Water with a preliminary indication of associated risks during design and planning.

6.1.2 Risk assessment process

The risk assessment process adopted is consistent with AS/NZS ISO 31000:2018 Risk Management Process. The following tasks were undertaken to identify, analyse and evaluate risks:

- Use existing environmental conditions and identify applicable legislation and policy to establish the context for the risk assessment
- Develop likelihood and consequence criteria and a risk matrix
- Consider construction, operational and decommissioning activities in the context of existing conditions to determine risk pathways
- Identify standard controls and requirements to mitigate identified risks
- Assign likelihood and consequence ratings for each risk to determine risk ratings considering design, proposed activities and standard mitigation

The assessment of risk combines the consequences of a threat and the likelihood of that consequence occurring, resulting in an overall risk rating. Any risk with an overall rating of medium or above requires further analysis in line with the avoid, minimise, or manage hierarchy.

Risk can be defined as a combination of:

- The magnitude of potential consequences of an event occurring
- The likelihood of the consequence event occurring

6.1.3 Assigning a consequence level

Consequence refers to the outcome of an event affecting an asset, value, or use. Table 12 presents the consequence framework describing the consequence levels from 'insignificant' to 'severe'. The consequence criteria have been developed in the form of project-wide criteria rather than discipline specific, to enable a consistent assessment of consequences across a range of potential environmental effects.

Consequence criteria is assigned based on the maximum credible consequence of the risk pathway occurring. Where uncertainty regarding consequences existed, a conservative approach to assessing risk has been adopted.

Consequence criteria considered the following characteristics:

- Spatial extent of impact
- Duration and reversibility of potential impacts

- Sensitivity and significance of the receiving environment
- Magnitude, or severity of potential impact

Each risk pathway would be assigned a level of consequence taking into account the guidance in Table 12. The consequence level, together with the likelihood level would be used to determine a risk rating in accordance with the risk matrix presented in section 6.1.5.

Table 12 Guide to consequence levels

Level	Criteria
Insignificant Impacts are barely recognised and/or quickly recovered from. No specific remediation required.	No detectable changes or very short-term and localised. Readily reversible (insignificant) impact (<1 year for recovery). Resilient or highly disturbed receiving environment or population. No impact to native vegetation or habitat. Surface water/groundwater: No detectable changes to water levels, flow, or quality with no measurable effect on assets, values or uses beyond the immediate occurrence or expression of the hazard.
Minor Hazard is perceived but has minor and typically temporary effects. Some remediation may be required.	Short-term localised detectable changes. Impact likely to be readily reversible (within 5 years for recovery). Resilient or disturbed receiving environment or population. Surface water/groundwater: Changes to water levels, flow, or quality with isolated and short-term effect on assets, values or uses. Minor contamination of natural waterway or wetland occurs, but water quality remains within applicable EPA or ANZG guidelines for existing beneficial uses. Water extraction or diversion reduces surface water flows or groundwater available for environmental uses, but with no detectable effect on dependent species or ecosystems and carried out within terms of water licence. Minor environmental contamination event (of land and/or water). Clean-up and rehabilitation may be required but can be completed within days.
Moderate Hazard has moderate, noticeable impact, in terms of severity, duration and/or frequency of occurrence. Moderate treatment or remediation effort may be required. Hazard event would be the subject of limited community concern.	Short or medium-term detectable changes at a number of locations within the study area. Impact likely to be medium-term and reversible (5–10 years for recovery). Undisturbed receiving environment or population. Short-term, localised impacts on critical habitats. Surface water/groundwater: Changes to water levels, flow, or quality with moderate effect on assets, values or uses. Localised contamination of surface water/groundwater aquifer leading to disruption of beneficial uses as defined by ERS for weeks to months. Environmental contamination event (of land and/or water) with clean-up and rehabilitation expected to run for weeks and cost \$10k–\$1 million.
Major Hazard has major impact, in terms of severity, duration and/or frequency of occurrence. Treatment or remediation effort is required. Some effects may be irreversible. Remediation of environmental contamination would require significant private and public resources. Hazard event would be the subject of widespread community concern.	Long-term changes that are significant regionally. Impact likely to be medium to long-term and potentially irreversible (> 10 years to recover). Sensitive receiving environment or population. Material impacts on critical habitats. Surface water/groundwater: Significant changes to water levels, flow or quality with assets, values or uses significantly compromised. Contamination of surface water/groundwater aquifer leading to disruption of beneficial uses as defined by ERS for up to one year. Environmental contamination event (of soil-land and/or water) of a magnitude that would necessitate a regional emergency management incident response. Clean-up and rehabilitation expected to run for months and/or cost \$1–10 million.
Severe Hazard has critical impact, in terms of severity and/or duration. Treatment or remediation effort is required, although some effects may be irreversible. Remediation of environmental contamination would require significant private and public resources. Hazard event would be the subject of widespread community outrage	Permanent changes that are significant at a State or Commonwealth level. Impact likely to be long-term and irreversible. Highly sensitive receiving environment or population. Significant impacts on critical habitats. Surface water/groundwater: Extensive changes to water levels, flow or quality with assets, values or uses irreversibly compromised. Contamination of surface water/groundwater aquifer leading to disruption of beneficial uses as defined by ERS for more than year. Environmental contamination event (of soil-land and/or water) of a magnitude that a State-level incident response is required. Incident response, clean-up and rehabilitation expected to run for years and/or cost ≥\$10 million.

6.1.4 Assigning a likelihood level

'Likelihood' is the combination of the chance of an event and the chance of the identified consequence occurring. The likelihood criteria range from 'rare' where the event and consequence may occur only in exceptional circumstances to 'almost certain' where the event and consequence is expected to occur in most circumstances. Likelihoods are assigned for the maximum credible consequence according to the levels presented in Table 13.

Table 13 Guide to likelihood levels

Descriptor	Explanation
Almost Certain	The event is expected to occur in most normal circumstances. 90% - 100% chance of occurring
Likely	The event will probably occur in most normal circumstances. 70% - 90% chance of occurring
Possible	The event might occur at some time. 30% – 70% chance of occurring
Unlikely	The event could occur at some time. 5% – 30% chance of occurring
Rare	Highly unlikely, but the risk event may occur in exceptional circumstances. Less than 5% chance of occurring

6.1.5 Assigning a level of risk

Risk is defined as combination of the likelihood of an event occurring and the consequence of that event occurring. A risk rating was determined by these factors using the risk matrix, presented in Table 14.

Table 14 Risk matrix

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

When risks are rated as medium or above, the impacts associated with the risk pathway are assessed in an increasing level of detail and would prompt further exploration of potential mitigation and management actions to reduce the overall impact.

Once the risk rating has been established, some risks will need to have controls in place to reduce them to an acceptable level. Higher risk levels should take priority. Table 15 provides guidance on what steps need to be taken depending upon the risk rating.

Table 15 Risk rating acceptability

Risk level	Description
Very High	Totally unacceptable level of risk. Controls must be put in place to reduce the risk to lower levels.
High	Generally unacceptable level of risk. Controls must be put in place to reduce the risk to lower levels.
Medium	May be acceptable provided the risk has been minimised as far as reasonably practicable.
Low	Acceptable level of risk provided the risk cannot be eliminated.

6.2 Risk register

The intent of this risk assessment was to identify the key initial, inferred risks during the design and planning phase, construction phase and operations phase upon the groundwater environment, and, to inform the design aspects of the retarding basins and/or the future development of controls to address these risks. Specifically, this risk assessment demonstrates that these risk mitigation protocols reduce the latent risk to tolerable thresholds in line with industry norms and legislative requirements. The completed risk register for the DM DSS and CFWR DSS has been attached as Table 16 and Table 17 respectively.

Table 16 Devon Meadows DSS Water Risk register

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Design and planning phase								
SRW not endorsing/approving the DSS concept design due to groundwater interception/extraction	Rainfall Groundwater levels within nominally 3 m of ground surface	Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Ground surface Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Possible (C)	Major (2)	High (H)	SRW assessment criteria unknown Preliminary dewatering assessment to be completed to inform potential groundwater inflows and disposal options for proposed stormwater management assets Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) Potential re-design of stormwater management assets
SRW not endorsing/approving the DSS due to infiltration of surface water into the water table	Rainfall Retarding basins, water quality treatment assets, and/or drainage channels hydraulically connected (or 'losing') to the water table	Surface run off Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Possible (C)	Major (2)	High (H)	SRW assessment criteria unknown Preliminary dewatering assessment to be completed to inform potential groundwater inflows and disposal options for proposed stormwater management assets Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) Potential re-design of stormwater management assets Requirements for specific stormwater management asset membrane/lining
Licenses not available to allow for groundwater extraction under the Koo Wee Rup Water Supply Protection Area (WSPA) (managed and administered by SRW)	Construction phase dewatering Stormwater management asset operation	Water table aquifer	Nearby groundwater users GDEs	SRW not endorsing/approving proposed project dewatering SRW adding conditions to approval	Unlikely (D)	Minor (4)	Low (L)	A preliminary dewatering assessment to inform potential groundwater inflows and disposal options for stormwater management assets is pending Any dewatering is likely to be temporary and short term in nature, and therefore the dewatering is considered to pose a low risk to the overall groundwater resource SRW considers construction dewatering as a 'medium impact'. A hydrogeological assessment may be required if bores or GDEs are identified within 1 km or other issues identified. Advertising and neighbour notification applies. Referrals apply if a risk assessment is required in accordance with the Guidelines for Groundwater Licensing & Protecting High Value GDEs. An Irrigation Drainage Plan may be required unless considered low impact. SRW would need to advise whether a dewatering license would be required, based on the findings of the hydrogeological assessment undertaken. It is unlikely that licence entitlements within the WSPA would be considered for temporary, relatively low volume construction dewatering.
The DSS concept design needing to be modified, leading to larger footprints than has been allowed for in the PSP as per the place-based plan at public exhibition	Rainfall Groundwater levels within nominally 3 m of ground surface Surface water storages	Surface run off Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Ground surface Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Unlikely (D)	Major (2)	High (H)	Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) The concept drainage strategy will be designed to minimise the potential interaction with groundwater based on the available groundwater level information at the time of conceptual design, noting that the conceptual design will prioritise the primary function of proposed stormwater management assets. There is risk that as further groundwater level information becomes available that the concept drainage strategy may need to be modified/red-designed. There is risk that following engagement with SRW the concept drainage strategy may need to be modified/re-designed

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Construction phase								
Connection of surface water and groundwater via runoff into the basin during construction	Retarding basins Neighbouring drainage lines	Surface water runoff Surface water – groundwater connection	Water table aquifer Nearby groundwater users GDEs	Impact to quantity and/or quality of groundwater	Possible (C)	Insignificant (5)	Low (L)	Groundwater monitoring to inform retarding basin designs and baseline quality of groundwater Potential requirement to assess quality of surface waters through baseline and construction phase monitoring Risk can be appropriately managed by standard construction controls such as bunding, runoff control
Shallow groundwater encountered during excavation of retarding basin. Dewatering (if required) would cause changes (declines) in groundwater level.	Shallow groundwater	Groundwater extraction via bores, infiltration channels, excavations etc.	Water table aquifer Nearby groundwater users GDEs	Impact to quantity and/or quality of groundwater	Likely (B)	Minor (4)	Medium (M)	Most susceptible for retarding basins located near bores MB01, MB02 and MB03 Likely to be short term dewatering Groundwater monitoring to inform retarding basin designs Preliminary dewatering assessment required to inform dewatering requirements/disposal options
Contaminated groundwater encountered during excavation of retarding basin.	Shallow groundwater	Groundwater extraction via bores, infiltration channels, excavations etc.	Construction workers Water table aquifer Nearby groundwater users GDEs	Adverse effects to construction workers Impact to surface water quality from contaminated groundwater Specific management and disposal requirements for wastewater	Possible (C)	Minor (4)	Medium (M)	Groundwater analysis does not indicate exceedances above adopted recreational criteria (ADWG), however, a comprehensive suite of parameters has not been analysed (e.g., hydrocarbons) owing to no previously identified potential contamination sources. Groundwater monitoring could inform retarding basin designs, through a broader suite of parameters to confirm the absence of contamination. Preliminary dewatering assessment required to inform dewatering requirements/disposal options Construction environment management plan assumed to be implemented
Storage and handling of hazardous materials during construction results in contamination of underlying groundwater	Hazardous materials	Chemical leakage, spills Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users GDEs	Impact to quality of groundwater, surface water	Unlikely (D)	Insignificant (5)	Low (L)	Risk can be appropriately managed by standard construction controls such as spill kits, bunding of chemical storage areas and response procedures. Construction environment management plan assumed to be developed and implemented
Erosion of soil and increased amounts of sediment in surface runoff results in contamination of runoff and receiving waterways	Surface water	Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users GDEs	Impact to quality of groundwater, surface water	Possible (C)	Insignificant (5)	Low (L)	Construction environment management plan assumed to be implemented Appropriate erosion controls and sediment barriers to be implemented
Operation phase								
Shallow groundwater connected to the retarding basin during operation resulting in inflow of groundwater to the basin	Shallow groundwater	Surface water – groundwater connection (gaining stream)	Retarding basin Nearby groundwater users GDEs	Limits basin capacity Impact to groundwater level and quality of surface water	Likely (B)	Minor (4)	Medium (M)	Groundwater level likely to equilibrate resulting in limited drawdown Groundwater monitoring to inform retarding basin designs Based on groundwater level data to date (early August 2024), there is a risk that shallow groundwater will be encountered during the operational phase of stormwater management assets. This may impact the primary function of proposed retarding basins by encroaching on available storage capacity
Potential for surface water runoff to affect groundwater quality through hydraulic connection with the surface water feature i.e., the retarding basin	Surface water Shallow groundwater	Retarding basins Neighbouring drainage lines Surface water runoff Water table aquifer	Nearby groundwater users GDEs Constructed or natural wetlands	Impact to quality of groundwater, surface water	Unlikely (D)	Insignificant (5)	Low (L)	Risk can be appropriately managed by standard operational controls such as bunding, runoff control Groundwater/surface water monitoring recommended during the operation stage to assess water quality

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Connection of surface water and contaminated groundwater i.e., infiltration of contaminated groundwater into retention basin (basin depth is deeper than water table) and/or wetland	Shallow contaminated groundwater	Water table aquifer	Surface water features i.e., wetlands	Impact to surface water quality from contaminated groundwater	Possible (C)	Minor (4)	Medium (M)	This risk event is uncertain and pending sampling and analysis of broader range of chemical parameters Groundwater monitoring to inform retarding basin designs Groundwater/surface water monitoring recommended during the operation stage to assess water quality
Storage and handling of hazardous materials during RB operation results in contamination of underlying groundwater	Hazardous materials	Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users. GDEs	Impact to quality of groundwater, surface water	Unlikely (D)	Insignificant (5)	Low (L)	Operation and maintenance of retarding basin unlikely to require the use and/or storage of hazardous material Risk can be appropriately managed by standard construction controls such as spill kits, bunding of chemical storage areas and response procedures. Operation environment management plan assumed to be implemented.
Elevated salinity in groundwater having an adverse effect on infrastructure (i.e., concrete pipes)	Shallow, saline groundwater	Direct connection/exposure of subsurface project infrastructure with saline groundwater	Subsurface infrastructure (at or below water table)	Degradation of concrete infrastructure (i.e., pipes) due to saline groundwater	Unlikely (D)	Minor (4)	Low (L)	Salinity of groundwater is relatively low (fresh to brackish) The use of concrete piping as part of the RB infrastructure is unlikely

Table 17 Clyde-Five Ways Road DSS Water Risk register

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Design and planning phase								
SRW not endorsing/approving the DSS concept design due to groundwater interception/extraction	Rainfall Groundwater levels within nominally 3 m of ground surface	Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Ground surface Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Possible (C)	Major (2)	High (H)	SRW assessment criteria unknown Preliminary dewatering assessment to be completed to inform potential groundwater inflows and disposal options for proposed stormwater management assets Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) Potential re-design of stormwater management assets
SRW not endorsing/approving the DSS due to infiltration of surface water into the water table	Rainfall Retarding basins and/or drainage channels hydraulically connected (or ‘losing’) to the water table	Surface run off Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Possible (C)	Major (2)	High (H)	SRW assessment criteria unknown Preliminary dewatering assessment to be completed to inform potential groundwater inflows and disposal options for proposed stormwater management assets Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) Potential re-design of stormwater management assets Requirements for specific stormwater management asset membrane/lining
Licenses not available to allow for groundwater extraction under the Koo Wee Rup Water Supply Protection Area (WSPA) (enforced by SRW)	Construction phase dewatering	Water table aquifer	Nearby groundwater users GDEs	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Unlikely (D)	Minor (4)	Low (L)	A preliminary dewatering assessment to inform potential groundwater inflows and disposal options for stormwater management assets is pending Any dewatering is likely to be temporary and short term in nature, and therefore the dewatering is considered to pose a low risk to the overall groundwater resource SRW considers construction dewatering as a ‘medium impact’. A hydrogeological assessment may be required if bores or GDEs are identified within 1 km or other issues identified. Advertising and neighbour notification applies. Referrals apply if a risk assessment is required in accordance with the Guidelines for Groundwater Licensing & Protecting High Value GDEs. An Irrigation Drainage Plan may be required unless considered low impact. SRW would need to advise whether a dewatering license would be required, based on the findings of the hydrogeological assessment undertaken. It is unlikely that licence entitlements within the WSPA would be considered for temporary, relatively low volume construction dewatering.
The DSS concept design needing to be modified, leading to larger footprints than has been allowed for in the PSP as per the place base plan at public exhibition	Rainfall Groundwater levels within nominally 3 m of ground surface Surface water storages	Surface run off Surface water features i.e., retarding basins, drainage channels and dams Surface water infiltration	Ground surface Water table aquifer	SRW not endorsing/approving the DSS concept design SRW adding conditions to approval	Unlikely (D)	Major (2)	High (H)	Potential for additional groundwater investigations Potential requirement for groundwater control during construction and/or operation (e.g., dewatering or passive drainage and disposal) The concept drainage strategy will be designed to minimise the potential interaction with groundwater based on the available groundwater level information at the time of conceptual design, noting that the conceptual design will prioritise the primary function of proposed stormwater management assets. There is risk that as further groundwater level information becomes available that the concept drainage strategy may need to be modified/red-designed. There is risk that following engagement with SRW the concept drainage strategy may need to be modified/re-designed

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Construction phase								
Connection of surface water and groundwater via runoff into the basin during construction	Retarding basins Neighbouring drainage lines	Surface water runoff Surface water – groundwater connection	Water table aquifer Nearby groundwater users GDEs	Impact to quantity and/or quality of groundwater	Possible (C)	Insignificant (5)	Low (L)	Groundwater monitoring to inform retarding basin designs and baseline quality of groundwater Potential requirement to assess quality of surface waters through baseline and construction phase monitoring Risk can be appropriately managed by standard construction controls such as bunding, runoff control
Shallow groundwater encountered during excavation of retarding basin. Dewatering (if required) would cause changes (declines) in groundwater level.	Shallow groundwater	Groundwater extraction via bores, infiltration channels, excavations etc.	Water table aquifer Nearby groundwater users GDEs	Impact to quantity and/or quality of groundwater	Likely (B)	Minor (4)	Medium (M)	Most susceptible for retarding basins located near bore MB09 Likely to be short term dewatering Groundwater monitoring to inform retarding basin designs Preliminary dewatering assessment required to inform dewatering requirements/disposal options
Contaminated groundwater encountered during excavation of retarding basin.	Shallow groundwater	Groundwater extraction via bores, infiltration channels, excavations etc.	Construction workers Water table aquifer Nearby groundwater users GDEs	Adverse effects to construction workers Impact to surface water quality from contaminated groundwater Specific management and disposal requirements for wastewater	Possible (C)	Minor (4)	Medium (M)	Groundwater analysis does not indicate exceedances above adopted recreational criteria (ADWG), however, a comprehensive suite of parameters has not been analysed (e.g., hydrocarbons) owing to no identified potential contamination sources. Groundwater monitoring could inform retarding basin designs, through a broader suite of parameters to confirm the absence of contamination. Preliminary dewatering assessment required to inform dewatering requirements/disposal options Construction environment management plan assumed to be implemented
Storage and handling of hazardous materials during construction results in contamination of underlying groundwater	Hazardous materials	Chemical leakage, spills Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users GDEs	Impact to quality of groundwater, surface water	Unlikely (D)	Insignificant (5)	Low (L)	Risk can be appropriately managed by standard construction controls such as spill kits, bunding of chemical storage areas and response procedures. Construction environment management plan assumed to be developed and implemented
Erosion of soil and increased amounts of sediment in surface runoff results in contamination of runoff and receiving waterways	Surface water	Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users GDEs	Impact to quality of groundwater, surface water	Possible (C)	Insignificant (5)	Low (L)	Construction environment management plan assumed to be implemented Appropriate erosion controls and sediment barriers to be implemented
Operation phase								
Shallow groundwater connected to the retarding basin during operation resulting in inflow of groundwater to the basin	Shallow groundwater	Surface water – groundwater connection (gaining stream)	Retarding basin Nearby groundwater users GDEs	Limits basin capacity Impact to groundwater level and quality of surface water	Likely (B)	Minor (4)	Medium (M)	Groundwater level likely to equilibrate resulting in limited drawdown Groundwater monitoring to inform retarding basin designs Based on groundwater level data to date (early August 2024), there is a risk that shallow groundwater will be encountered during the operational phase of stormwater management assets. This may impact the primary function of proposed retarding basins by encroaching on available storage capacity
Potential for surface water runoff to affect groundwater quality through hydraulic connection with the surface water feature i.e., the retarding basin	Surface water Shallow groundwater	Retarding basins Neighbouring drainage lines Surface water runoff Water table aquifer	Nearby groundwater users GDEs Constructed or natural wetlands	Impact to quality of groundwater, surface water	Possible (C)	Insignificant (5)	Low (L)	Risk can be appropriately managed by standard operational controls such as bunding, runoff control Groundwater/surface water monitoring recommended during the operation stage to assess water quality

Risk Event	Risk source	Risk pathways	Risk receptor	Risk outcome	Initial risk analysis		Level of risk	Comments/mitigation
					Likelihood	Consequence		
Connection of surface water and contaminated groundwater i.e., infiltration of contaminated groundwater into retention basin (basin depth is deeper than water table) and/or wetland	Shallow contaminated groundwater	Water table aquifer	Surface water features i.e., wetlands	Impact to surface water quality from contaminated groundwater	Possible (C)	Minor (4)	Medium (M)	This risk event is uncertain and pending sampling and analysis of broader range of chemical parameters Groundwater monitoring to inform retarding basin designs Groundwater/surface water monitoring recommended during the operation stage to assess water quality
Storage and handling of hazardous materials during RB operation results in contamination of underlying groundwater	Hazardous materials	Retarding basins Neighbouring drainage lines Surface water runoff	Water table aquifer Nearby groundwater users. GDEs	Impact to quality of groundwater, surface water	Unlikely (D)	Insignificant (5)	Low (L)	Operation and maintenance of retarding basin unlikely to require the use and/or storage of hazardous material Risk can be appropriately managed by standard construction controls such as spill kits, bunding of chemical storage areas and response procedures. Operation environment management plan assumed to be implemented.
Elevated salinity in groundwater having an adverse effect on infrastructure (i.e., concrete pipes)	Shallow, saline groundwater	Direct connection/exposure of subsurface project infrastructure with saline groundwater	Subsurface infrastructure (at or below water table)	Degradation of concrete infrastructure (i.e., pipes) due to saline groundwater	Unlikely (D)	Minor (4)	Low (L)	Salinity of groundwater is relatively low (fresh to brackish) The use of concrete piping as part of the RB infrastructure is unlikely

7. Conclusions

To inform the potential locations of stormwater management assets (retarding basins, stormwater quality treatment) as part of the Devon Meadows and Clyde Five Ways Road Development Services Schemes (DSS) (the study area), GHD undertook hydrogeological site investigations to assess groundwater conditions at the study area. Results of the groundwater investigation have been used to identify and assess groundwater related risks associated with the DSS investigation.

Groundwater levels are shallow in the Devon Meadows DSS and the Clyde Five Ways Road DSS, with both DSS areas recording groundwater levels <2 m below ground level (bgl) at some bore locations.

Groundwater salinity in the study area was identified to be fresh to brackish with most environmental values of the ERS (2021) Segment B considered relevant. The absence of saline groundwater suggests low risk relating to salinity impacts on subsurface project infrastructure.

The following **High** groundwater related risks have been identified for the design and planning phase:

- Southern Rural Water not endorsing/approving the DSS concept design as part of the design and planning phase due to potential groundwater interception/extraction and infiltration of surface water into the water table – **High** for both DSS areas
- The DSS concept design needing to be modified, leading to larger footprints than has been allowed for in the PSP place-based plan at public exhibition – **High** for both DSS areas

The following risks have been identified as **Medium** during the construction and operation phases for both DSSs:

- Shallow (potentially contaminated) groundwater is encountered during the construction and operational phase of the retarding basins:
 - Encountered shallow groundwater during the construction phase will require temporary dewatering, potentially resulting in changes (declines) in surrounding groundwater levels (further assessment of potential dewatering requirements will be carried out by GHD as part of the pending preliminary dewatering assessment)
 - Encountered potential contaminated groundwater during the construction phase will need to be managed and disposed of appropriately (further assessment of disposal options is to be carried out by GHD as part of the pending preliminary dewatering assessment, however, analysis of a broader range of chemical parameters may be required)
 - Shallow groundwater connected to the retarding basins/stormwater management assets during operation resulting in inflow of groundwater to retarding basins
 - Encountered potential contaminated groundwater during the operation phase will need to be managed appropriately. However, the event is uncertain and pending sampling and analysis of a broader range of chemical parameters

As part of GHD's monitoring program, hydraulic conductivity testing was conducted in August 2024 and will be incorporated into GHD's pending preliminary dewatering assessment (reported separately).

8. Recommendations

Based on the findings of this report, GHD recommends the following:

- Ongoing groundwater monitoring to establish baseline groundwater level trends across all seasons. This proposed monitoring should continue during project construction and for a period during project operation. This may include the installation of more bores, or replacement of existing bores if damaged, to provide a more targeted understanding of groundwater conditions at proposed stormwater management asset locations.
- A second GME should be undertaken to provide a further understanding of groundwater quality expanded to include a wider range of chemicals of potential concern

9. References

EPA Victoria, 2022: *Groundwater Sampling Guidelines*, EPA Publication 669.1, EPA Victoria 2022

EPA Victoria, 2021: *Environment Reference Standard*. No.S245 Gazette 26 May 2021

EPA Victoria, 2009: *Industrial Waste Resource Guidelines. Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*.

GHD, 2023: *Drainage Strategy for 3 PSP2 in South East Melbourne – Hydrogeological Desktop Assessment*. Report prepared for Melbourne Water Corporation. GHD reference 12568833. August 2023.

National Uniform Drillers Licensing Committee (NUDLC), 2020: *'Minimum Construction Requirements for Water Bores in Australia, 4th Edition'* nominally referred to as the ARMCANZ guidelines. ISBN 978-0-646-81881-8

Appendices

Appendix A

Monitoring bore survey report

Our Ref: 2400895

ACN 006 197 235
ABN 38 006 197 235

19 April 2024

██████████
Hydrologist
GHD
██████████
Melbourne VIC 3000

Melbourne Office
██████████
PO Box 61
Malvern VIC 3144
Tel: (03) ██████████

beveridgewilliams.com.au

Dear ██████████,

RE: MONITORING WELL SURVEY – DEVON MEADOWS

Survey results have been processed and are presented below in both MGA94 and MGA2020 Zone 55 coordinate systems.
Coordinates and levels have been measured by GPS.
Levels have been adjusted to AHD via connection to 3rd order VLN Permanent Marks Sherwood PM 85 (RL.43.062) & Sherwood PM97 (18.388) – SMES 16/04/2024.

MGA94 SURVEY RESULTS

POINT ID	GROUND				POINT ID	TOP OF PVC PIPE (INTERNAL)		
	EASTING	NORTHING	RL			EASTING	NORTHING	RL
MB01-GROUND	351069.85	5775905.31	33.43		MB01-PIPE	351069.95	5775905.45	34.32
MB02-GROUND	351570.68	5776476.93	36.28		MB02-PIPE	351570.62	5776476.56	36.20
MB03-GROUND	352288.54	5776046.42	25.79		MB03-PIPE	352288.68	5776046.21	26.74
MB04-GROUND	351418.12	5777012.45	45.64		MB04-PIPE	351418.23	5777012.62	46.48
MB05-GROUND	352142.37	5777196.48	31.36		MB05-PIPE	352142.26	5777196.30	32.16
MB06-GROUND	352974.63	5777172.65	30.75		MB06-PIPE	352974.40	5777172.61	31.60
MB07-GROUND	352922.30	5776732.66	28.37		MB07-PIPE	352922.05	5776732.71	29.30
MB08-GROUND	352950.97	5775866.81	24.32		MB08-PIPE	352950.93	5775866.54	25.34
MB09-GROUND	353222.85	5774812.86	15.02		MB09-PIPE	353222.85	5774813.11	15.89

MGA2020 SURVEY RESULTS

POINT ID	GROUND				POINT ID	TOP OF PVC PIPE (INTERNAL)		
	EASTING	NORTHING	RL			EASTING	NORTHING	RL
MB01-GROUND	351070.34	5775906.77	33.43		MB01-PIPE	351070.44	5775906.92	34.32
MB02-GROUND	351571.16	5776478.40	36.28		MB02-PIPE	351571.10	5776478.03	36.20
MB03-GROUND	352289.02	5776047.89	25.79		MB03-PIPE	352289.16	5776047.68	26.74
MB04-GROUND	351418.61	5777013.92	45.64		MB04-PIPE	351418.71	5777014.09	46.48
MB05-GROUND	352142.86	5777197.95	31.36		MB05-PIPE	352142.74	5777197.76	32.16
MB06-GROUND	352975.12	5777174.12	30.75		MB06-PIPE	352974.89	5777174.07	31.60
MB07-GROUND	352922.78	5776734.12	28.37		MB07-PIPE	352922.54	5776734.17	29.30
MB08-GROUND	352951.45	5775868.28	24.32		MB08-PIPE	352951.42	5775868.01	25.34
MB09-GROUND	353223.33	5774814.33	15.02		MB09-PIPE	353223.33	5774814.57	15.89

All monitoring points are above-ground casings, except MB02 which is a flush gatic lid.

Thank you for the opportunity to complete this task for you. Should you have any queries please do not hesitate to contact me via [REDACTED] or by phone [REDACTED]
[REDACTED]

Yours faithfully,

A handwritten signature in blue ink, appearing to be 'G2'.

[REDACTED]
Survey Infrastructure Team Leader
BEVERIDGE WILLIAMS

Appendix B

**Bore construction license and bore
completion reports**

COPY OF RECORD IN THE VICTORIAN WATER REGISTER LICENCE TO CONSTRUCT WORKS

under Section 67 of the Water Act 1989

The information in this copy of record is as recorded at the time of printing. Current information should be obtained by a search of the register. The State of Victoria does not warrant the accuracy or completeness of this information and accepts no responsibility for any subsequent release, publication or reproduction of this information.

This licence does not remove the need to apply for any authorisation or permission necessary under any other Act of Parliament with respect to anything authorised by the works licence.

Water used under this licence is not fit for any use that may involve human consumption, directly or indirectly, without first being properly treated.

This licence is not to be interpreted as an endorsement of the design and/or construction of any works (including dams). The Authority does not accept any responsibility or liability for any suits or actions arising from injury, loss, damage or death to person or property which may arise from the maintenance, existence or use of the works.

Each person named as a licence holder is responsible for ensuring all the conditions of this licence are complied with.

This licence authorises its holders to construct the described works, subject to the conditions.

Licence Holder(s)

[REDACTED]

Licence Contact Details

[REDACTED] [REDACTED]
[REDACTED]

Licence Details

Expiry date	14 Mar 2025
Status	Active
Authority	Southern Rural Water
Name of waterway or aquifer	NA for construct/decommission
Water system	Koo Wee Rup (GMU)

Summary of Licensed Works

The details in this section are a summary only. They are subject to the conditions specified in this licence.

<i>Works ID</i>	<i>Works type</i>	<i>Use of water</i>
WRK143257	Bore	Observation
WRK143258	Bore	Observation
WRK143259	Bore	Observation
WRK143260	Bore	Observation
WRK143261	Bore	Observation
WRK143262	Bore	Observation
WRK143263	Bore	Observation
WRK143264	Bore	Observation
WRK143265	Bore	Observation

Description of Licensed Works

WORKS ID WRK143257

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
351075.610	5775897.672	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143258

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
352288.557	5776042.738	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143259

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
353218.111	5774808.650	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143260

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
352948.430	5775863.904	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143261

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
352975.389	5777169.547	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143262

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
351571.248	5776474.351	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143263

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
352138.915	5777189.583	Zone 55

Land description

[REDACTED]
[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143264

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
352921.797	5776731.374	Zone 55

Land description

[REDACTED]

Property address

[REDACTED]

Description of Licensed Works

WORKS ID WRK143265

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	50.000 metres

Works location

<i>Easting</i>	<i>Northing</i>	<i>Zone MGA</i>
351423.728	5777010.212	Zone 55

Land description

[REDACTED]

Property address

[REDACTED]

Related Instruments

Related entitlements	Nil
Related water-use entities	Nil

Application History

<i>Reference</i>	<i>Type</i>	<i>Status</i>	<i>Lodged date</i>	<i>Approved date</i>	<i>Recorded date</i>
WLI619620	Issue	Approved	14 Mar 2024	14 Mar 2024	

Conditions

Licence WLE087395 is subject to the following conditions:

Siting and construction

- 1 The bore(s) must be drilled at the location specified in the application approved by the Authority.
- 2 If after drilling the bore is considered unsatisfactory a replacement bore may be drilled on the land specified in the licence.

Preventing pollution

- 3 All earthworks must be carried out, and all drilling fluids and waters produced during construction and development must be disposed of, in ways that avoid contaminating native vegetation, waterways, aquifers, the riparian environment, the riverine environment or other people's property.
- 4 Construction must stop immediately if the Authority reasonably believes that fuel, lubricant, drilling fluid, soil or water produced during construction and development is at risk of being spilled into native vegetation, waterways, aquifers, the riparian environment, the riverine environment or other people's property.
- 5 The licence holder must construct and maintain bund walls, in accordance with the timeframe, specifications, guidelines or standards prescribed by the Authority, to prevent fuel, lubricant, drilling fluid, soil or water produced during construction and development from being spilled into native vegetation, waterways, aquifers, the riparian environment, the riverine environment or other people's property.

Construction standards

- 6 The bore(s) must be constructed, and where relevant decommissioned, in accordance with the Minimum Construction Requirements for Water Bores in Australia, Edition 4 or its successor.

Drilling licence and supervision requirements

- 7 The bore(s) must be constructed by, or under the direct supervision of, a driller licensed under the Water Act 1989 and endorsed as a Class 1, 2, or 3 driller, with appropriate endorsements.
- 8 If artesian pressure is expected or encountered, then a driller licensed under the Water Act 1989, and endorsed as a class 3 driller, must install casing in the bore(s) to a suitable depth, and in a suitable manner, to prevent its outbreak. A suitable valve must also be fitted to the bore.

Bore completion report

- 9 A Bore Completion Report must be submitted to the Authority within 28 working days of the bore(s) being completed.

Protecting water resources

- 10 No more than 9 bore(s) may be brought to final development under this licence.
- 11 At the completion of drilling and before the drilling rig leaves the site, all but 9 bore(s) must be decommissioned so as to eliminate physical hazards, conserve aquifer yield, prevent groundwater contamination and prevent the intermingling of desirable and undesirable waters.
- 12 The bore(s) must be located at least 30 metres from any authority's channel, reserve or easement unless authorised by the Authority.

Protecting water quality

- 13 Drilling must not exceed the maximum depth.
- 14 The bore(s) must be constructed so as to prevent aquifer contamination caused by vertical flow outside the casing.
- 15 If two or more aquifers are encountered, the bore(s) must be constructed to ensure that an impervious seal is made and maintained between each aquifer to prevent aquifer connection through vertical flow outside the casing; under no circumstances are two or more aquifers to be screened within the one bore or in any other manner to allow connection between them.
- 16 Boreheads must be constructed, to ensure that no flood water, surface runoff or potential

subsurface contaminated soakage can enter the bore or bore annulus.

Protecting other water users

- 17 The diameter of the drill casing must not exceed 130 millimetres.
- 18 The bore(s) must be constructed so that water levels in the bore(s) can be measured by an airline, a piezometer or a method approved in writing by the Authority.

Fees and charges

- 19 The licence holder must, when requested by the Authority, pay all fees, costs and other charges under the Water Act 1989 in respect of this licence.

END OF COPY OF RECORD

Bore Completion Report (BCR)

BCR number

BCR040392

Report status

Approved

Works/bore ID

WRK143257

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

9.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

20/03/2024

Date work completed

20/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

351074.632

Northing

5775896.651

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	9.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	6.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	6.0	9.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	4.5	1.0	40.0	POURED			
Bentonite	4.5	5.5						
Gravel	5.5	9.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

9.0

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	9.0

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040393

Report status

Approved

Works/bore ID

WRK143258

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

7.5

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

18/03/2024

Date work completed

18/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

352288.557

Northing

5776042.738

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	7.5	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	6.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	6.0	7.5	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	2.5	1.0	20.0	POURED			
Bentonite	2.5	3.5						
Gravel	3.5	7.5						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

7.5

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	7.5

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040394

Report status

Approved

Works/bore ID

WRK143259

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

9.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

19/03/2024

Date work completed

19/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

353217.133

Northing

5774807.629

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	9.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	6.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	6.0	9.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	4.5	1.0	40.0	POURED			
Bentonite	4.5	5.5						
Gravel	5.5	9.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

To(m):

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	9.0

Supporting Documents

Bore Completion Report (BCR)

BCR number

BCR040395

Report status

Approved

Works/bore ID

WRK143260

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

10.5

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

20/03/2024

Date work completed

20/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

352948.430

Northing

5775863.904

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	10.5	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	5.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	5.0	8.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	3.5	1.0	20.0	POURED			
Bentonite	3.5	4.5						
Gravel	4.5	8.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

10.5

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	10.5

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040396

Report status

Approved

Works/bore ID

WRK143261

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

9.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

21/03/2024

Date work completed

21/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

352975.389

Northing

5777169.547

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	9.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	6.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	6.0	9.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	4.5	1.0	40.0	POURED			
Bentonite	4.5	5.5						
Gravel	5.5	9.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

9.0

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	9.0

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040397

Report status

Approved

Works/bore ID

WRK143262

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

8.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

21/03/2024

Date work completed

21/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

351571.248

Northing

5776474.351

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	8.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	2.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	2.0	5.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Gatic cover

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	1.5	1.0	20.0	POURED			
Bentonite	1.5	2.5						
Gravel	2.5	5.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

8.0

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	8.0

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040398

Report status

Approved

Works/bore ID

WRK143263

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

9.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

22/03/2024

Date work completed

22/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

352138.915

Northing

5777189.583

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	9.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	6.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	6.0	9.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	4.5	1.0	40.0	POURED			
Bentonite	4.5	5.5						
Gravel	5.5	9.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

9.0

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	9.0

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040399

Report status

Approved

Works/bore ID

WRK143264

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

15.0

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

21/03/2024

Date work completed

21/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

352921.797

Northing

5776731.374

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	15.0	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)
-------------	----------	--------	------------------	------------------	---------------	--------------------	-------------------	-------------------

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	TradeName
Casing	0.0	9.0	50.4	60.4	PVC -U PN 18		Butthead
Screen	9.0	15.0	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	7.5	2.0	60.0	POURED			
Bentonite	7.5	8.5						
Gravel	8.5	15.0						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

15.0

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	15.0

Supporting Documents[Close](#)

Bore Completion Report (BCR)

BCR number

BCR040400

Report status

Approved

Works/bore ID

WRK143265

Works licence number

WLE087395

Licence Holder

MELBOURNE WATER

Drillers name

[REDACTED]

Alternate bore ID

Name of plant operator

Bore type

Drilled bore

Drilled depth (m)

7.5

Type of work carried out

Construct

Was bore decommissioned?

☐ Yes ☒ No

Bore use

Observation

Date work commenced?

20/03/2024

Date work completed

21/03/2024

Bore Location

Property address

[REDACTED]

Ground water management unit

Koo Wee Rup (GMU)

Easting

351422.750

Northing

5777009.191

Zone

55

Datum

MGA94

Drilling Technique

Method	From (m)	To (m)	Bit Diam (mm)
Mechanical auger	0.0	7.5	150.0

Water Intersection

Test Method	From (m)	To (m)	Static level (m)	Est rate (l/sec)	Draw down (m)	Casing at test (m)	Depth at test (m)	EC at 25C (μS/cm)

Casing and screens

Type	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Apeture (mm)	TradeName
Casing	0.0	4.5	50.4	60.4	PVC -U PN 18		Butthead
Screen	4.5	7.5	50.4	60.4	PVC SCREEN	0.4	Butthead

Fittings

Well head fitting

Monument

Base of casing

Endcap

Grouting and filter pack

Material	From (m)	To (m)	Cement (bags)	Water (liters)	Cement installation method	Seal/packer type	Outer diam of seal (mm)	Filter pack gain size (mm)
Cement	0.0	2.5	1.0	20.0	POURED			
Bentonite	2.5	3.5						
Gravel	3.5	7.5						4.0

Final bore development

Method	Yield (l/sec)	Draw down (m)	Pumping time (min)	Recovery time (min)	Final static level (m)	EC at 25C (μS/cm)
						0.0

Driller pumping test

Method	Static level (m)	Yield (l/sec)	Pumping level (m)	Draw down (m)	Pumping time (min)	Recovery time (min)	EC at 25C (µS/cm)
					0.0		0.0

Samples☒ Material samples have been taken

From(m):

0.0

To(m):

7.5

☐ Water Samples have been taken

Samples taken by:

Disinfection☐ The bore was disinfected**Drillers log**

Material	From (m)	To (m)
CLAY	0.0	7.5

Supporting Documents[Close](#)

Appendix C

Borehole photographs

WRK143257 (MB01)



WRK143262 (MB02)



WRK143258 (MB03)



WRK143265 (MB04)



WRK143263 (MB05)



WRK143261 (MB06)



WRK143264 (MB07)



WRK143260 (MB08)





Appendix D

Lithological logs and bore construction

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water

Project : 3 PSP - Devon Meadows Groundwater Investigation

HOLE No. MB01

SHEET 1 OF 1

Location : [REDACTED]

Position : 351070.0 E 5775905.4 N GDA94 55

Surface RL: 33.43m AHD

Angle from Horiz. : 90°

Processed : [REDACTED]

Rig Type : Geoprobe

Mounting: Track

Contractor : Star Drilling

Driller : [REDACTED]

Checked : [REDACTED]

Date Started : 21/3/2024

Date Completed : 21/3/2024

Logged by : [REDACTED]

Date: 22/04/2024

DRILLING					MATERIAL							WELL PIEZOMETER	
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
	Hand Auger				0.00 (33.43)			TOPSOIL	D				Well cover - plastic lockable monument/standpipe
					0.50 (32.93)			Sandy SILT; Light brown, dry, loose, contains rootlets. Sand, fine to coarse, well graded, quartz					Cement bentonite (3%) grout
1					0.90 (32.53)			Sandy SILT; Light grey, dry, loose, contains rootlets. Sand, medium to coarse, quartz					Class 18 uPVC 50 mm diam. casing
			✓		2.00 (31.43)			Silty CLAY some sand; Grey mottled orange, dry, stiff (crumbly), low plasticity (when wetted), contains rootlets. Sand, fine					Bentonite seal
2					3.00 (30.43)			Silty CLAY; Grey mottled orange, dry, soft, moderate plasticity			Harder drilling		
3					4.00 (29.43)			Clayey sandy SILT; Orange, dry, low plasticity. Sand, very fine					
					5.00 (28.43)			Sandy SILT minor clay; Orange brown, moist, soft / cohesive. Sand, very fine	M				8/16 gravel pack
4					6.00 (27.43)			As above with some grey mottles, silt is dilatant					Class 18 uPVC 50 mm diam. slotted casing
5					7.00 (26.43)			Sandy SILT; Orange, wet (sloppy). Sand, medium to coarse, angular, quartz and basalt	W				End Cap
6					8.00 (25.43)			Sandy SILT; Orange, wet. Sand, coarse, angular, quartz and basalt					Hole collapsed
7					9.00 (24.43)			Sandy gravelly CLAY; Orange, wet. Sand, coarse / gravel, fine, angular, quartz and basalt					
8					End of borehole at 9.00 metres. Target Depth								
9													
10													

See standard sheets for details of abbreviations & basis of descriptions



GHD

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.

12568833

GEO BOREHOLE - AS1726 2017 12568833 DEVON MEADOWS BH LOGS.GPJ GHD TEMPLATE 2.00 GDT 1/1/24

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water

Project : 3 PSP - Devon Meadows Groundwater Investigation

Location :

HOLE No. MB02

SHEET 1 OF 1

Position : 351570.6 E 5776476.6 N GDA94 55

Surface RL: 36.28m AHD

Angle from Horiz. : 90°

Processed :

Rig Type : Geoprobe

Mounting: Track

Contractor : Star Drilling

Driller :

Checked :

Date Started : 22/3/2024

Date Completed : 22/3/2024

Logged by :

Date: 22/04/2024

DRILLING					MATERIAL							WELL PIEZOMETER	
SCALE (m)	Drilling Method	Hole Support \\ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
1	Hand Auger				0.40 (35.88)			Silty SAND; Grey brown, dry, contains rootlets. Sand, fine to coarse, well graded, subround, quartz	D				Well cover - flush mounted gatic
1					1.20 (35.08)			Silty SAND; orange, dry, cemented in areas (coarse gravel size). Sand, fine to coarse, well graded, angular, quartz	M				Class 18 uPVC 50 mm diam. casing
2								SAND; Grey brown, moist, loose. Sand, fine to coarse, well graded, subround to round, quartz with black specs					Cement bentonite (3%) grout
3					3.00 (33.28)			As above, wet	W				Bentonite seal
4					4.00 (32.28)			Silty SAND minor clay; Grey, wet, slightly cohesive. Sand, fine to coarse, subround to round					8/16 gravel pack
5					5.00 (31.28)			Silty SAND some clay; Grey, wet, slightly cohesive. Sand, fine to medium, subround to round, quartz					Class 18 uPVC 50 mm diam. slotted casing
6					6.00 (30.28)			As above with minor clay nodules (low plasticity)					Hole collapsed around screen
7													End Cap
8					7.50 (28.78)			End of borehole at 7.50 metres. Target Depth					Hole collapsed
9													
10													

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB03**SHEET 1 OF 1**

Position : 352288.7 E 5776046.2 N GDA94 55 **Surface RL:** 25.79m **AHD** **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 18/3/2024 **Date Completed :** 18/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
0.30 (25.49)	Hand Auger	V	V		0.30 (25.49)			TOPSOIL; Sandy Silt, grey, dry, loose, contains rootlets. Sand, fine	D				Well cover - plastic lockable monument/standpipe
1.00 (24.79)							Silty SAND; Grey brown, dry, loose. Sand, fine to medium		Cement bentonite (3%) grout				
2.00 (23.79)					Silty CLAY; Grey orange, dry, firm, moderate plasticity, trace organics		Class 18 uPVC 50 mm diam. casing						
3.00 (22.79)					Silty CLAY minor sand; Grey with orange streaks, dry, firm, low plasticity. Sand, fine		Bentonite seal						
4.00 (21.79)					Clayey silty SAND; Brown orange, moist, loose, non-plastic. Sand, fine to coarse, well graded	M							
5.00 (20.79)					Silty SAND some clay; Brown orange, moist, loose								
6.00 (19.79)					Clayey SAND some silt; Brown orange, wet, soft, very low plasticity	W	8/16 gravel pack						
7.00 (18.79)					Silty SAND some clay; Grey, wet (sloppy). Sand, fine		Class 18 uPVC 50 mm diam. slotted casing						
8.00 (17.79)	Solid Flight Auger				8.00 (17.79)			Clayey SAND some silt; Orange, wet (sloppy). Sand, fine				End Cap	
								End of borehole at 8.00 metres. Target Depth					
9													
10													

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**12568833**

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB04

SHEET 1 OF 1

Position : 351418.2 E 5777012.6 N GDA94 55 **Surface RL:** 45.64m AHD **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 19/3/2024 **Date Completed :** 19/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
0.20 (45.44) 0.50 (45.14) 0.90 (44.70) 1.00 (44.64)	Hand Auger							TOPSOIL; Sandy SILT with bark, dry, loose	D				Well cover - plastic lockable monument/standpipe
								As above with less bark					
2.00 (43.64)	Solid Flight Auger							Silty SAND; Brown, dry, loose, trace organics. Sand, fine, mostly quartz with some basalt [FILL]	M				Cement bentonite (3%) grout
								Silty SAND; Brown grey, dry, loose. Sand, fine to medium, mostly quartz with some basalt					
								Silty SAND; Brown orange, moist, loose. Sand, medium to coarse, subangular, quartz with indurated clay					
								Silty SAND trace clay; Orange, moist, loose. Sand, medium to coarse, quartz with clay nodules (nodules non-plastic)					
5.00 (40.64)								Sandy SILT minor clay; Orange, moist, loose. Sand, fine, quartz - increases to some clay at 6.0 m					
7.00 (38.64)								Silty CLAY some sand; Orange grey, dry, firm, low plasticity. Sand, fine	D				
8.00 (37.64)								Clayey SILT some sand; Orange, moist, soft, non-plastic. Sand, fine, quartz	M				
9.00 (36.64)								Sandy SILT some clay; Orange, dry, soft, slightly cohesive. Sand, very fine	D				
10.00 (35.64)								Clayey SILT minor sand; Orange, moist, soft, slightly cohesive. Sand, very fine	M				
11.00 (34.64)								Silty CLAY; Orange with grey streaks, dry, soft, low plasticity	D				
12.00 (33.64)	Silty CLAY trace sand; Orange, dry, soft, low plasticity	D											
13.00 (32.64)	Silty CLAY; Grey, wet, firm, moderate plasticity	W											
15.00 (30.64)								End of borehole at 15.00 metres. Target Depth					End Cap

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**12568833**

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water

Project : 3 PSP - Devon Meadows Groundwater Investigation

HOLE No. MB05

SHEET 1 OF 1

Location : [REDACTED]

Position : 352142.3 E 5777196.3 N GDA94 55

Surface RL: 31.36m AHD

Angle from Horiz. : 90°

Processed : [REDACTED]

Rig Type : Geoprobe

Mounting: Track

Contractor : Star Drilling

Driller : [REDACTED]

Checked : [REDACTED]

Date Started : 20/3/2024

Date Completed : 20/3/2024

Logged by : [REDACTED]

Date: 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER				
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components	
0 1 2 3 4 5 6 7 8 9 10	Hand Auger				0.20 (31.16)			TOPSOIL; Sandy SILT, brown, dry, firm, contains rootlets. Sand, fine Clayey SILT minor sand; Brown, dry, firm / brittle (crumbly), non-plastic. Sand, fine	D				Well cover - plastic lockable monument/standpipe	
	Solid Flight Auger				1.00 (30.36)			CLAY some silt; Brown mottled orange, dry, stiff, contains rootlets					Cement bentonite (3%) grout	
					2.00 (29.36)			CLAY some silt; Dark grey, dry, soft, moderate plasticity, contains minor indurated fine gravel clay fragments					Class 18 uPVC 50 mm diam. casing	
													Bentonite seal	
						5.00 (26.36)			Silty CLAY; Orange, moist, soft, low plasticity, contains some indurated fine gravel clay fragments					8/16 gravel pack
						6.00 (25.36)			CLAY / SILT; Orange brown, indurated fragments of clay / weathered rock throughout					Class 18 uPVC 50 mm diam. slotted casing
						7.00 (24.36)			SILT / CLAY (residual rock); Brown, fragments of extremely weathered basalt, wet. Basalt fragments are fine gravel size, angular, brittle	W				
						7.40 (23.96)			End of borehole at 7.40 metres. Target Depth					End Cap

See standard sheets for details of abbreviations & basis of descriptions



GHD

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.

12568833

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB06

SHEET 1 OF 1

Position : 352974.4 E 5777172.6 N GDA94 55 **Surface RL:** 30.75m AHD **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 18/3/2024 **Date Completed :** 18/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
0.00 (30.75)	Hand Auger				0.00 (30.75)			TOPSOIL	D				Well cover - plastic lockable monument/standpipe
1.00 (29.75)							FILL; Silty SAND some gravel, dry. Sand, fine. Gravel, fine to coarse, angular						
2.00 (28.75)	Solid Flight Auger				2.00 (28.75)			SAND minor gravel; Light grey, dry. Sand fine to medium. Gravel, fine to coarse, angular	M				Cement bentonite (3%) grout
3.00 (27.75)							SAND trace silt; Light grey brown, moist, soft. Sand fine to moderate, quartz with dark specs	D					
4.00 (26.75)							Silty CLAY some sand; Brown with orange streaks, dry, firm, moderate plasticity. Sand, fine						
5.00 (25.75)							Silty sandy CLAY; Brown orange, dry, firm, low plasticity. Sand, fine to medium						
6.00							Silty CLAY some sand; Grey orange, dry, firm, moderate plasticity. Sand, fine						
7.00							Silty CLAY; Brown orange, dry, soft, moderate plasticity						
8.00													
9.00 (21.75)							SILT / CLAY trace sand; Brown orange, moist, very soft. Sand, fine						
10.00 (20.75)							As above but wet	W					
11.00 (19.75)							Silty CLAY trace sand; Brown orange, wet, soft, moderate plasticity						
11.50 (19.25)			End of borehole at 11.50 metres. Target Depth					End Cap					
12													
13													

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**12568833**

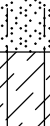
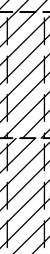
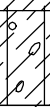
BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB07

SHEET 1 OF 1

Position : 352922.1 E 5776732.7 N GDA94 55 **Surface RL:** 28.37m AHD **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 20/3/2024 **Date Completed :** 20/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
1	Hand Auger				0.00 (28.10)			TOPSOIL	D				Well cover - plastic lockable monument/standpipe
2	Solid Flight Auger		W		1.00 (27.37)			Silty SAND some gravel; Brown grey, dry, loose, contains rootlets. Sand, fine to coarse, well graded, quartz, subrounded, basalt, angular. Gravel, medium to coarse (aggregated), angular					
2.00 (26.37)							Silty SAND trace clay; Light brown, dry, loose. Sand, fine to coarse, well graded, quartz, subrounded	M				Cement bentonite (3%) grout	
3.00 (25.37)							Silty SAND some clay; Dark brown, moist, loose. Sand, fine to medium, quartz, subrounded. Clay (nodules), brown orange, low plasticity						
4.00 (24.37)							Clayey SILT; Orange grey, moist. Silt, orange, loose. Clay, grey, soft, low plasticity					Class 18 uPVC 50 mm diam. casing	
5.00 (23.37)							CLAY / SILT; Orange grey, moist, soft to firm, low plasticity. Silt crumbly texture						
6.20 (22.17)							Silty CLAY; Grey streaked brown, dry, soft, moderate plasticity	D				Bentonite seal	
8.00 (20.37)							Silty CLAY; Grey, wet, soft, low to moderate plasticity	W					
9.00 (19.37)							As above but brown					8/16 gravel pack	
10.00 (18.37)							Clayey gravelly SILT; Brown, coarse sand to fine gravel, basalt, angular					Class 18 uPVC 50 mm diam. slotted casing	
11									10.75 (17.62)			End of borehole at 10.75 metres. Target Depth	

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**12568833**

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB08

SHEET 1 OF 1

Position : 352950.9 E 5775866.5 N GDA94 55 **Surface RL:** 24.32m **AHD** **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 19/3/2024 **Date Completed :** 19/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL							WELL PIEZOMETER		
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components	
0	Hand Auger		▽		0.40 (24.22)			FILL; Silty SAND minor gravel, brown, dry, loose. Sand, medium to coarse, subround to angular. Gravel, fine to medium, basalt, vesicular, angular	D		Drilling softens at 7 m with minimal returns		Well cover - plastic lockable monument/standpipe	
1					1.00 (23.32)			Silty SAND; Brown, dry, loose, trace organics. Sand, fine to coarse, well graded, quartz	M				Cement bentonite (3%) grout	
2	2.00 (22.32)						Silty SAND trace clay; Orange dark brown, moist, loose. Sand, medium to coarse, quartz, subround to angular					Class 18 uPVC 50 mm diam. casing		
3	3.00 (21.32)						Sandy SILT minor clay; Light orange, moist, soft. Sand, very fine							
4	4.00 (20.32)						As above but dark orange							Bentonite seal
5	6.00 (18.32)						Silty SAND; Orange, moist, medium dense (cohesive). Sand, very fine (gritty)							
6	7.00 (17.32)						SILT / SAND; Orange, moist, medium dense (dilatent). Sand, very fine (gritty)							Class 18 uPVC 50 mm diam. slotted casing
7	8.00 (15.32)						Clayey SILT some sand; Orange, wet, soft. Sand, very fine (gritty). Clay, low plasticity	W					8/16 gravel pack	
8	9.00 (15.32)						Clayey sandy SILT; Orange, wet, sloppy. Sand, very fine (gritty)						End Cap	
9	10.00 (14.32)						End of borehole at 10.00 metres. Target Depth						Backfilled gravel pack	
10														
11														
12														

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

Job No.**12568833**

BOREHOLE LOG SHEET WITH WELL PIEZOMETER

Client : Melbourne Water
Project : 3 PSP - Devon Meadows Groundwater Investigation
Location : [REDACTED]

HOLE No. MB09**SHEET 1 OF 1**

Position : 353222.8 E 5774813.1 N GDA94 55 **Surface RL:** 15.02m AHD **Angle from Horiz. :** 90° **Processed :** [REDACTED]
Rig Type : Geoprobe **Mounting:** Track **Contractor :** Star Drilling **Driller :** [REDACTED] **Checked :** [REDACTED]
Date Started : 21/3/2024 **Date Completed :** 21/3/2024 **Logged by :** [REDACTED] **Date:** 22/04/2024

DRILLING					MATERIAL					WELL PIEZOMETER			
SCALE (m)	Drilling Method	Hole Support \ Casing	Water	Samples & Tests	Depth/(RL) metres	Graphic Log	USC Symbol	Description [FILL/TOPSOIL/COBBLES/BOULDERS/-] SOIL NAME: plasticity / primary particle characteristics, colour, secondary and minor components, zoning (origin) and ROCK NAME: grain size, colour, fabric / texture, inclusions or minor components, durability, strength, weathering / alteration, defects	Moisture Condition	Consistency / Density Index	Comments/ Observations	WELL PIEZOMETER Log	Components
1	Hand Auger				0.90 (14.12)			Sandy SILT; Light grey, dry, loose, contains rootlets. Sand, fine, with some fine basalt gravels [FILL], angular	D				Well cover - plastic lockable monument/standpipe
2								Silty CLAY; Orange grey, dry, soft, low plasticity					Class 18 uPVC 50 mm diam. casing
3					3.00 (12.02)			Sandy SILT minor clay; Grey, moist, soft. Sand, very fine	M				Cement bentonite (3%) grout
4					4.00 (11.02)			Sandy SILT; Grey, moist, soft. Sand, fine to coarse, well graded, quartz, subrounded					Bentonite seal
5					5.00 (10.02)			Silty SAND; Grey, moist, soft. Sand, very fine matrix with coarse quartz sand					8/16 gravel pack
6								Silty SAND minor clay; Grey mottled orange, wet, soft. Sand, very fine matrix with coarse quartz sand					Class 18 uPVC 50 mm diam. slotted casing
7					7.00 (8.02)			Silty SAND; Grey, wet (sloppy). Sand, very fine matrix with coarse quartz sand					Hole collapsed around screen
8					8.00 (7.02)			Silty SAND; Grey, wet (sloppy). Sand, very fine matrix with coarse quartz sand					End Cap
9					9.00 (6.02)			End of borehole at 9.00 metres. Target Depth					
10													

See standard sheets for details of abbreviations & basis of descriptions

**GHD**

CONSULTING GEOTECHNICAL ENGINEERS AND GEOLOGISTS

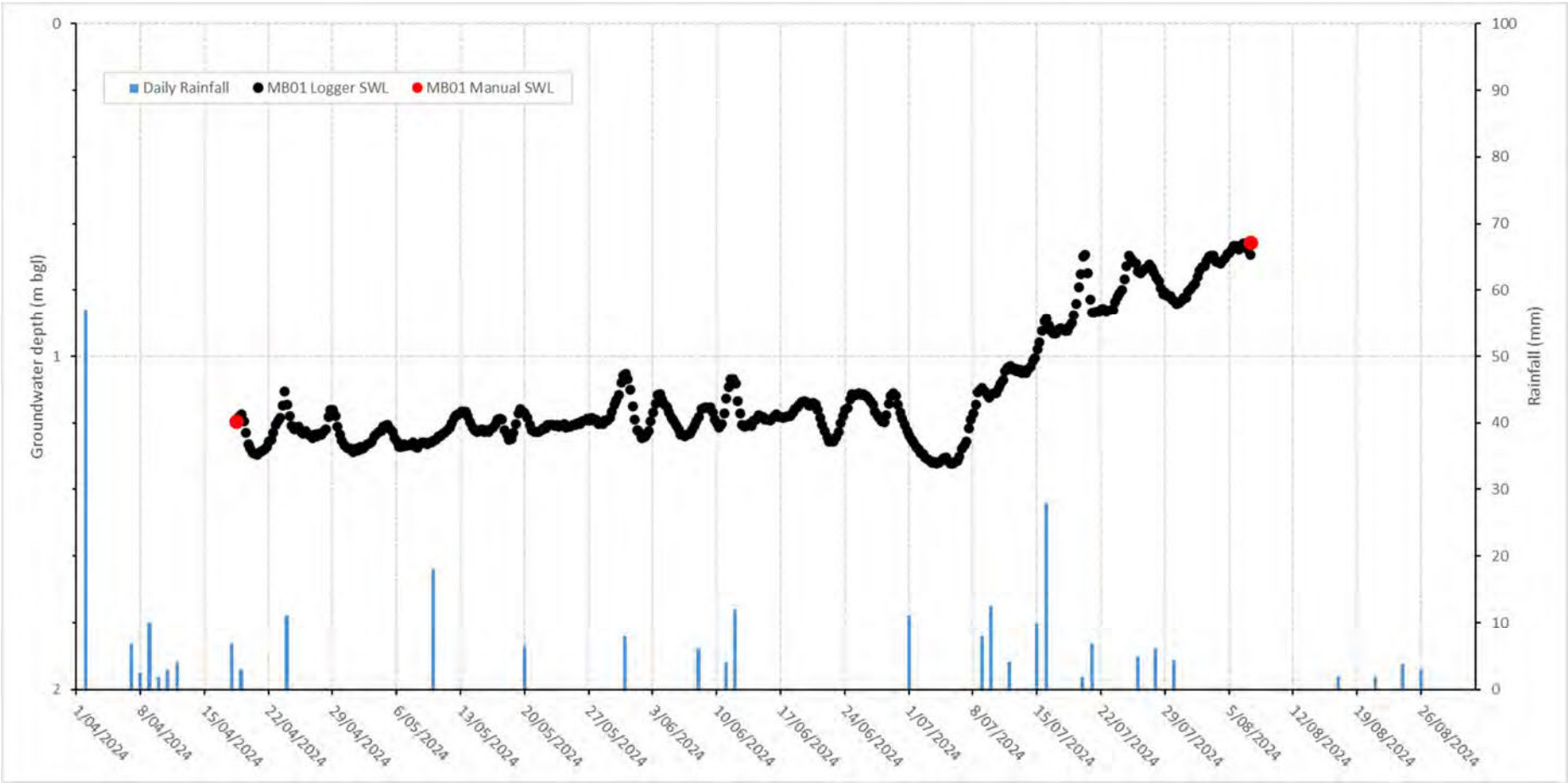
Job No.**12568833**

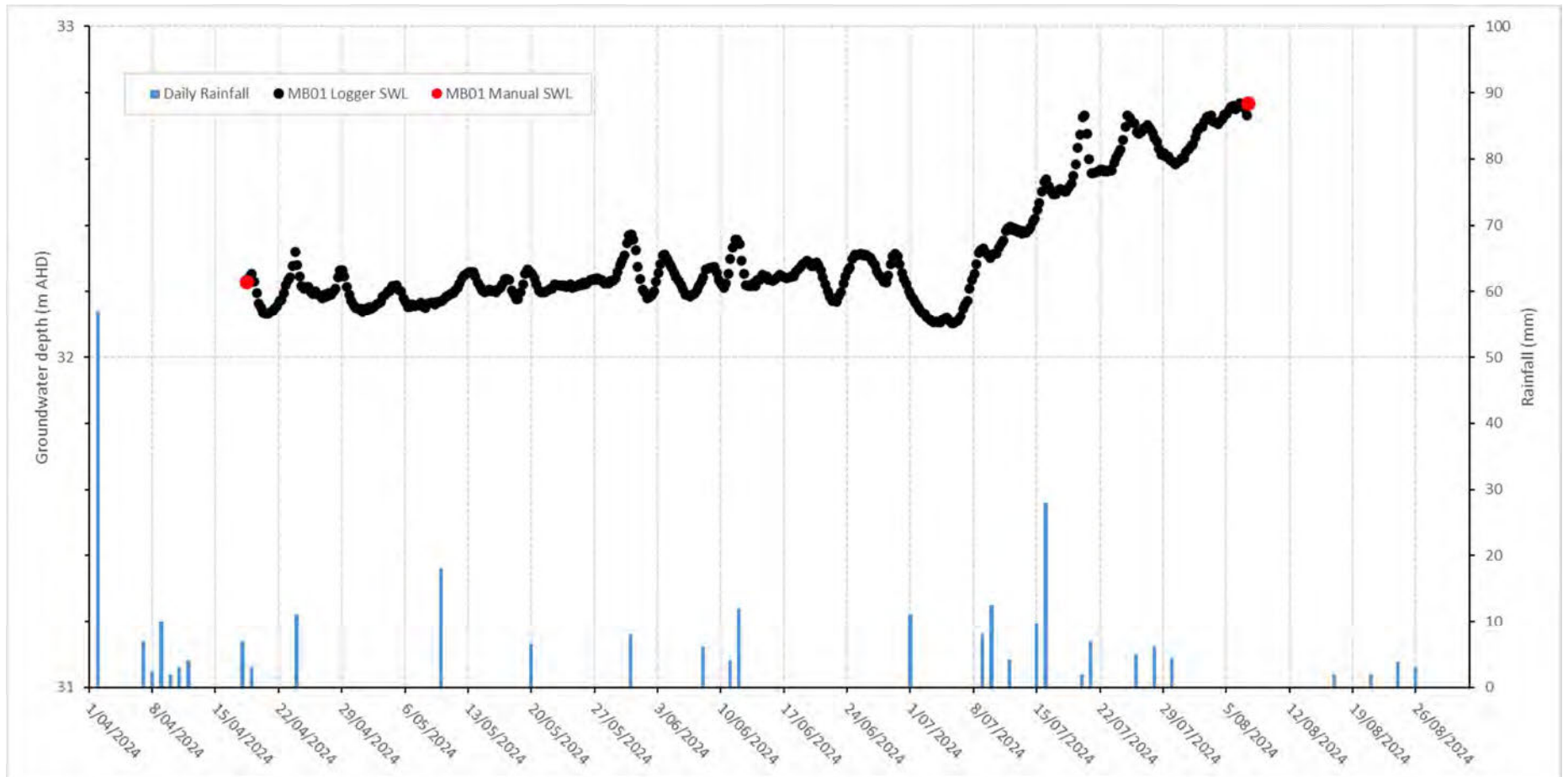
Appendix E

Hydrographs

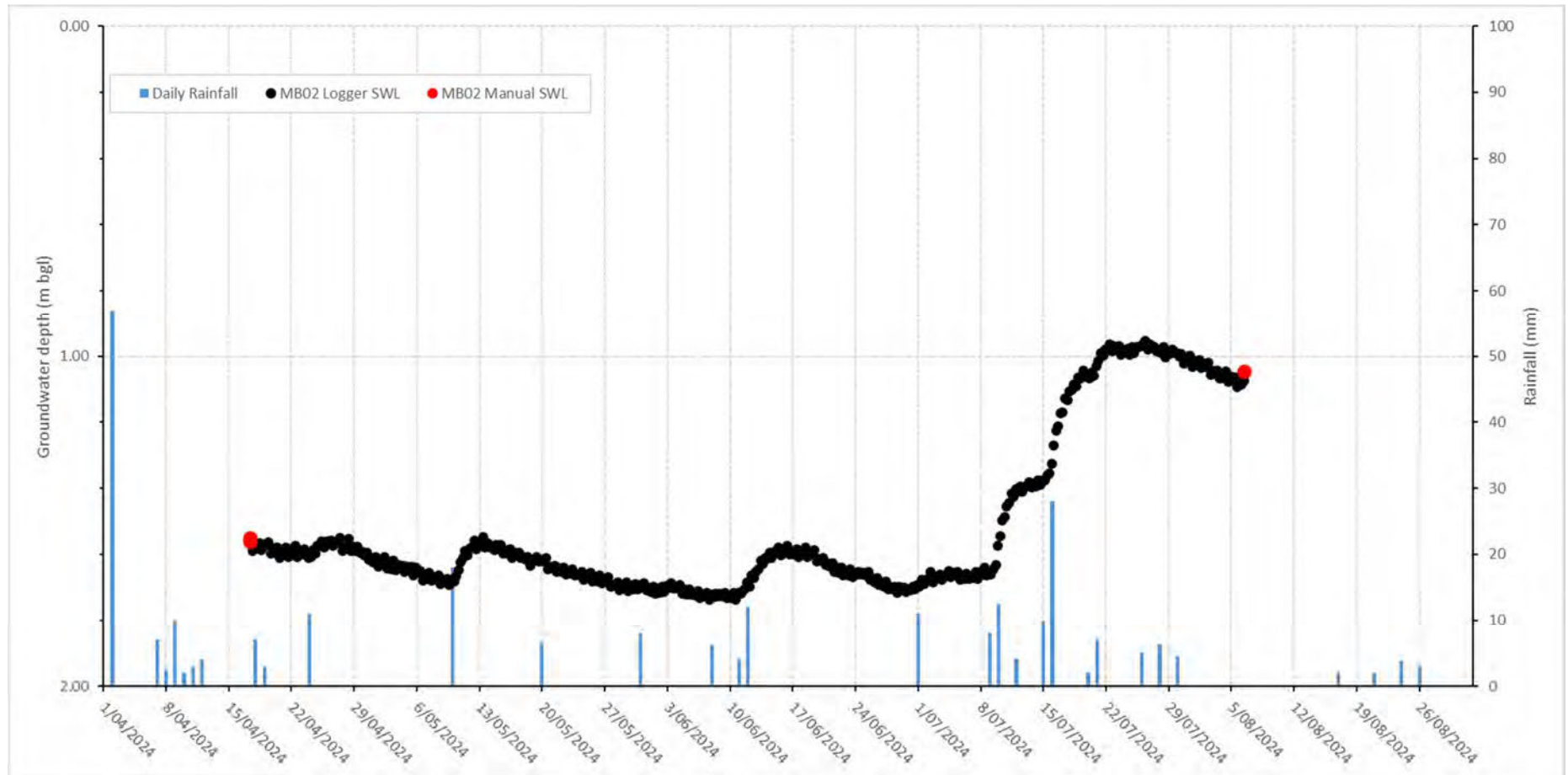
Note: rainfall data from Bonbeach (086210) weather station.

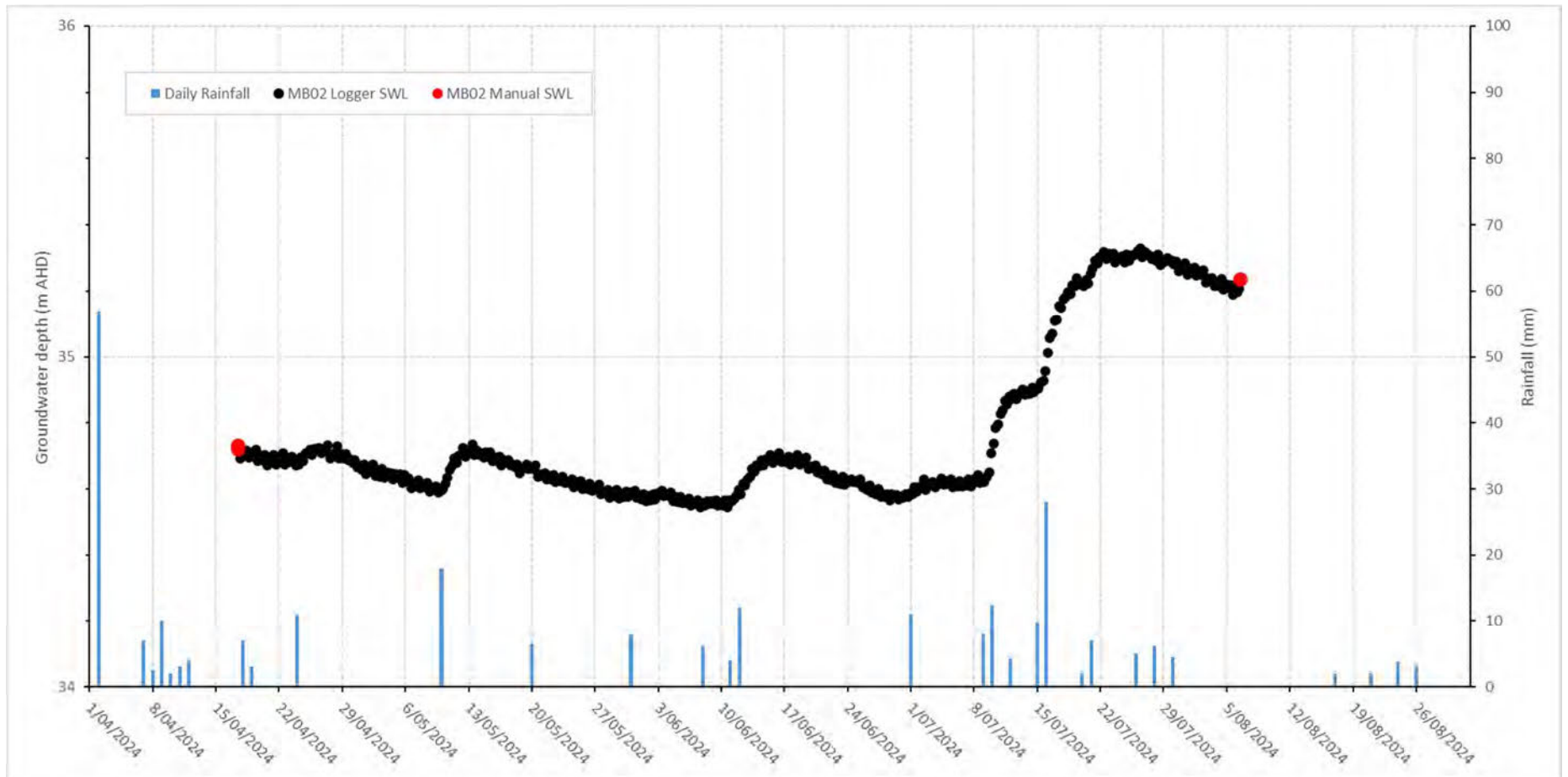
MB01



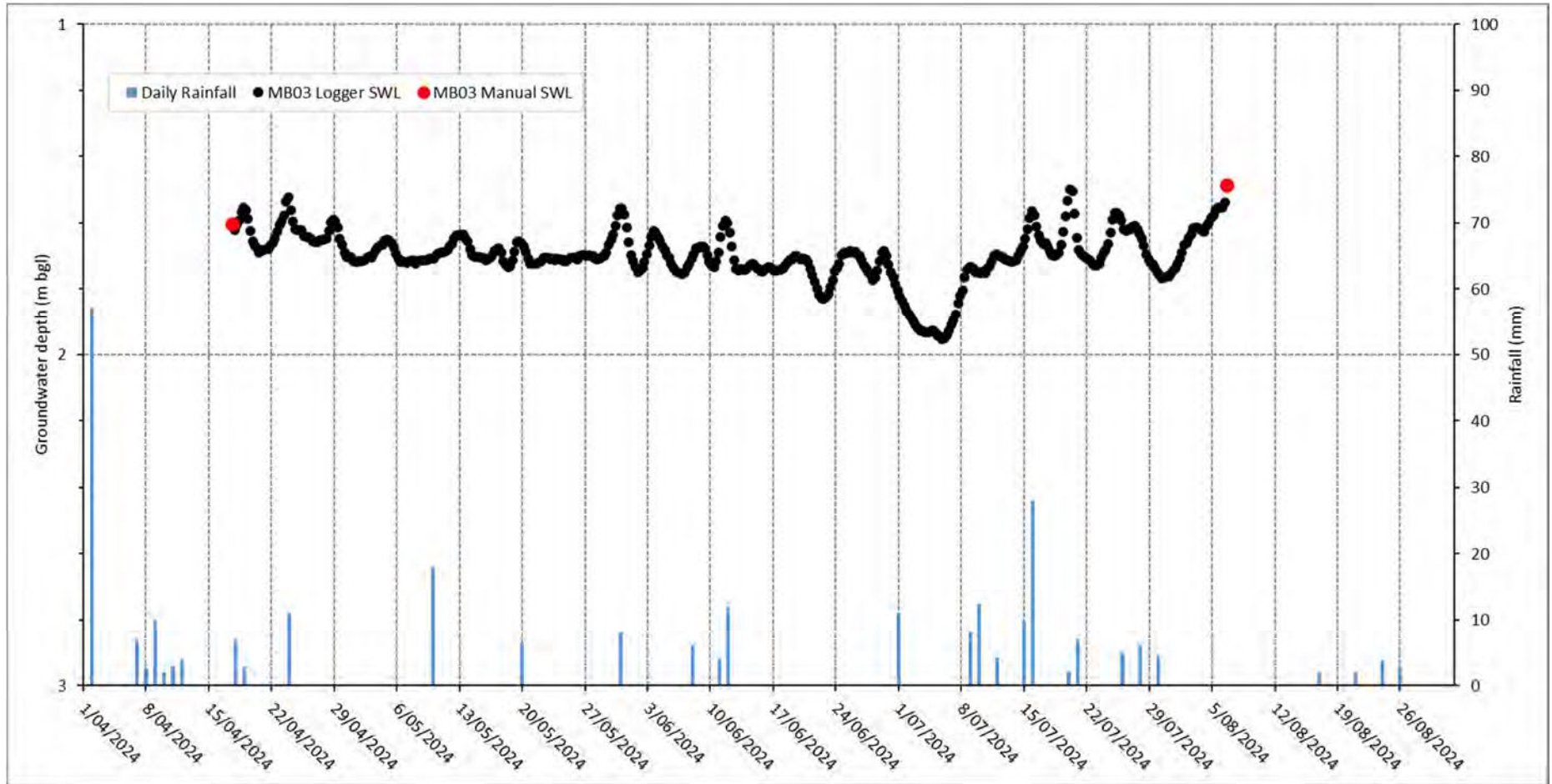


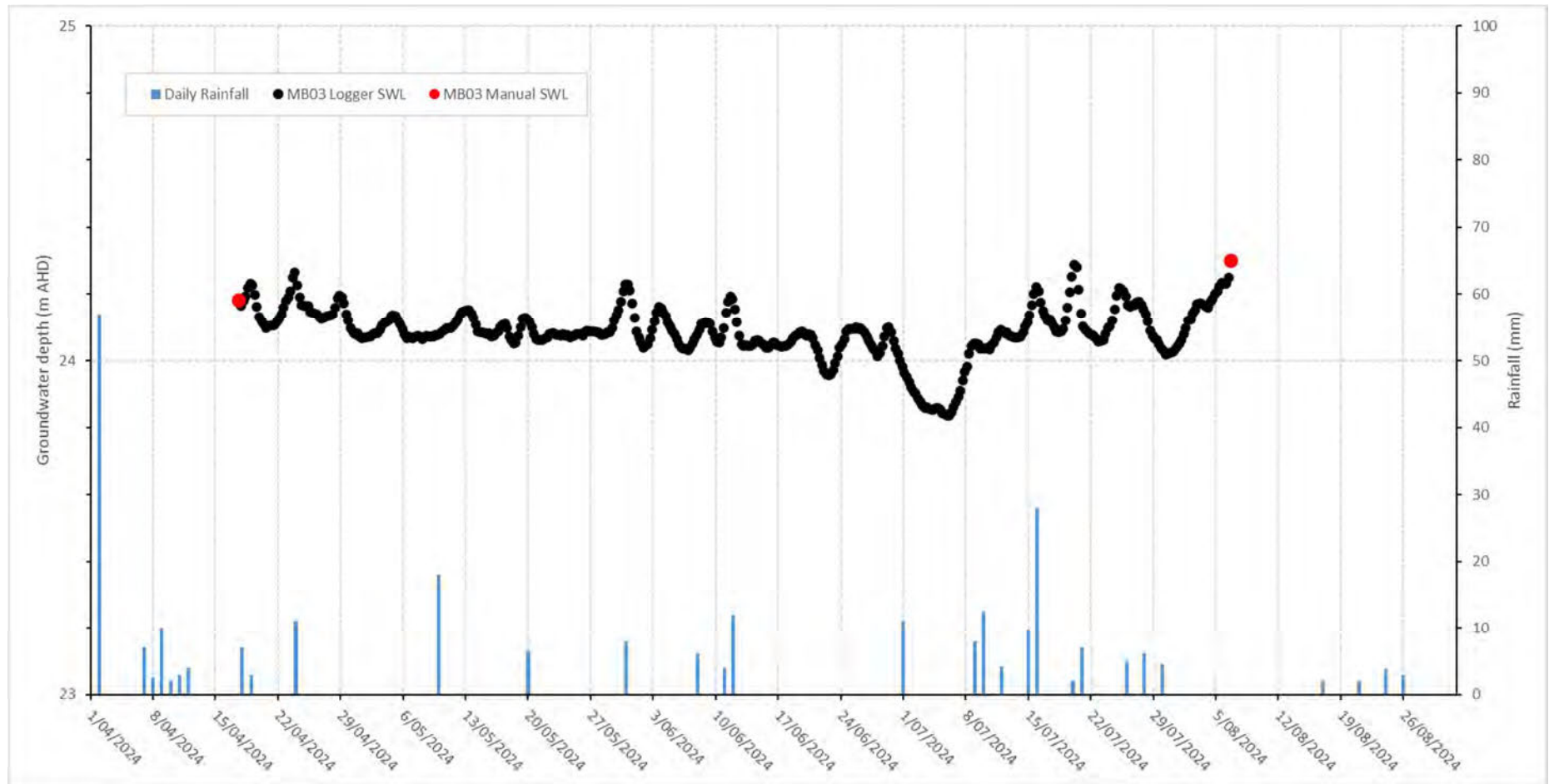
MB02



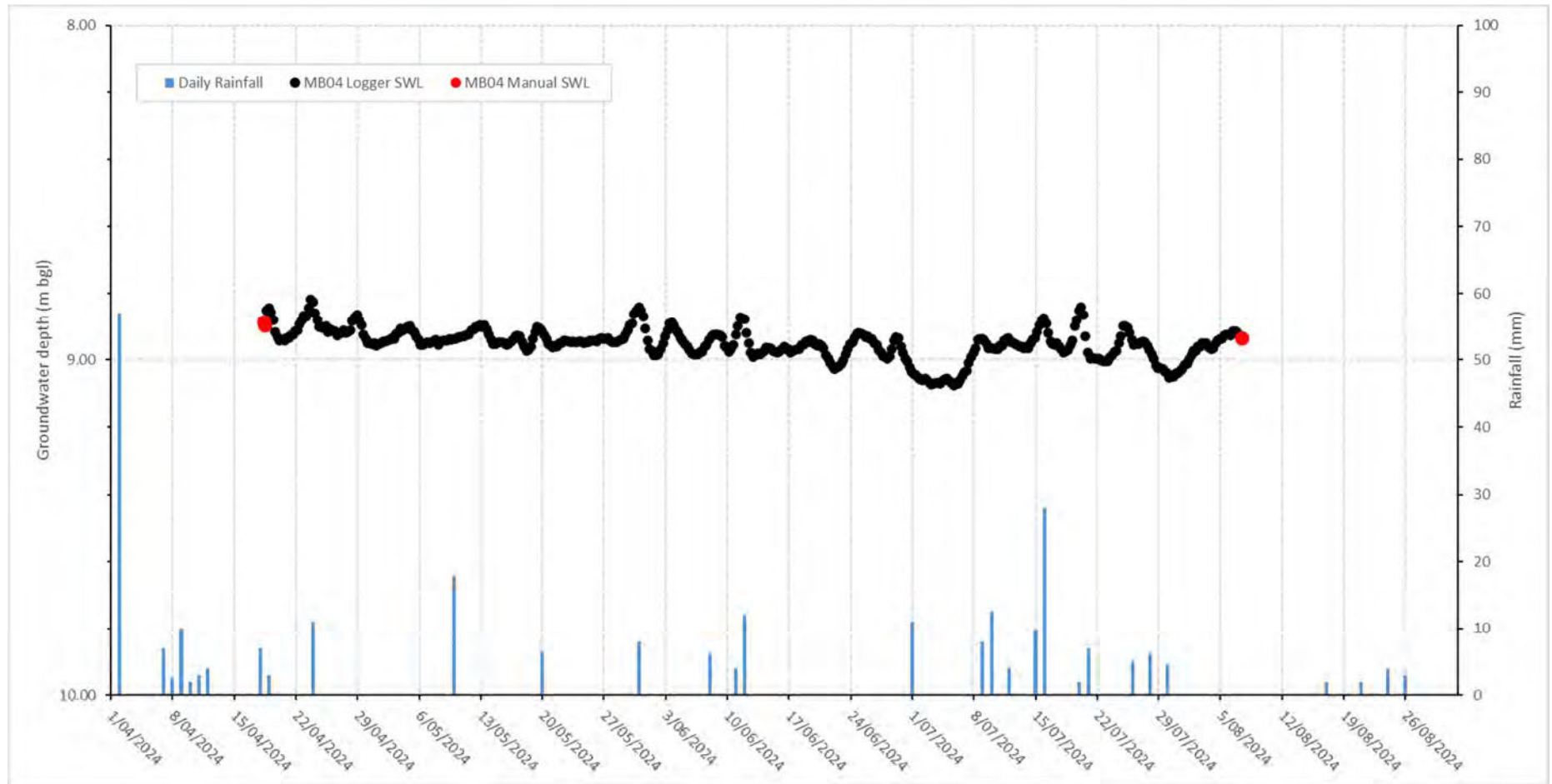


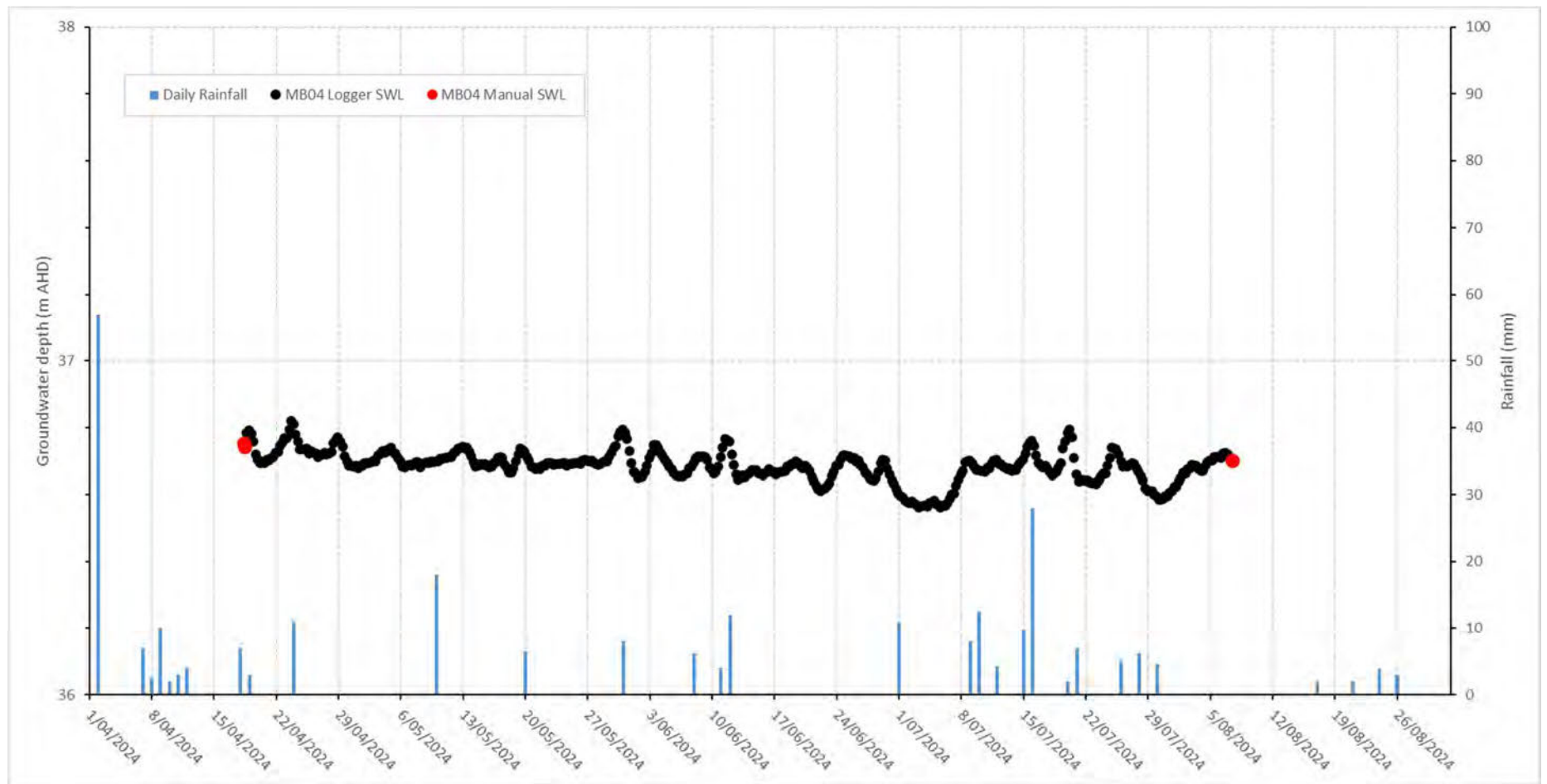
MB03



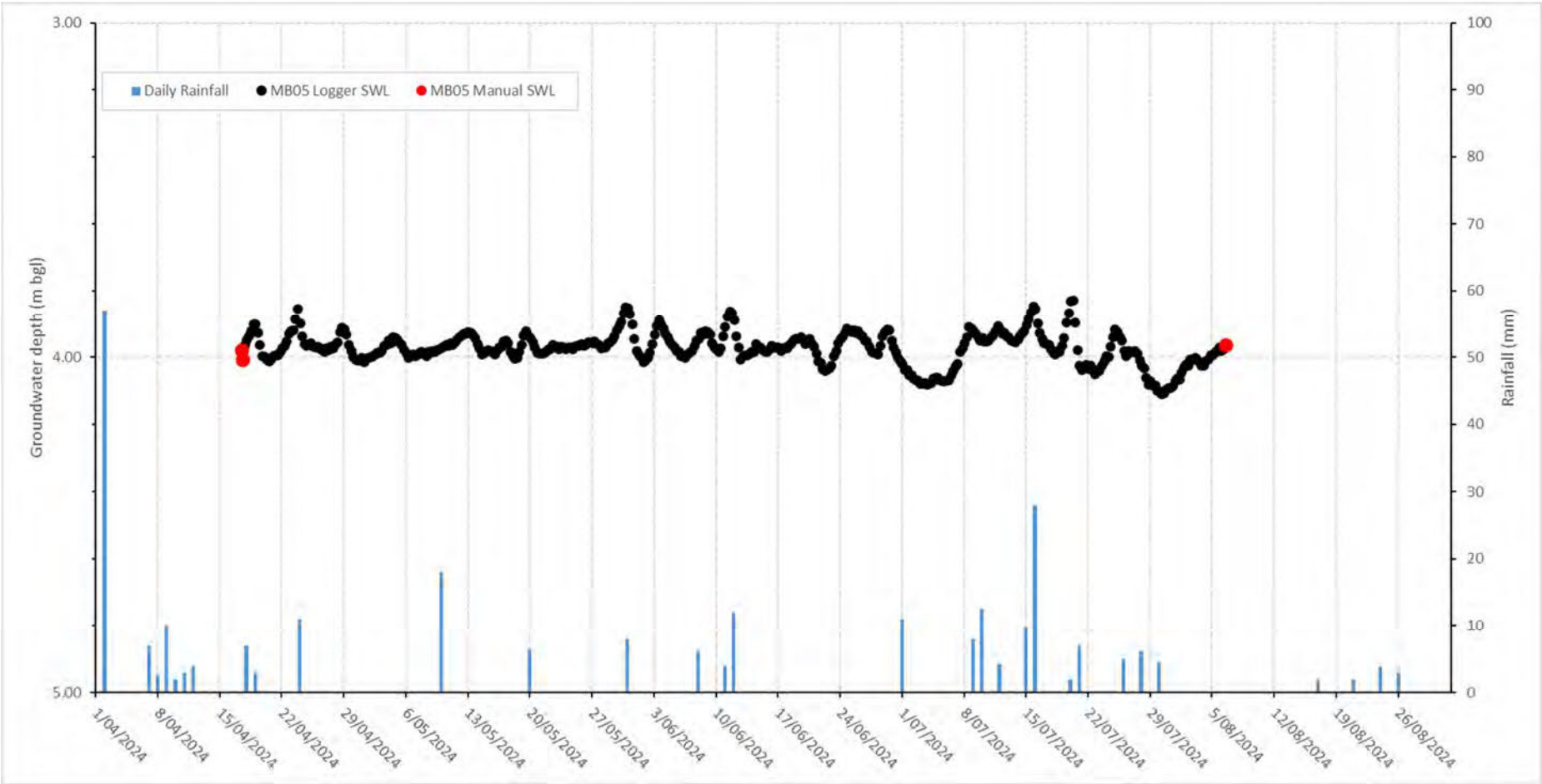


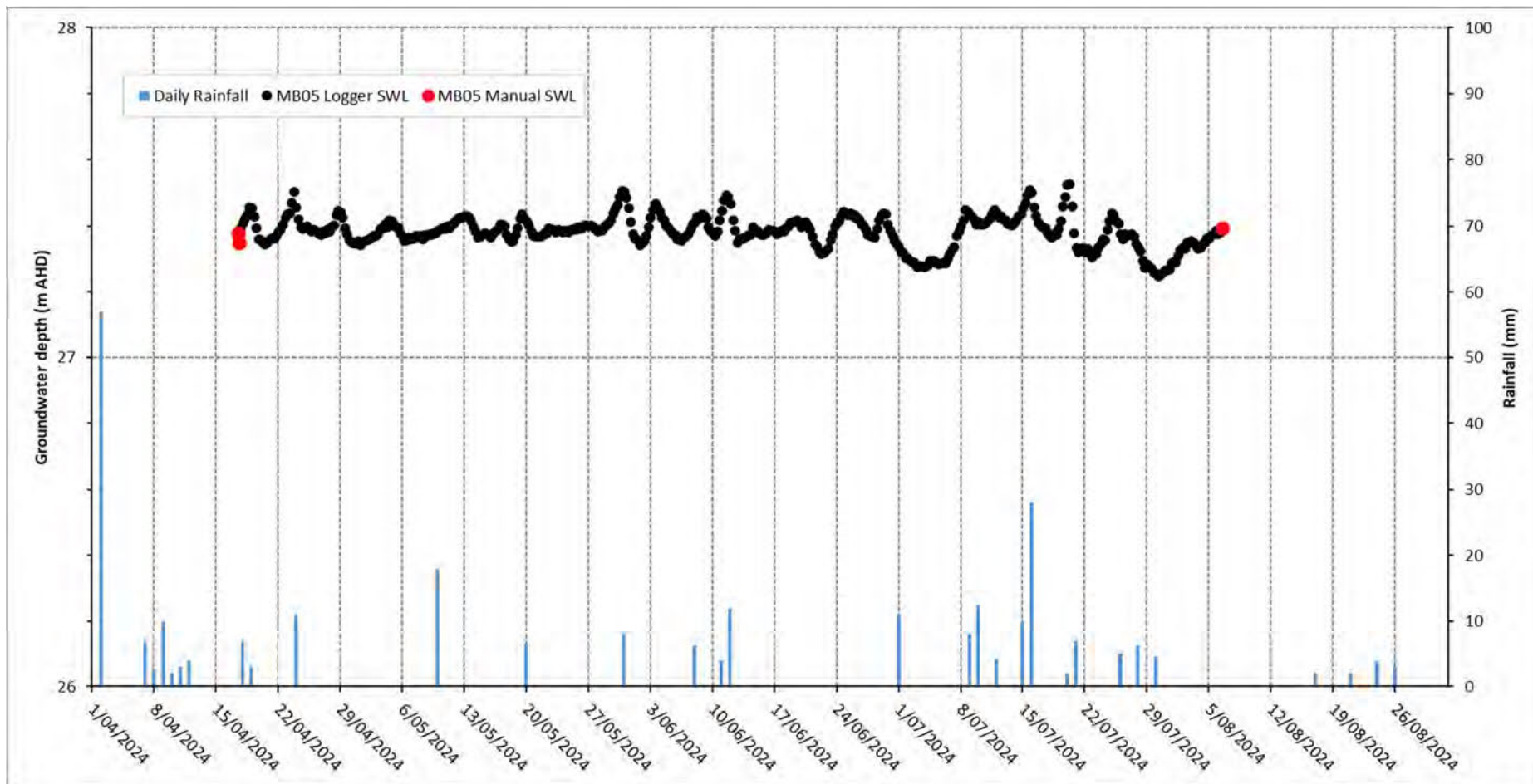
MB04



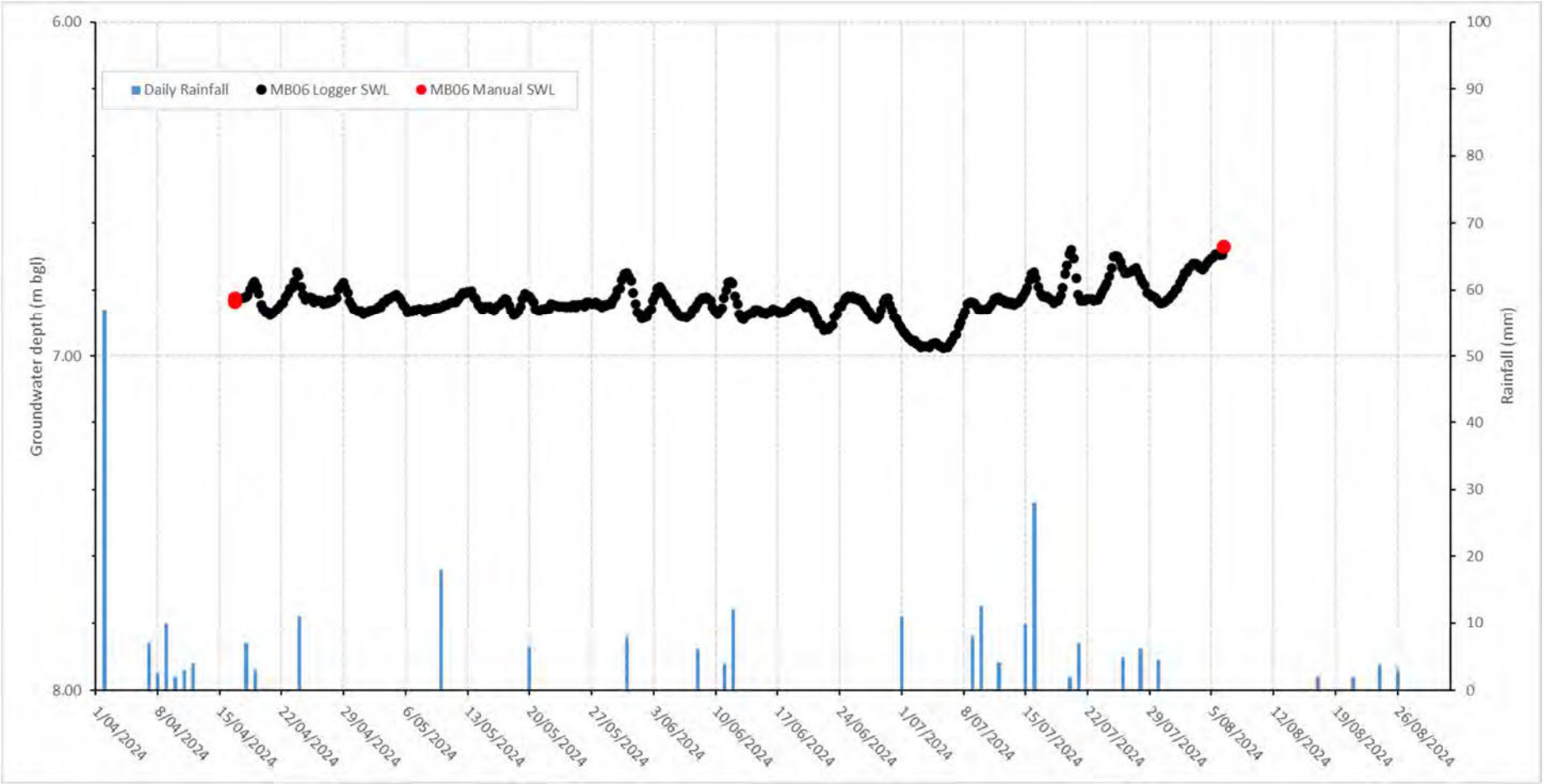


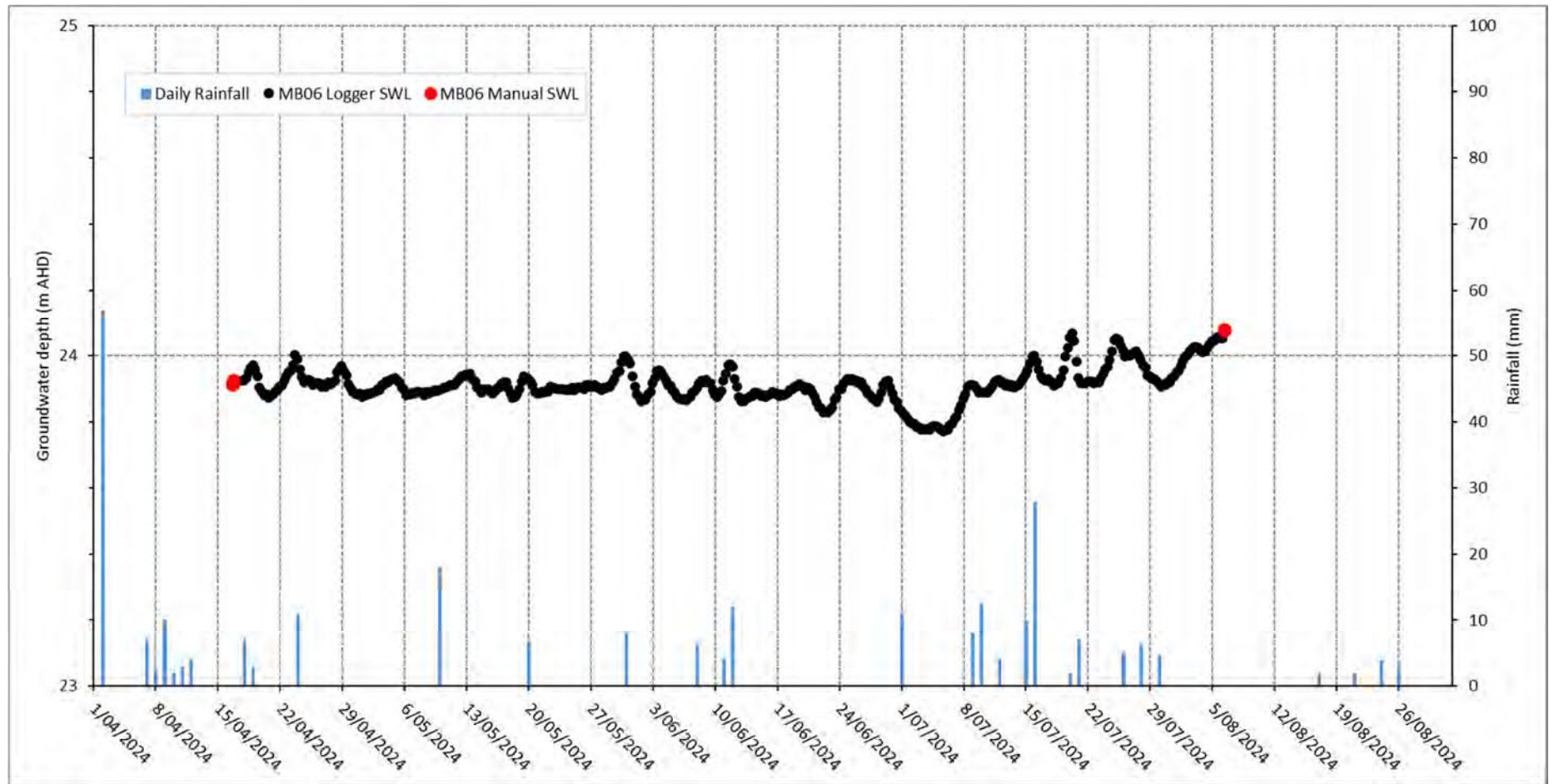
MB05



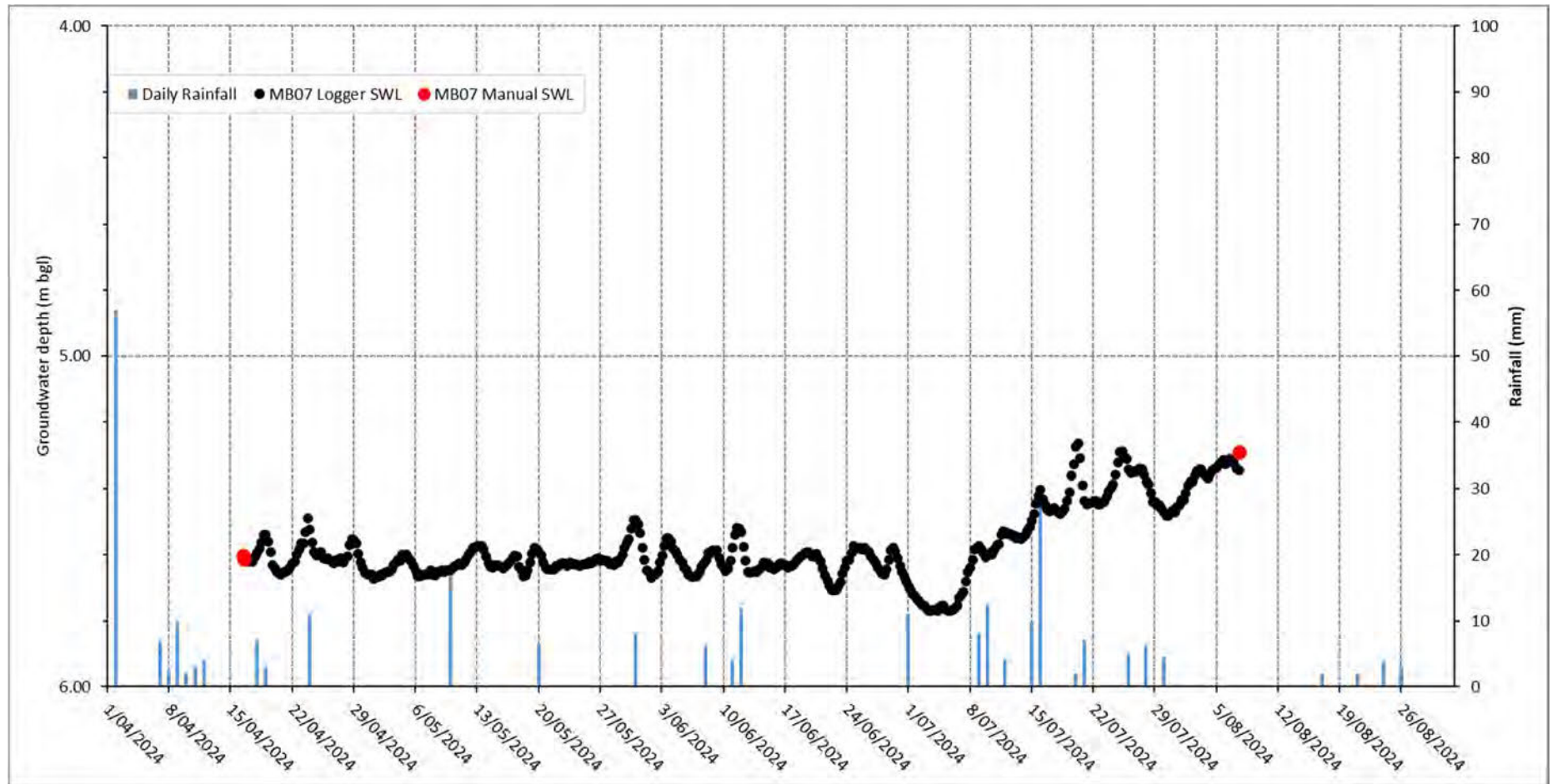


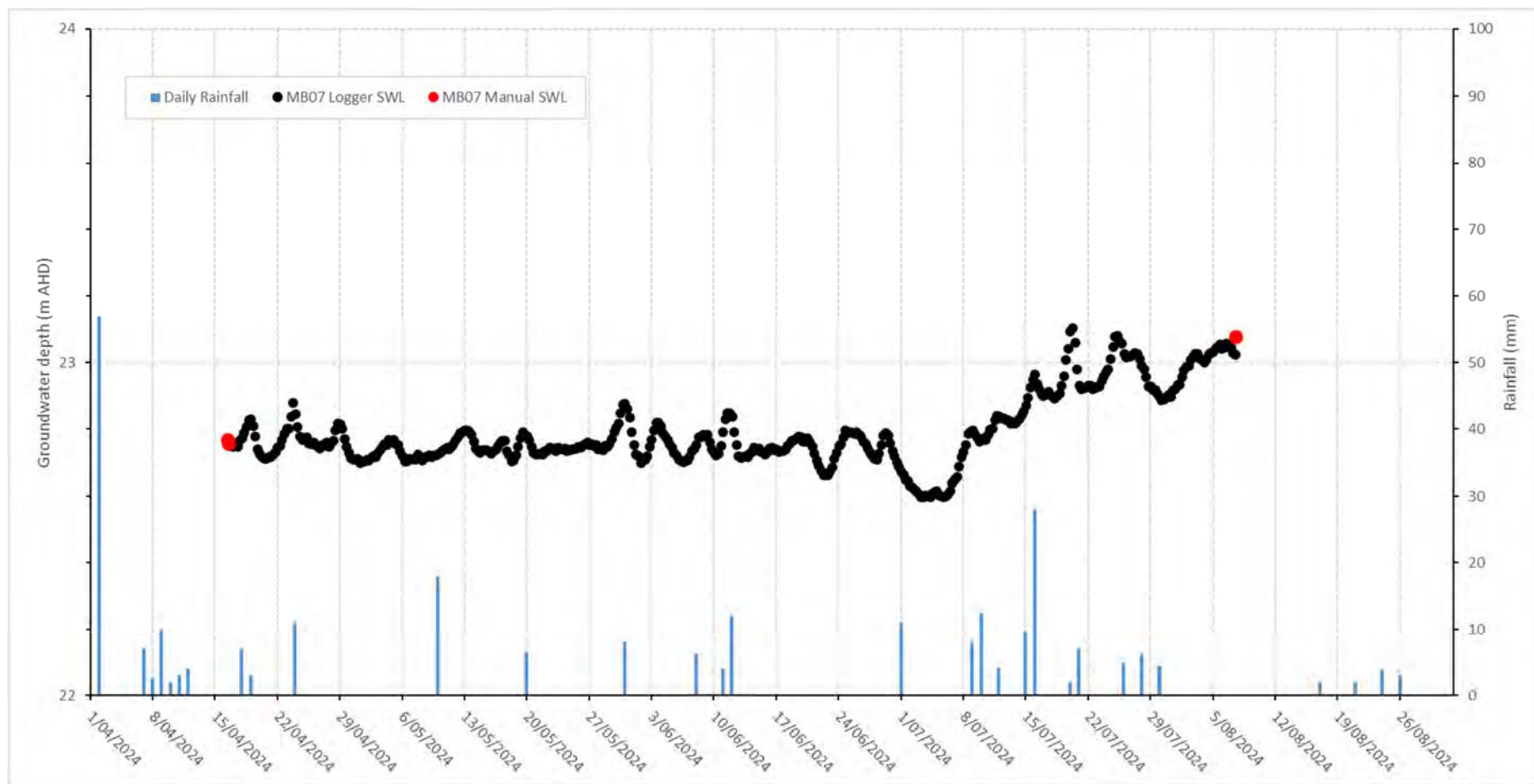
MB06



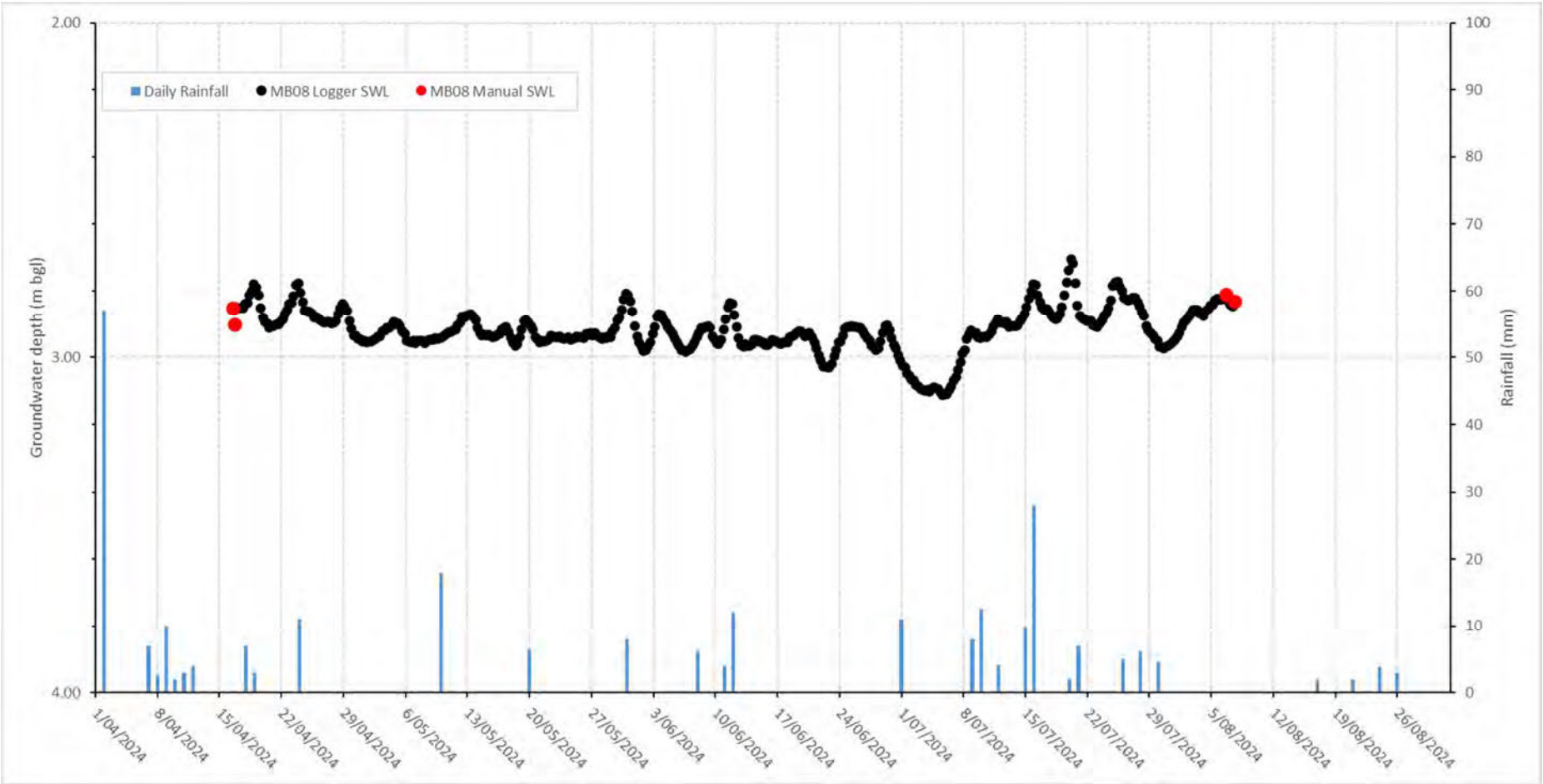


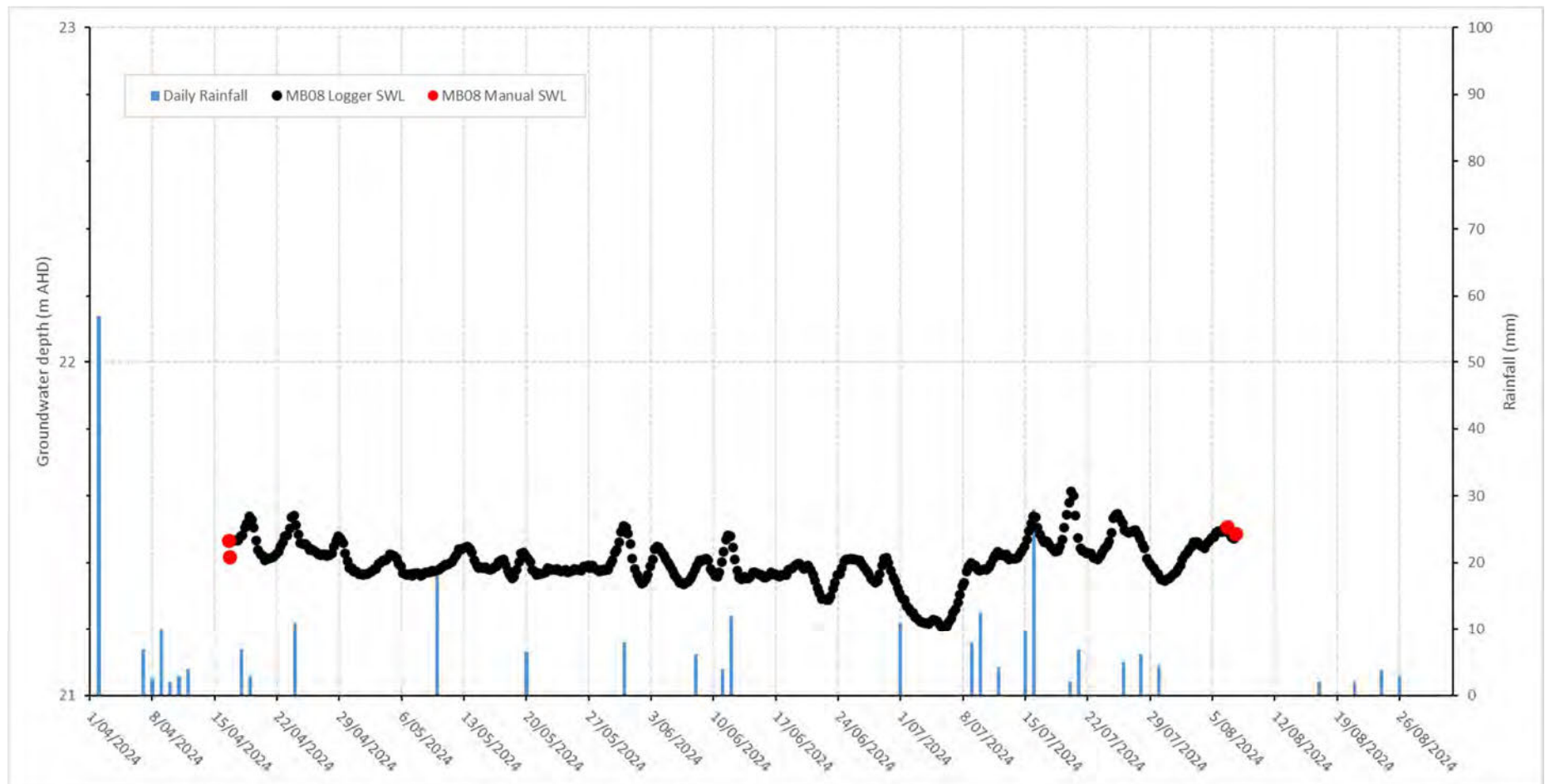
MB07



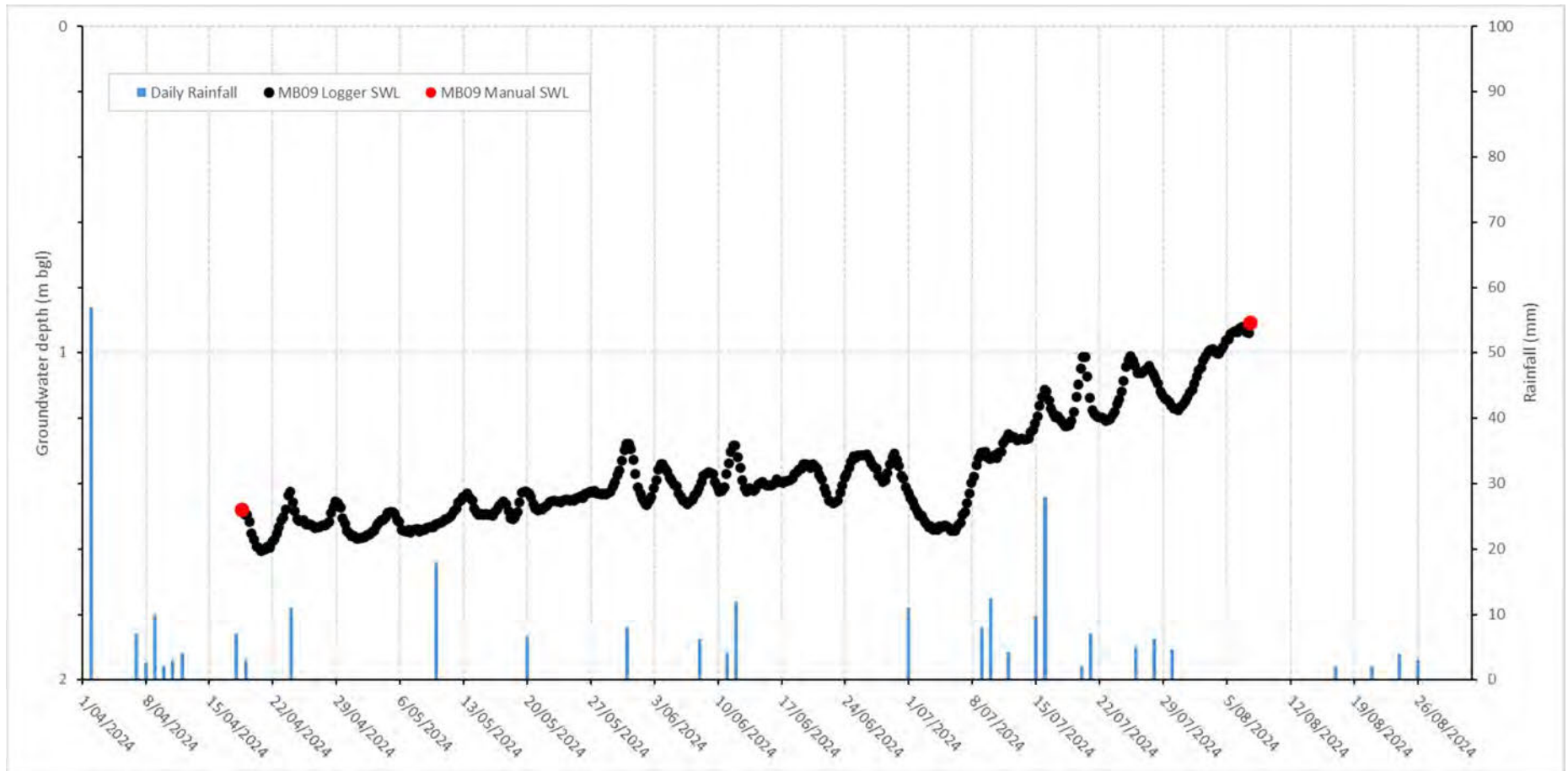


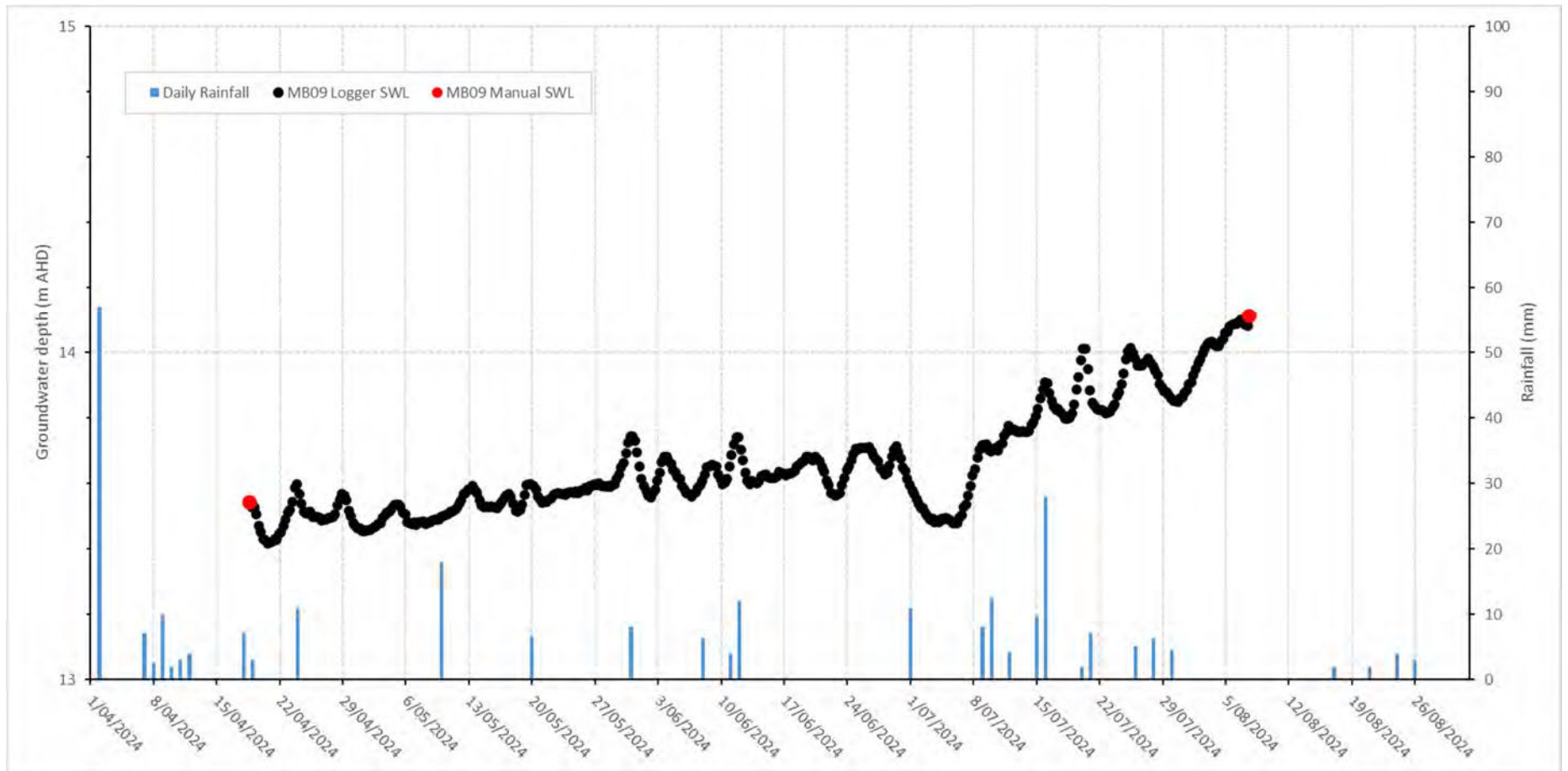
MB08





MB09





Appendix F

Groundwater sampling purge sheets (April 2024)



Purging and Sampling Record

logger 7m
SN 1061201

2.43

Bore ID: m301

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: low flow bladder	SWL(mbTOC): 2.09 m	Logic Check: Y		
Project: ...3 PSP - Devon Meadows.	Sample Method: tube	Screen: From 3.5 to 8.5 m	Stick Up: 0.89 m	agl	
Proj. No.: ...12568833.....	WQ Meter Type: YSI Pro	NAPL Check: No NAPL	Bore Diam.: 50 mm		
Sampler: [redacted]	Flow Cell: Y/N Pump Depth: 6.5 m	Ref. datum: TOC	Well Cap Secure? Y		
Date: 18.04	WLevel Meter Type: Dip / Fox / Int. Fce / Gge	Bore Depth: 8.5 m			
Round: 1	Field Filtered? Y/N (filter vessel, disposable filter/syringe)				

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec. Cond (µS/cm)	Dis. Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	DO% / TDS mg/L (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):	-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable			
11:57							2.03		
12:02	0.1	17.4	5.79	3,443	4.92	236.8	2.17	52.2/2619	light brown, mod sed, cloudy, no odour
12:10	0.5	17.4	5.71	3,464	3.90	221	2.19	41.6/2,632	AA
12:12	1.0	17.2	5.75	3,443	3.50	213.3	2.25	36.9/2,632	AA
12:17	1.5	17.3	5.70	3,462	3.20	208.6	2.26	34.9/2,645	AA
12:27	2.0	17.4	5.70	3,514	3.18	205	2.27	33.8/2,678	AA
12:33	2.5	17.4	5.62	3,556	2.98	200	2.31	31.7/2,704	light brown, low-med sed, cloudy
12:40	3.0	17.1	5.56	3,573	2.89	193.3	2.32	30.5/2,756	AA
12:44	3.5	17.2	5.67	3,599	2.47	187.2	2.34	24.1/2,743	AA
12:49	4.0	17.1	5.74	3,598	2.43	182.8	2.36	25.2/2,749	Very light brown, low sed
12:54	4.5	17.2	5.66	3,650	2.26	180.2	2.37	24.1/2,762	AA
12:59	5.0	17.6	5.67	3,642	2.29	178.6	2.37	24.0/2,756	AA
	Sample	ad	12:59						

Field QA Checks:		Parameters									
Air bubbles in vials? Y/N	Any violent reactions? Y/N	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	
Decontamination as per GHD procedure? Y/N		Preservatives									
Was sampling equipment pre-cleaned? Y/N											
COC updated? Y/N											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Pump 5/45
QA 62 rinse

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (L/m of casing) 2.0 7.9 17.7
*Double for gravel pack



Purging and Sampling Record

Bore ID: MB02

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: Low flow bladder	SWL(mbTOC): 1.47 m	Logic Check: Y		
Project: ...3 PSP - Devon Meadows.	Sample Method: tube	Screen: From: 1.29 to 4.89 m	Stick Up: 0.08 m	bg	
Proj. No.: ...12568833.....	WQ Meter Type: 451 Pro	NAPL Check: No NAPL	Bore Diam.: 50 mm		
Sampler: [redacted]	Flow Cell: Y / N	Pump Depth: 3.90 m	Well Cap Secure? Y		
Date: 17.04.24	WLevel Meter Type: Dip / Fox / Int.Fce / Gge	Ref.datum: 100	Bore Depth: 4.89 m		
Round: 1	Field Filtered? Y / N (filter vessel, disposable filter/syringe)				

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	10% TDS (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
08:50							1.45		
08:52	0.1	16.3	5.21	292.2	3.71	157.6	1.47	37.3/227	Brown, mod sed load, no odour
08:58	0.5	16.8	5.12	295.8	1.96	143.8	1.48	19.7/228	AA
09:00	1.0	16.8	5.14	228.15	1.45	142.1	1.50	13.4/228	AA
09:05	2.0	16.9	5.14	296.7	1.10	139.4	1.50	11.7/227	AA
09:10	3.0	17.0	5.14	295.2	0.69	138.7	1.50	7.2/225	Light brown, low-mod sed
09:20	5.0	16.9	5.07	292.5	0.53	142.0	1.51	6.1/224	AA
09:25	5.5	16.9	5.04	291.4	0.78	145.5	1.51	7.9/224	AA
09:26	6.0	16.9	5.03	290	0.74	147.9	1.51	7.7/223	AA
09:33	7.0	16.9	5.02	290	0.77	149.3	1.51	7.0/223	AA
09:35	7.5	16.9	5.01	288	0.77	149.7	1.51	7.0/222	AA
Sample at 09:35									

Field QA Checks:		Parameters									
Air bubbles in vials? Y / N		BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	
Any violent reactions? Y / N		Preservatives									
Decontamination as per GHD procedure? Y / N											
Was sampling equipment pre-cleaned? Y / N											
COC updated? Y / N											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Pumping at 5/20

Purge Volumes
 Casing Int. Dia (mm) 50 100 150
 Vol (L/m of casing) 2.0 7.9 17.7
 *Double for gravel pack



Purging and Sampling Record

Bore ID: m303

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: <u>Low-flow bladder</u>	SWL(mbTOC): <u>2.56</u> m	Logic Check: <u>✓</u>		
Project: ...3 PSP - Devon Meadows.	Sample Method: <u>7.56</u>	Screen: From: <u>6.20</u> to: <u>9.24</u> m	Stick Up: <u>0.93</u> m	<u>agl</u>	
Proj. No.: ...12568833.....	WQ Meter Type: <u>ysi pro</u>	NAPL Check: <u>No NAPL</u>	Bore Diam.: <u>50</u> mm		
Sampler: <u>[redacted]</u>	Flow Cell: <u>Y / N</u> Pump Depth: <u>7.35</u> m	Ref.datum: <u>TOC</u>	Well Cap Secure? <u>yes</u>		
Date: <u>17/09/24</u>	WLevel Meter Type: <u>Dip / Fox / Int.Fce / Gge</u>	Bore Depth: <u>9.24</u> m	<u>fox</u>		
Round: <u>1</u>	Field Filtered? <u>Y / N</u> (filter vessel, disposable filter/syringe)				

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	DO % / TDS mg/L (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
19:30	0.1	18	5.38	1,264	6.74	159.9	2.51	72.1/968	
	↓						2.59		tint of grey (clear), no sed, no odour
19:35	0.5	17.6	5.40	1,499	6.72	180.3	2.64	70.4/1,127	light brown, med sed load, no odours, cloudy
19:40	1.0	17.5	5.40	1,498	6.63	185.1	2.66	68.8/1,137	A.A
19:45	1.5	17.4	5.40	1,497	6.78	188.4	2.68	66.7/1,137	A.A
19:46	2.0	17.5	5.40	1,493	6.58	190.4	2.70	63.8/1,127	A.A
19:48	3.0	17.4	5.38	1,485	6.47	196.5	2.70	57.2/1,131	AA
19:54	4.0	17.2	5.33	1,498	5.15	200.4	2.70	53.8/1,114	light brown, cloudy, low-med sed
19:58	4.5	17.2	5.34	1,500	5.34	202.4	2.71	51.1/1,114	AA
sample at 15:10									

Field QA Checks:		Parameters									
Air bubbles in vials? <u>Y / N</u>	Any violent reactions? <u>Y / N</u>	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot.Metal	Biol.	
Decontamination as per GHD procedure? <u>Y / N</u>	Was sampling equipment pre-cleaned? <u>Y / N</u>	Preservatives									
COC updated? <u>Y / N</u>											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Pump 5/401

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (L/m of casing) 2.0 7.9 17.7
*Double for gravel pack



Purging and Sampling Record

Bore ID: m804

Job Information	Sampling Information	Bore Information
Client: ...Melbourne Water.....	Purge Method: <u>low flow bladder</u>	SWL(mbTOC): <u>9.73</u> m
Project: ...3 PSP - Devon Meadows.	Sample Method: <u>tube</u>	Screen: From: <u>10.10</u> to <u>16.10</u> m
Proj. No.: ...12568833.....	WQ Meter Type: <u>VSI</u> <u>pro</u>	NAPL Check: <u>No NAPL</u>
Sampler: <u>[redacted]</u>	Flow Cell: Y / N	Ref.datum: <u>TOC</u>
Date: <u>18.04.24</u>	Pump Depth: <u>13</u> m	Bore Depth: <u>16.10</u> m
Round: <u>1</u>	WLevel Meter Type: <u>Dip / Fox / Int.Fce / Gge</u>	Well Cap Secure? <u>yes</u>
Field Filtered? Y / N (filter vessel, disposable filter/syringe)		

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (μ S/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. ($\pm$ mV)	SWL (m TOC)	DO % / TDS (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
08.55							9.71		
09.05	0.1	17.2	5.10	238.7	2.34	183.2	9.73	23.9/182	Light brown / orange, mod Sed, no odour
09.11	1.0	17.7	5.07	240.8	1.43	197.8	9.83	13.7/182	AA
09.17	2.0	17.5	5.07	239.8	1.11	207	9.82	12.1/182	AA
09.24	3.0	17.6	5.06	239.9	1.09	213.9	9.87	11.3/182	Light brown / orange, Low-mod Sed
9.31	4.0	17.3	5.05	239.5	1.25	218.9	9.91	11.1/182	AA
9.41	5.0	17.5	5.02	241.9	1.28	224.6	9.91	11.3/183.3	AA
Sampled at 9.41									Logged

Field QA Checks:	Parameters	BTEX	TPH	PAH	CHC	PCB	OCF	OPP	Tot. Metal	Biol.				
Air bubbles in vials? Y / N	Preservatives													
Any violent reactions? Y / N														
Decontamination as per GHD procedure? Y / N														
Was sampling equipment pre-cleaned? Y / N														
COC updated? Y / N														

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Pump at 10/40

Purge Volumes
 Casing Int. Dia (mm) 50 100 150
 Vol (L/m of casing) 2.0 7.9 17.7
 *Double for gravel pack



Purging and Sampling Record

Bore ID: m805

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: <u>Low flow bladder</u>	SWL(mbTOC): <u>4.78</u> m	Logic Check: <u>Y</u>		
Project: ...3 PSP - Devon Meadows.	Sample Method: <u>tube</u>	Screen: From: <u>5.15</u> to <u>8.15</u> m	Stick Up: <u>0.81</u> m	agl	
Proj. No.: ...12568833.....	WQ Meter Type: <u>YSI pro</u>	NAPL Check: <u>No Napl</u>	Bore Diam.: <u>50</u> mm		
Sampler:	Flow Cell: <u>Y</u> / N	Pump Depth: <u>6.7</u> m	Ref.datum: <u>TOC</u>	Well Cap Secure? <u>Y</u>	
Date: <u>17.04</u>	WLevel Meter Type: <u>Dip / Fox / Int.Fce / Gge</u>	Bore Depth: <u>8.15</u> m			
Round: <u>1</u>	Field Filtered? <u>Y</u> / N (filter vessel, disposable filter/syringe)				

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red Pt. (± mV)	SWL (m TOC)	D50 / TSS mg/L (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):	-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable			
11:45						4.78			
11:51	0.1	17.8	6.51	2,116	8.72	161.9	4.83	91.7 / 1,509	Very light grey very light sed, no odour
11:54	0.5	17.3	6.49	2,114	8.20	156.3	4.86	86.4 / 1,605	AA
11:57	1.0	17.2	6.50	2,107	8.12	154.7	4.90	84.4 / 1,612	AA
12:02	1.5	17.2	6.50	2,109	7.93	152.6	4.92	83.0 / 1,612	AA
12:05	2.0	17.2	6.49	2,109	7.85	152.2	4.93	82.1 / 1,605	AA
12:09	2.5	17.5	6.49	2,094	7.65	153	4.93	80.2 / 1,592	Very light grey/brown, no sed
12:13	3.0	17.2	6.48	2,080	7.64	153	4.93	79.9 / 1,592	AA
12:16	3.5	17.0	6.46	2,032	7.55	153.3	4.95	76.6 / 1,579	AA
12:22	4.0	16.3	6.45	2,054	7.46	153.2	4.94	77.7 / 1,579	AA
12:26	4.5	16.9	6.45	2,050	7.39	154.2	4.94	76.6 / 1,573	AA
12:31	5.0	16.9	6.44	2,044	7.27	154.6	4.94	75.6 / 1,573	AA
12:32	5.5	16.9	6.44	2,036	7.13	154.9	4.96	74.5 / 1,566	AA
12:37	6.0	16.9	6.44	2,031	7.13	154.0	4.97	74.2 / 1,566	AA
12:40	6.5	16.9	6.43	2,028	7.08	155.1	4.97	73.7 / 1,510	AA Sampled at 12:40

Field QA Checks:		Parameters									
Air bubbles in vials? Y / N Any violent reactions? Y / N		BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	
Decontamination as per GHD procedure? Y / N		Preservatives									
Was sampling equipment pre-cleaned? Y / N											
COC updated? Y / N											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

QA_01

Pump 5/45
5/40 @ 12:00

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (L/m of casing) 2.0 7.9 17.7
*Double for gravel pack



Purging and Sampling Record

Bore ID: BH06

Job Information	Sampling Information	Bore Information
Client: ...Melbourne Water.....	Purge Method: <u>Low flow bladder</u>	SWL(mbTOC): <u>7.685</u> m
Project: ...3 PSP - Devon Meadows.	Sample Method: <u>tube</u>	Screen: From: <u>9.40</u> to: <u>12.40</u> m
Proj. No.: ...12568833.....	WQ Meter Type: <u>ysi pro</u>	NAPL Check: <u>No NAPL</u>
Sampler: <u>[redacted]</u>	Flow Cell: <u>Y</u> / N Pump Depth: <u>10.40</u> m	Ref.datum: <u>TOL</u>
Date: <u>16/04/24</u>	WLevel Meter Type: <u>Dip / Fox / Int.Fce / Gge</u>	Bore Depth: <u>12.40</u> m
Round: <u>1</u>	Field Filtered? <u>Y</u> / N (filter vessel, disposable filter/syringe)	

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	DO% / TDS (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):									
		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
15:50	0.1	18.4	6.70	2,807	9.65	169.2	7.73	102.4/2,106	light brown, mod sediment load, no odour
16:00	0.5	16.9	6.49	3,027	9.03	172.5	7.79	94.9/2,333	brown, mod sediment load
16:05	1.0	16.6	6.49	3,010	8.84	172.6	7.80	91.6/2,327	AA
16:08	1.5	16.3	6.48	2,965	8.53	172.7	7.83	87.5/2,314	AA
16:13	2.0	16.2	6.48	2,949	8.46	172.7	7.85	86.7/2,300	AA
16:16	2.5	16.2	6.48	2,914	8.22	172.8	7.84	85.7/2,275	light brown, low sed
16:19	3.0	16.2	6.48	2,889	8.12	172.6	7.87	84.3/2,255	AA
16:22	3.5	16.2	6.48	2,872	8.14	172.5	7.87	82.4/2,242	AA
16:25	4.0	16.2	6.48	2,848	7.91	172.4	7.88	82.1/2,223	AA
16:29	5.0	16.2	6.48	2,820	7.76	172.2	7.88	79.6/2,203	AA
16:33	5.5	16.2	6.48	2,810	7.79	172.2	7.88	79.9/2,197	AA
Sample at 16:33									

Field QA Checks:	Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.
Air bubbles in vials? <u>Y</u> / N	Preservatives									
Any violent reactions? <u>Y</u> / N										
Decontamination as per GHD procedure? <u>Y</u> / N										
Was sampling equipment pre-cleaned? <u>Y</u> / N										
COC updated? <u>Y</u> / N										

Comment:	Purge Volumes
Duplicate samples collected, bottles used, access, condition of headworks etc	Casing Int. Dia (mm) 50 100 150
Pumping at 10/45	Vol (L/m of casing) 2.0 7.9 17.7
changed to 10/30 at 16:10	*Double for gravel pack



Purging and Sampling Record

Bore ID: BH07

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: low flow	SWL(mbTOC): 6.53 m	Logic Check: Yes		
Project: ...3 PSP - Devon Meadows.	Sample Method:	Screen: From: 8.5 to 11.5 m	Stick Up: 0.84 m		
Proj. No.: ...12568833.....	WQ Meter Type: YSI Pro	NAPL Check: NO NAPL	Bore Diam.: 50 mm		
Sampler: [redacted]	Flow Cell: Y/N	Pump Depth: 9.5 m	Ref. datum: TOC	Well Cap Secure? Yes	
Date: 16.04.24	WLevel Meter Type: Dip / Fox / Int. Fce / Gge	Bore Depth: 11.5 m	TOC		
Round: 1	Field Filtered? Y/N (filter vessel, disposable filter/syringe)				

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec. Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	DO % / TDS (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
10.18							6.54		
10.25	1	16.2	6.78	2474	8.06	152	6.54	82.2/1.956	Light brown, no odour, light sed load
10.30	2	15.9	6.78	2,537	7.56	155	6.54	76.9/2.002	AA
10.35	2.5	15.9	6.77	2,595	7.29	157	6.54	75.9/2.041	Very light brown, no sed, no odour
10.40	3.5	15.8	6.96	2,574	7.03	159.6	6.54	70.1/2.028	AA
10.43	4.0	15.8	6.76	2,544	6.76	159.9	6.54	68/2.002	AA
10.48	5.0	15.9	6.76	2,580	6.55	160.3	6.54	67.2/1.956	clear, no sed
10.52	5.5	15.8	6.47	2,464	6.52	160.7	6.54	65.8/1.937	AA
10.55	6.0	15.8	6.75	2,435	6.39	160.5	6.54	65.2/1.999	AA
10.57	6.5	15.8	6.75	2,400	6.29	160.7	6.54	64.5/1.885	AA
11.00	7.0	15.7	6.74	2,370	6.27	160.9	6.54	63.2/1.859	AA
Sampled at 11.00									

Field QA Checks:		Parameters									
Air bubbles in vials? Y/N	Any violent reactions? Y/N	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	
Decontamination as per GHD procedure? Y/N		Preservatives									
Was sampling equipment pre-cleaned? Y/N											
COC updated? Y/N											

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

7 Sec discharge
30 Sec Fill - dropped fill to 25 sec

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (L/m of casing) 2.0 7.9 17.7
*Double for gravel pack



Purging and Sampling Record

Bore ID: MB08

Job Information	Sampling Information	Bore Information
Client: ...Melbourne Water.....	Purge Method: Low flow (bladders)	SWL(mbTOC): 3.87 m
Project: ...3 PSP - Devon Meadows.	Sample Method: tube	Screen: From: 5.91 to 8.91 m
Proj. No.: ...12568833.....	WQ Meter Type: YSI pro	NAPL Check: No NAPL
Sampler: [redacted]	Flow Cell: Y / N	Ref.datum: 100
Date: 16.04	Pump Depth: 7 m	Bore Depth: 8.91 m
Round: 4	WLevel Meter Type: Dip / Fox / Int.Fce / Gge	Well Cap Secure? Y
Field Filtered? Y / N (filter vessel, disposable filter/syringe)		

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (mg/L)	Ox-Red.Pt. (± mV)	SWL (m TOC)	100% / TDS (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
1.15							3.87		
1.17	0.1	17.8	6.87	1,196	4.14	149.4	3.94	43.2/897	Very light grey, low sed, no odour
1.21	0.5	17.9	6.80	1,225	2.63	145.6	3.99	27.4/923	AA
1.27	1.0	17.9	6.77	1,237	2.25	147.8	3.97	23.1/920	AA
1.35	1.5	17.9	6.77	1,247	2.12	149.4	3.97	22.1/936	AA
1.40	2.0	17.9	6.76	1,259	2.15	149.9	3.97	22.1/949	AA
1.43	2.5	17.6	6.76	1,309	1.70	150.7	3.98	17.6/904	AA
1.47	3.0	17.6	6.77	1,322	1.61	150.9	3.98	17.6/1,007	AA
1.50	3.5	17.7	6.76	1,357	1.51	150.9	3.98	15.7/1,027	Very light grey/brown, no sed
1.54	4.0	17.8	6.77	1,434	1.32	151.4	3.98	13.4/1,092	AA
2.00	4.5	17.9	6.79	1,500	1.06	151.1	3.98	11.3/1,510	AA
2.02	5.0	17.7	6.79	1,525	0.99	150.9	3.97	10.4/1,517	AA
2.06	5.5	17.5	6.79	1,538	0.93	150.6	3.97	9.7/1,167	AA
2.10	6.0	17.5	6.79	1,542	0.87	150.2		9.2/1,170	AA
Samples at 2.10									

Field QA Checks:																													
Air bubbles in vials? Y / N	Any violent reactions? Y / N																												
Decontamination as per GHD procedure? Y / N																													
Was sampling equipment pre-cleaned? Y / N																													
COC updated? Y / N																													
	<table><tr><th>Parameters</th><th>BTEX</th><th>TPH</th><th>PAH</th><th>CHC</th><th>PCB</th><th>OCP</th><th>OPP</th><th>Tot. Metal</th><th>Biol.</th><th></th><th></th><th></th><th></th></tr><tr><td>Preservatives</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.					Preservatives													
Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.																				
Preservatives																													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

pump 5/30 (was drawing down)
change to 5/45 @ 1.21
change to 5/35 @ 1.40

Purge Volumes
Casing Int. Dia (mm) 50 100 150
Vol (L/m of casing) 2.0 7.9 17.7
*Double for gravel pack



Purging and Sampling Record

Bore ID: M809

Job Information		Sampling Information		Bore Information	
Client: ...Melbourne Water.....	Purge Method: <u>Low Flow Bladder</u>	SWL(mbTOC): <u>2.34</u> m	Logic Check: <u>Yes</u>		
Project: ...3 PSP - Devon Meadows.	Sample Method: <u>tube</u>	Screen: From: <u>6.8</u> to: <u>9.8</u> m	Stick Up: <u>0.84</u> m	<u>ggl</u>	
Proj. No.: ...12568833.....	WQ Meter Type: <u>ysi pro</u>	NAPL Check: <u>No Naph</u>	Bore Diam.: <u>50</u> mm		
Sampler: <u>[redacted]</u>	Flow Cell: <u>Y</u> / <u>N</u>	Ref.datum: <u>TOL</u>	Well Cap Secure? <u>Yes</u>		
Date: <u>18/04</u>	Pump Depth: <u>8</u> m	Bore Depth: <u>9.8</u> m			
Round: <u>1</u>	WLevel Meter Type: <u>Dip / Fox / Int.Fce / Gge</u>				
Field Filtered? <u>Y</u> / <u>N</u> (filter vessel, disposable filter/syringe)					

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	DO% / TDS mg/L (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	+/- 0.05 pH	+/- 3%	+/- 10%	+/- 10 mV	stable		
14:24							2.12		
14:28	0.1	17	7.12	1.191	5.16	166.0	2.27	33 / 916	hint of grey / low sed / cloudy
14:35	0.5	16.8	6.99	1.279	5.38	163.7	2.48	35.7 / 988	AA
14:40	1.0	16.9	6.98	1.281	5.91	162.3	2.60	61.6 / 988	AA
14:50	1.5	16.9	6.99	1.284	2.50	161.3	2.71	26.5 / 989	AA
14:55	2.0	16.8	6.99	1.273	2.71	160.7	2.79	26.1 / 981.5	AA
15:02	2.5	16.8	7.01	1.262	2.72	160.2	2.86	29.8 / 975	AA
15:09	3.0	16.5	7.01	1.250	2.77	159.6	2.92	28.1 / 960	AA
15:15	3.5	16.5	7.03	1.265	2.58	160.1	2.97	24.5 / 981	AA
15:25	4.6	16.6	6.90	1.279	2.50	160	3.0	25.6 / 994	
Sample at 15:25									

Field QA Checks:		Parameters												
Air bubbles in vials? <u>Y</u> / <u>N</u>	Any violent reactions? <u>Y</u> / <u>N</u>	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.				
Decontamination as per GHD procedure? <u>Y</u> / <u>N</u>	Was sampling equipment pre-cleaned? <u>Y</u> / <u>N</u>	Preservatives												
COC updated? <u>Y</u> / <u>N</u>														

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes
 Casing Int. Dia (mm) 50 100 150
 Vol (L/m of casing) 2.0 7.9 17.7
 *Double for gravel pack

Appendix G

Tabulated laboratory results



								Location Code		MB01		MB02		MB03		MB04		MB05		MB06		MB07		MB08		MB09	
								Date		18 Apr 2024		17 Apr 2024		17 Apr 2024		18 Apr 2024		17 Apr 2024		16 Apr 2024		16 Apr 2024		16 Apr 2024		18 Apr 2024	
								Field ID		MB01		MB02		MB03		MB04		MB05		MB06		MB07		MB08		MB09	
								Lab Report Number		1089182		1088804		1088804		1089182		1088804		1088191		1088191		1088191		1089182	
	Unit	EQL	ADWG 2011 Recreational (v3.7 updated 2022)	ANZG (2018) - FW - slightly to moderately disturbed (updated 26 July 2021)	ANZECC 2000 - Stock Watering	ANZECC 2000 Irrigation - Long- term Trigger Values	ANZECC 2000 Irrigation - Short- term Trigger Values																				
Field data																											
Standing Water Level	m bTOC							2.09	1.47	2.56	9.73	4.78	7.69	6.53	3.87	2.34											
Field Parameters																											
pH (Field)	pH units							5.67	5.01	5.34	5.03	6.43	6.48	6.74	6.79	6.99											
Electrical conductivity (field)	µS/cm					2,900 ^{#14}		3,648.0	288	1,500.0	242	2,028.0	2,810.0	2,370.0	1,543.0	1,279.0											
Dissolved Oxygen (Field)	mg/L							2.29	0.77	5.34	1.28	7.08	7.74	6.27	0.87	2.5											
Redox (Field)	mV							179	150	202	225	155	172	161	150	160											
Temperature (Field)	°C							17.6	16.9	17.2	17.5	16.9	16.2	15.7	17.5	16.6											
Inorganics																											
pH (Lab)	pH units	0.1				6-9 ^{#15}		6.0	5.5	5.6	5.7	6.6	6.9	7.1	7.2	7.1											
Electrical conductivity (lab)	µS/cm	10				2,900 ^{#14}		4,000	47	110	220	2,200	3,300	2,600	1,700	1,400											
Salinity	mg/L	10						2,400	570	980	250	1,400	1,900	1,800	1,100	910											
Acidity & Alkalinity																											
Alkalinity (Carbonate as CaCO3)	mg/L	10						<10	<10	<10	<10	<10	<10	<10	<10	<10											
Alkalinity (Bicarbonate as CaCO3)	mg/L	20						290	48	32	1,800	230	470	370	510	2,500											
Alkalinity (Hydroxide as CaCO3)	mg/L	20						<20	<20	<20	<20	<20	-	-	-	<20											
Alkalinity (total as CaCO3)	mg/L	20						290	48	32	1,800	230	-	-	-	2,500											
Hardness as CaCO3	mg/L	5						620	76	120	15	370	670	460	180	150											
Major Ions																											
Calcium	mg/L	0.5			1,000			26	20	4.4	1.5	24	61	40	13	21											
Magnesium	mg/L	0.5						140	6.3	25	2.4	76	130	86	36	23											
Potassium	mg/L	0.5						<5	10	<0.5	0.5	<0.5	1.5	0.8	0.7	<0.5											
Sodium	mg/L	0.5						740	26	320	45	340	480	470	360	300											
Chloride	mg/L	1				350 ^{#16}		1,500	62	800	68	1,000	1,100	770	340	330											
Sulfate	mg/L	5	5,000 ^{#1}		1,000			61	29	38	<5	33	45	100	97	37											
Nutrients																											
Ammonia as N	mg/L	0.01		0.9 ^{#4}				0.03	0.24	<0.01	0.03	<0.01	0.18	0.41	0.23	0.03											
Nitrate (as N)	mg/L	0.02	112.9 ^{#2}	2.4 ^{#5}	90 ^{#11}			<0.02	0.03	0.10	3.5	0.60	3.8	20	36	33											
Nitrite (as N)	mg/L	0.02	9.1 ^{#3}		9.1 ^{#12}			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.04											
Nitrogen (Total Oxidised) (as N)	mg/L	0.05						<0.05	<0.05	0.10	3.5	0.60	3.8	20	37	33											
Nitrogen (Total)	mg/L	0.2				5	25 ^{#19}	<0.2	3.2	0.9	4.7	0.6	5.7	23	42	36											
Kjeldahl Nitrogen Total	mg/L	0.2						<0.2	3.2	0.8	1.2	<0.2	1.9	3.3	5	2.6											
Phosphorus (Total)	mg/L	0.01				0.05 ^{#17}	0.8 ^{#20}	<0.01	9.3	0.02	<0.01	0.07	0.08	0.16	0.01	<0.01											
Metals																											
Aluminium (filtered)	mg/L	0.05		0.055 ^{#6}	5	5	20	<0.05	<0.05	0.83	<0.05	0.21	<0.05	<0.05	<0.05	<0.05											
Arsenic (filtered)	mg/L	0.001	0.1	0.013 ^{#7}	0.5	0.1	2	<0.001	<0.001	0.008	<0.001	<0.001	<0.001	0.019	0.001	<0.001											
Cadmium (filtered)	mg/L	0.0002	0.02	0.0002 ^{#8}	0.01	0.01	0.05	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002											
Chromium (III+VI) (filtered)	mg/L	0.001		0.001 ^{#9}	1	0.1 ^{#18}	1 ^{#18}	<0.001	0.001	0.003	<0.001	0.002	0.003	<0.001	<0.001	<0.001											
Copper (filtered)	mg/L	0.001	20	0.0014 ^{#8}	1 ^{#13}	0.2	5	0.014	0.004	0.022	0.016	0.003	0.015	0.01	0.012	0.004											
Iron (filtered)	mg/L	0.05				0.2	10	0.26	<0.05	1.3	<0.05	0.19	<0.05	<0.05	<0.05	<0.05											
Lead (filtered)	mg/L	0.001	0.1	0.0034 ^{#8}	0.1	2	5	0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001											
Mercury (filtered)	mg/L	0.0001	0.01	0.00006 ^{#10}	0.002	0.002	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001											
Nickel (filtered)	mg/L	0.001	0.2	0.011 ^{#8}	1	0.2	2	0.041	0.026	0.025	0.016	0.028	0.021	0.015	0.007	0.005											
Selenium (filtered)	mg/L	0.001	0.1	0.005 ^{#10}	0.02	0.02	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.004	<0.001											
Zinc (filtered)	mg/L	0.005		0.008 ^{#8}	20	2	5	0.071	0.029	0.081	0.068	0.017	0.1	0.042	0.042	0.049											

Comments

- #1 Not specifically guideline value: >500mg/L can have purgative effects
- #2 Guideline value calculated by dividing Nitrate (as Nitrate) value (50 mg/L) by 4.427
- #3 Guideline value calculated by dividing Nitrite (as Nitrite) value (30 mg/L) by molecular weight (3.2967033).
- #4 Measured as NH3-N at pH 8, 95% FW value
- #5 Values taken from "Updating nitrate toxicity effects on freshwater aquatic species, 2013"
- #6 (pH >6.5, 0.8 ug/L for pH<6.5) 95% FW value
- #7 In absence of total As guideline, As (V) guideline has been adopted. 95% FW value
- #8 95% FW value
- #9 In absence of total Cr guideline, Cr (VI) guideline has been adopted. 95% FW value
- #10 99% FW value
- #11 400 mg/L divided by molecular weight, stock may tolerate higher nitrate concentrations if nitrate in feed are not high, water containing >1500 mg/L (as NO3) is likely to be toxic.
- #12 30 mg/L divided by molecular weight
- #13 >0.5 mg/L hazardous to sheep, >1 mg/L for cattle, >5 mg/L pigs and poultry
- #14 General guide, not intended to define suitability of irrigation water <650 uS/cm for sensitive crops, <1300 uS/cm for moderately sensitive crops, <2900 for moderately tolerant crops, <52000 for tolerant crops, <8100 for very tolerant crops.
- #15 pH between 6-8.5 for groundwater and 6-9 for surface water, to limit corrosion and fouling of systems
- #16 Low risk of increasing crop cadmium concentrations at <350 mg/L, may cause foliar injury (table 9.2.12 and 9.2.13)
- #17 Minimise bioclogging of irrigation equipment only
- #18 Chromium VI value has been used an indicator
- #19 25-125 mg/L - requires a site specific assessment
- #20 0.8-12 mg/L - requires a site specific assessment

Environmental Standards

National Health and Medical Research Council, January 2022, ADWG 2011 Recreational (v3.7 updated 2022)
Department of Agriculture and Water Resources, 2018 updated July 2021, ANZG (2018) - FW - slightly to moderately disturbed (updated 26 July 2021)

Appendix H

Certified Laboratory Report (April 2024)

GHD Melbourne
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention:
Report
1088191-W

Project name

Devon Meadows Groundwater Investigations

Project ID

12568833

Received Date

Apr 16, 2024

Client Sample ID			MB07	MB08	MB06
Sample Matrix			Water	Water	Water
Eurofins Sample No.			M24- Ap0041609	M24- Ap0041610	M24- Ap0041611
Date Sampled			Apr 16, 2024	Apr 16, 2024	Apr 16, 2024
Test/Reference	LOR	Unit			
Ammonia (as N)	0.01	mg/L	0.41	0.23	0.18
Chloride	1	mg/L	770	340	1100
Conductivity (at 25 °C)	10	uS/cm	2600	1700	3300
Nitrate & Nitrite (as N)	0.05	mg/L	20	37	3.8
Nitrate (as N)	0.02	mg/L	20	36	3.8
Nitrite (as N)	0.02	mg/L	< 0.02	0.06	< 0.02
pH (at 25 °C)	0.1	pH Units	7.1	7.2	6.9
Salinity (expressed as TDS)*	10	mg/L	1800	1100	1900
Sulphate (as SO4)	5	mg/L	100	97	45
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	3.3	5.0	1.9
Total Nitrogen (as N)*	0.2	mg/L	23	42	5.7
Hardness mg equivalent CaCO3/L	5	mg/L	460	180	670
Phosphate total (as P)	0.01	mg/L	0.16	0.01	0.08
Alkalinity (speciated)					
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	370	510	470
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10
Heavy Metals					
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	0.019	0.001	< 0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	0.003
Copper (filtered)	0.001	mg/L	0.010	0.012	0.015
Iron (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.015	0.007	0.021
Selenium (filtered)	0.001	mg/L	0.002	0.004	< 0.001
Zinc (filtered)	0.005	mg/L	0.042	0.042	0.10
Alkali Metals					
Calcium	0.5	mg/L	40	13	61
Magnesium	0.5	mg/L	86	36	130
Potassium	0.5	mg/L	0.8	0.7	1.5
Sodium	0.5	mg/L	470	360	480

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Major Cations			
Ammonia (as N)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser			
Alkali Metals	Melbourne	Apr 17, 2024	180 Days
- Method: LTM-MET-3010 Alkali Metals Sulfur Silicon Phosphorus by ICP-AES			
Major Anions			
Chloride	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4270 Anions by Ion Chromatography			
Nitrate (as N)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser			
Sulphate (as SO ₄)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4270 Anions by Ion Chromatography			
Alkalinity (speciated)	Melbourne	Apr 17, 2024	14 Days
- Method: LTM-INO-4250 Alkalinity by Electrometric Titration			
Conductivity (at 25 °C)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4030 Conductivity			
pH (at 25 °C)	Melbourne	Apr 17, 2024	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Salinity (expressed as TDS)*	Melbourne	Apr 17, 2024	7 Days
- Method: LTM-INO-4030			
Phosphate total (as P)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Melbourne	Apr 17, 2024	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Mobil Metals : Metals M15	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N)	Melbourne	Apr 17, 2024	28 Days
- Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser			
Nitrite (as N)	Melbourne	Apr 17, 2024	2 Days
- Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser			
Total Kjeldahl Nitrogen (as N)	Melbourne	Apr 17, 2024	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Hardness Set			
Hardness mg equivalent CaCO ₃ /L	Melbourne	Apr 17, 2024	28 Days
- Method: APHA 2340B Hardness by Calculation			



web: www.eurofins.com.au
email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarie	Mayfield West
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	NSW 2304
+61 3 8564 5000	+61 3 8564 5000	+61 2 9900 8400	+61 2 6113 8091	T: +61 7 3902 4600	+61 2 4968 8448
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	Site# 25079 & 25289

ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2377
Site# 2370

ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road
Welshpool
WA 6106
+61 8 6253 4444
NATA# 2561
Site# 2554

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road	Unit C1/4 Pacific Rise,	43 Detroit Drive	1277 Cameron Road,
Penrose,	Mount Wellington,	Rolleston,	Gate Pa,
Auckland 1061	Auckland 1061	Christchurch 7675	Tauranga 3112
+64 9 526 4551	+64 9 525 0568	+64 3 343 5201	+64 9 525 0568
IANZ# 1327	IANZ# 1308	IANZ# 1290	IANZ# 1402

Company Name:

GHD Pty Ltd VIC

Address:

Melbourne

VIC 3000

Project Name:

Devon Meadows Groundwater Investigations

Project ID:

12568833

Order No.:

Report #:

Phone:

Fax:

1088191

8687 8000

8687 8111

Received:

Due:

Priority:

Contact Name:

Apr 16, 2024 5:45 PM

Apr 24, 2024

5 Day

Eurofins Analytical Services Manager :

Sample Detail						Aluminium (filtered)	Arsenic (filtered)	Cadmium (filtered)	Chromium (filtered)	Conductivity (at 25 °C)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	pH (at 25 °C)	Phosphate total (as P)	Salinity (expressed as TDS)*	Selenium (filtered)	Zinc (filtered)	Total Nitrogen Set (as N)	Major Anions	Hardness Set	Major Cations
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																			
1	MB07	Apr 16, 2024	11:00AM	Water	M24-Ap0041609	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB08	Apr 16, 2024	2:10PM	Water	M24-Ap0041610	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB06	Apr 16, 2024	4:33PM	Water	M24-Ap0041611	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Conductivity (at 25 °C)	uS/cm	10			10	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Salinity (expressed as TDS)*	mg/L	< 10			10	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Hardness mg equivalent CaCO3/L	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							
Ammonia (as N)	%	113			70-130	Pass	
Chloride	%	102			70-130	Pass	
Conductivity (at 25 °C)	%	93			70-130	Pass	
Nitrate & Nitrite (as N)	%	110			70-130	Pass	
Sulphate (as SO4)	%	127			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	%	117			70-130	Pass	
Phosphate total (as P)	%	93			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	114			70-130	Pass	
LCS - % Recovery							
Nitrate & Nitrite (as N)	%	111			70-130	Pass	
LCS - % Recovery							
Nitrite (as N)	%	106			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	91			80-120	Pass	
Magnesium	%	93			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Potassium			%	92			80-120	Pass	
Sodium			%	93			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Total Kjeldahl Nitrogen (as N)	M24-Ap0041540	NCP	%	101			70-130	Pass	
Phosphate total (as P)	M24-Ap0038957	NCP	%	96			70-130	Pass	
Spike - % Recovery									
				Result 1					
Heavy Metals									
Aluminium (filtered)	M24-Ap0036522	NCP	%	92			75-125	Pass	
Arsenic (filtered)	M24-Ap0036522	NCP	%	93			75-125	Pass	
Cadmium (filtered)	M24-Ap0036522	NCP	%	87			75-125	Pass	
Chromium (filtered)	M24-Ap0036522	NCP	%	86			75-125	Pass	
Copper (filtered)	M24-Ap0036522	NCP	%	84			75-125	Pass	
Iron (filtered)	M24-Ap0036522	NCP	%	88			75-125	Pass	
Lead (filtered)	M24-Ap0036522	NCP	%	84			75-125	Pass	
Mercury (filtered)	M24-Ap0036522	NCP	%	90			75-125	Pass	
Nickel (filtered)	M24-Ap0036522	NCP	%	85			75-125	Pass	
Selenium (filtered)	M24-Ap0036522	NCP	%	87			75-125	Pass	
Zinc (filtered)	M24-Ap0036522	NCP	%	90			75-125	Pass	
Spike - % Recovery									
				Result 1					
Alkali Metals									
Calcium	M24-Ap0039585	NCP	%	94			75-125	Pass	
Magnesium	M24-Ap0039585	NCP	%	98			75-125	Pass	
Potassium	M24-Ap0039585	NCP	%	93			75-125	Pass	
Sodium	M24-Ap0039585	NCP	%	93			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M24-Ap0040063	NCP	mg/L	0.14	0.11	20	30%	Pass	
Chloride	M24-Ap0038451	NCP	mg/L	1.9	1.9	<1	30%	Pass	
Nitrite (as N)	M24-Ap0040063	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
pH (at 25 °C)	M24-Ap0038643	NCP	pH Units	3.6	3.6	pass	30%	Pass	
Sulphate (as SO4)	M24-Ap0038451	NCP	mg/L	76	72	4.2	30%	Pass	
Total Kjeldahl Nitrogen (as N)	M24-Ap0040846	NCP	mg/L	1.0	1.2	18	30%	Pass	
Hardness mg equivalent CaCO3/L	M24-Ap0038451	NCP	mg/L	88	88	<1	30%	Pass	
Phosphate total (as P)	M24-Ap0041609	CP	mg/L	0.16	0.15	7.2	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Alkalinity (speciated)									
Bicarbonate Alkalinity (as CaCO3)	M24-Ap0038643	NCP	mg/L	< 20	< 20	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M24-Ap0038643	NCP	mg/L	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Heavy Metals									
Aluminium (filtered)	M24-Ap0036522	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic (filtered)	M24-Ap0036522	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	M24-Ap0036522	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M24-Ap0036522	NCP	mg/L	0.006	0.006	2.3	30%	Pass	
Copper (filtered)	M24-Ap0036522	NCP	mg/L	0.004	0.004	2.4	30%	Pass	
Iron (filtered)	M24-Ap0036522	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Lead (filtered)	M24-Ap0036522	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	M24-Ap0036522	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	M24-Ap0036522	NCP	mg/L	0.007	0.007	1.7	30%	Pass	
Selenium (filtered)	M24-Ap0036522	NCP	mg/L	0.002	0.002	2.7	30%	Pass	
Zinc (filtered)	M24-Ap0036522	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate								
Alkali Metals				Result 1	Result 2	RPD		
Calcium	M24-Ap0038451	NCP	mg/L	7.2	7.3	<1	30%	Pass
Magnesium	M24-Ap0038451	NCP	mg/L	17	17	<1	30%	Pass
Potassium	M24-Ap0038451	NCP	mg/L	0.8	0.8	<1	30%	Pass
Sodium	M24-Ap0038451	NCP	mg/L	3.2	3.2	<1	30%	Pass

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Catherine Wilson	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal


Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

GHD Melbourne
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention:
Report
1088804-W

Project name

Devon Meadows Groundwater Investigations

Project ID

12568833

Received Date

Apr 17, 2024

Client Sample ID			MB02	MB05	QA_01	MB03
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M24- Ap0046402	M24- Ap0046403	M24- Ap0046404	M24- Ap0046405
Date Sampled			Apr 17, 2024	Apr 17, 2024	Apr 17, 2024	Apr 17, 2024
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	0.24	< 0.01	< 0.01	< 0.01
Chloride	1	mg/L	62	1000	1000	800
Conductivity (at 25 °C)	10	uS/cm	47	2200	2100	110
Nitrate & Nitrite (as N)	0.05	mg/L	< 0.05	0.60	0.68	0.10
Nitrate (as N)	0.02	mg/L	0.03	0.60	0.68	0.10
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
pH (at 25 °C)	0.1	pH Units	5.5	6.6	6.6	5.6
Salinity (expressed as TDS)*	10	mg/L	570	1400	1400	980
Sulphate (as SO4)	5	mg/L	29	33	33	38
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	3.2	< 0.2	< 0.2	0.8
Total Nitrogen (as N)*	0.2	mg/L	3.2	0.6	0.7	0.9
Hardness mg equivalent CaCO3/L	5	mg/L	76	370	390	120
Phosphate total (as P)	0.01	mg/L	9.3	0.07	0.09	0.02
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	48	230	280	32
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	< 10
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	< 20
Total Alkalinity (as CaCO3)	20	mg/L	48	230	280	32
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	0.21	0.17	0.83
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.008
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	0.001	0.002	0.001	0.003
Copper (filtered)	0.001	mg/L	0.004	0.003	0.003	0.022
Iron (filtered)	0.05	mg/L	< 0.05	0.19	0.33	1.3
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.002
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.026	0.028	0.027	0.025
Selenium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Zinc (filtered)	0.005	mg/L	0.029	0.017	0.014	0.081
Alkali Metals						
Calcium	0.5	mg/L	20	24	26	4.4
Magnesium	0.5	mg/L	6.3	76	79	25
Potassium	0.5	mg/L	10	< 0.5	< 0.5	< 0.5
Sodium	0.5	mg/L	26	340	360	320

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Ammonia (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Conductivity (at 25 °C) - Method: LTM-INO-4030 Conductivity	Melbourne	Apr 18, 2024	28 Days
pH (at 25 °C) - Method: LTM-GEN-7090 pH in water by ISE	Melbourne	Apr 18, 2024	0 Hours
Salinity (expressed as TDS)* - Method: LTM-INO-4030	Melbourne	Apr 19, 2024	7 Days
Phosphate total (as P) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 19, 2024	28 Days
Heavy Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 23, 2024	180 Days
Mercury (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 19, 2024	28 Days
Eurofins Suite B11C: Na/K/Ca/Mg - Method: LTM-MET-3040 METALS IN WATERS, SOLIDS,	Melbourne	Apr 23, 2024	180 Days
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 18, 2024	28 Days
Sulphate (as SO4) - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 18, 2024	28 Days
Alkalinity (speciated) - Method: LTM-INO-4250 Alkalinity by Electrometric Titration	Melbourne	Apr 23, 2024	14 Days
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Nitrate (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	2 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Apr 19, 2024	28 Days
Hardness Set			
Hardness mg equivalent CaCO3/L - Method: APHA 2340B Hardness by Calculation	Melbourne	Apr 19, 2024	28 Days
Alkali Metals - Method: LTM-MET-3010 Alkali Metals Sulfur Silicon Phosphorus by ICP-AES	Melbourne	Apr 19, 2024	180 Days

Repeat Samples

Description	Testing Site	Extracted	Holding Time
Ammonia (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Conductivity (at 25 °C) - Method: LTM-INO-4030 Conductivity	Melbourne	Apr 18, 2024	28 Days
pH (at 25 °C) - Method: LTM-GEN-7090 pH in water by ISE	Melbourne	Apr 18, 2024	0 Hours
Salinity (expressed as TDS)* - Method: LTM-INO-4030	Melbourne	Apr 19, 2024	7 Days
Phosphate total (as P) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 19, 2024	28 Days

Description	Testing Site	Extracted	Holding Time
Heavy Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 23, 2024	180 Days
Mercury (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 19, 2024	28 Days
Eurofins Suite B11C: Na/K/Ca/Mg - Method: LTM-MET-3040 METALS IN WATERS, SOLIDS,	Melbourne	Apr 23, 2024	180 Days
Eurofins Suite B11E: Cl/SO4/Alkalinity			
Chloride - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 18, 2024	28 Days
Sulphate (as SO4) - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 18, 2024	28 Days
Alkalinity (speciated) - Method: LTM-INO-4250 Alkalinity by Electrometric Titration	Melbourne	Apr 23, 2024	14 Days
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Nitrate (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	28 Days
Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 19, 2024	2 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Apr 19, 2024	28 Days
Hardness Set			
Hardness mg equivalent CaCO3/L - Method: APHA 2340B Hardness by Calculation	Melbourne	Apr 19, 2024	28 Days
Alkali Metals - Method: LTM-MET-3010 Alkali Metals Sulfur Silicon Phosphorus by ICP-AES	Melbourne	Apr 19, 2024	180 Days



web: www.eurofins.com.au
email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne 6 Monterey Road Dandenong South VIC 3175 +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarie QLD 4172 T: +61 7 3902 4600 NATA# 1261 Site# 20794	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289
---	--	--	--	---	--

ABN: 91 05 0159 898

Perth 46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2377 Site# 2370

ABN: 47 009 120 549

Perth ProMicro 46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2561 Site# 2554
--

NZBN: 9429046024954

Auckland 35 O'Rorke Road Penrose, Auckland 1061 +64 9 526 4551 IANZ# 1327	Auckland (Focus) Unit C1/4 Pacific Rise, Mount Wellington, Auckland 1061 +64 9 525 0568 IANZ# 1308	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 +64 3 343 5201 IANZ# 1290	Tauranga 1277 Cameron Road, Gate Pa, Tauranga 3112 +64 9 525 0568 IANZ# 1402
---	--	--	--

Company Name:

GHD Pty Ltd VIC

Address:

Melbourne

VIC 3000

Project Name:

Devon Meadows Groundwater Investigations

Project ID:

12568833

Order No.:

Report #:

Phone:

Fax:

1088804

8687 8000

8687 8111

Received:

Due:

Priority:

Contact Name:

Apr 17, 2024 5:40 PM

Apr 26, 2024

5 Day

Eurofins Analytical Services Manager :

Sample Detail						Aluminium (filtered)	Ammonia (as N)	Arsenic (filtered)	Cadmium (filtered)	Chromium (filtered)	Conductivity (at 25 °C)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	pH (at 25 °C)	Phosphate total (as P)	Salinity (expressed as TDS)*	Selenium (filtered)	Zinc (filtered)	Total Nitrogen Set (as N)	Hardness Set	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																									
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																				
1	MB02	Apr 17, 2024	9:33AM	Water	M24-Ap0046402	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB05	Apr 17, 2024	12:40PM	Water	M24-Ap0046403	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	QA_01	Apr 17, 2024	12:49PM	Water	M24-Ap0046404	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	MB03	Apr 17, 2024	2:10PM	Water	M24-Ap0046405	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						6	4	6	4	4	4	6	6	4	4	4	4	4	4	6	4	4	4	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Conductivity (at 25 °C)	uS/cm	10			10	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Salinity (expressed as TDS)*	mg/L	< 10			10	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkali Metals							
Potassium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Hardness mg equivalent CaCO3/L	mg/L	< 5			5	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Chloride	%	116			70-130	Pass	
Conductivity (at 25 °C)	%	98			70-130	Pass	
Sulphate (as SO4)	%	91			70-130	Pass	
Phosphate total (as P)	%	94			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	87			70-130	Pass	
Total Alkalinity (as CaCO3)	%	118			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	92			80-120	Pass	
Magnesium	%	90			80-120	Pass	
Potassium	%	92			80-120	Pass	
Sodium	%	90			80-120	Pass	
LCS - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Nitrite (as N)			%	107			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Aluminium (filtered)			%	104			80-120	Pass	
Arsenic (filtered)			%	101			80-120	Pass	
Cadmium (filtered)			%	99			80-120	Pass	
Chromium (filtered)			%	100			80-120	Pass	
Copper (filtered)			%	98			80-120	Pass	
Iron (filtered)			%	114			80-120	Pass	
Lead (filtered)			%	96			80-120	Pass	
Mercury (filtered)			%	90			80-120	Pass	
Nickel (filtered)			%	101			80-120	Pass	
Selenium (filtered)			%	88			80-120	Pass	
Zinc (filtered)			%	102			80-120	Pass	
LCS - % Recovery									
Nitrate & Nitrite (as N)			%	112			70-130	Pass	
Total Kjeldahl Nitrogen (as N)			%	92			70-130	Pass	
LCS - % Recovery									
Alkali Metals									
Calcium			%	97			80-120	Pass	
Magnesium			%	97			80-120	Pass	
Potassium			%	97			80-120	Pass	
Sodium			%	97			80-120	Pass	
LCS - % Recovery									
Ammonia (as N)			%	112			70-130	Pass	
Nitrate & Nitrite (as N)			%	115			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Nitrate & Nitrite (as N)	M24-Ap0043540	NCP	%	110			70-130	Pass	
Nitrite (as N)	M24-Ap0043540	NCP	%	102			70-130	Pass	
Sulphate (as SO4)	M24-Ap0047505	NCP	%	89			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	M24-Ap0043550	NCP	%	112			70-130	Pass	
Phosphate total (as P)	M24-Ap0047721	NCP	%	103			70-130	Pass	
Spike - % Recovery									
				Result 1					
Aluminium (filtered)	M24-Ap0046402	CP	%	99			75-125	Pass	
Arsenic (filtered)	M24-Ap0046402	CP	%	100			75-125	Pass	
Cadmium (filtered)	M24-Ap0046402	CP	%	96			75-125	Pass	
Chromium (filtered)	M24-Ap0046402	CP	%	94			75-125	Pass	
Copper (filtered)	M24-Ap0046402	CP	%	91			75-125	Pass	
Iron (filtered)	M24-Ap0046402	CP	%	96			75-125	Pass	
Lead (filtered)	M24-Ap0046402	CP	%	91			75-125	Pass	
Mercury (filtered)	M24-Ap0046402	CP	%	100			75-125	Pass	
Nickel (filtered)	M24-Ap0046402	CP	%	95			75-125	Pass	
Selenium (filtered)	M24-Ap0046402	CP	%	92			75-125	Pass	
Zinc (filtered)	M24-Ap0046402	CP	%	100			75-125	Pass	
Spike - % Recovery									
				Result 1					
Calcium	M24-Ap0046402	CP	%	99			75-125	Pass	
Magnesium	M24-Ap0046402	CP	%	94			75-125	Pass	
Potassium	M24-Ap0046402	CP	%	92			75-125	Pass	
Sodium	M24-Ap0046402	CP	%	88			75-125	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
				Result 1					
Ammonia (as N)	G24-Ap0047540	NCP	%	113			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium (filtered)	M24-Ap0046403	CP	%	89			75-125	Pass	
Arsenic (filtered)	M24-Ap0046403	CP	%	92			75-125	Pass	
Cadmium (filtered)	M24-Ap0046403	CP	%	86			75-125	Pass	
Chromium (filtered)	M24-Ap0046403	CP	%	87			75-125	Pass	
Copper (filtered)	M24-Ap0046403	CP	%	83			75-125	Pass	
Iron (filtered)	M24-Ap0046403	CP	%	109			75-125	Pass	
Lead (filtered)	M24-Ap0046403	CP	%	83			75-125	Pass	
Mercury (filtered)	M24-Ap0046403	CP	%	81			75-125	Pass	
Nickel (filtered)	M24-Ap0046403	CP	%	84			75-125	Pass	
Selenium (filtered)	M24-Ap0046403	CP	%	98			75-125	Pass	
Zinc (filtered)	M24-Ap0046403	CP	%	88			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M24-Ap0043539	NCP	mg/L	1.3	1.2	8.9	30%	Pass	
Chloride	M24-Ap0037292	NCP	mg/L	450	440	<1	30%	Pass	
Nitrate & Nitrite (as N)	M24-Ap0043539	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Nitrite (as N)	M24-Ap0043539	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Sulphate (as SO4)	M24-Ap0037292	NCP	mg/L	120	120	<1	30%	Pass	
Hardness mg equivalent CaCO3/L	M24-Ap0046402	CP	mg/L	76	76	<1	30%	Pass	
Phosphate total (as P)	M24-Ap0046402	CP	mg/L	9.3	9.6	2.2	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	M24-Ap0046402	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic (filtered)	M24-Ap0046402	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	M24-Ap0046402	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M24-Ap0046402	CP	mg/L	0.001	0.001	3.6	30%	Pass	
Copper (filtered)	M24-Ap0046402	CP	mg/L	0.004	0.004	2.8	30%	Pass	
Iron (filtered)	M24-Ap0046402	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Lead (filtered)	M24-Ap0046402	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	M24-Ap0046402	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	M24-Ap0046402	CP	mg/L	0.026	0.025	3.2	30%	Pass	
Selenium (filtered)	M24-Ap0046402	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc (filtered)	M24-Ap0046402	CP	mg/L	0.029	0.029	1.3	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	M24-Ap0046402	CP	mg/L	20	20	1.3	30%	Pass	
Magnesium	M24-Ap0046402	CP	mg/L	6.3	6.3	<1	30%	Pass	
Potassium	M24-Ap0046402	CP	mg/L	10	10	<1	30%	Pass	
Sodium	M24-Ap0046402	CP	mg/L	26	26	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Kjeldahl Nitrogen (as N)	M24-Ap0046403	CP	mg/L	< 0.2	< 0.2	<1	30%	Pass	
Phosphate total (as P)	M24-Ap0046403	CP	mg/L	0.07	0.07	8.6	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	M24-Ap0046403	CP	mg/L	0.21	0.17	18	30%	Pass	
Arsenic (filtered)	M24-Ap0046403	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	M24-Ap0046403	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M24-Ap0046403	CP	mg/L	0.002	0.001	17	30%	Pass	

Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Copper (filtered)	M24-Ap0046403	CP	mg/L	0.003	0.003	6.2	30%	Pass
Iron (filtered)	M24-Ap0046403	CP	mg/L	0.19	0.16	19	30%	Pass
Lead (filtered)	M24-Ap0046403	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Mercury (filtered)	M24-Ap0046403	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel (filtered)	M24-Ap0046403	CP	mg/L	0.028	0.027	4.0	30%	Pass
Selenium (filtered)	M24-Ap0046403	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Zinc (filtered)	M24-Ap0046403	CP	mg/L	0.017	0.016	4.9	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Conductivity (at 25 °C)	M24-Ap0046404	CP	uS/cm	2100	2100	<1	30%	Pass
pH (at 25 °C)	M24-Ap0046404	CP	pH Units	6.6	6.6	pass	30%	Pass
Total Kjeldahl Nitrogen (as N)	M24-Ap0046404	CP	mg/L	< 0.2	< 0.2	<1	30%	Pass
Duplicate								
Alkalinity (speciated)				Result 1	Result 2	RPD		
Bicarbonate Alkalinity (as CaCO ₃)	M24-Ap0046404	CP	mg/L	280	300	5.1	30%	Pass
Carbonate Alkalinity (as CaCO ₃)	M24-Ap0046404	CP	mg/L	< 10	< 10	<1	30%	Pass
Hydroxide Alkalinity (as CaCO ₃)	M24-Ap0046404	CP	mg/L	< 20	< 20	<1	30%	Pass
Total Alkalinity (as CaCO ₃)	M24-Ap0046404	CP	mg/L	280	300	5.1	30%	Pass

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Catherine Wilson	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal


Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

GHD Melbourne
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
 NATA is a signatory to the ILAC Mutual Recognition
 Arrangement for the mutual recognition of the
 equivalence of testing, medical testing, calibration,
 inspection, proficiency testing scheme providers and
 reference materials producers reports and certificates.

Attention:
Report
1089182-W

Project name

DEVON MEADOWS GROUNDWATER INVESTIGATIONS

Project ID

12568833

Received Date

Apr 18, 2024

Client Sample ID			MB04	MB01	MB09	QA_2
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			M24- Ap0049805	M24- Ap0049806	M24- Ap0049807	M24- Ap0049808
Date Sampled			Apr 18, 2024	Apr 18, 2024	Apr 18, 2024	Apr 18, 2024
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	0.03	0.03	0.03	< 0.01
Chloride	1	mg/L	68	1500	330	-
Conductivity (at 25 °C)	10	uS/cm	220	4000	1400	-
Nitrate & Nitrite (as N)	0.05	mg/L	3.5	< 0.05	33	< 0.05
Nitrate (as N)	0.02	mg/L	3.5	< 0.02	33	< 0.02
Nitrite (as N)	0.02	mg/L	< 0.02	< 0.02	0.04	< 0.02
pH (at 25 °C)	0.1	pH Units	5.7	6.0	7.1	-
Salinity (expressed as TDS)*	10	mg/L	250	2400	910	-
Sulphate (as SO4)	5	mg/L	< 5	61	37	-
Total Kjeldahl Nitrogen (as N)	0.2	mg/L	1.2	< 0.2	2.6	< 0.2
Total Nitrogen (as N)*	0.2	mg/L	4.7	< 0.2	36	< 0.2
Hardness mg equivalent CaCO3/L	5	mg/L	15	620	150	-
Phosphate total (as P)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	1800	290	2500	-
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	-
Hydroxide Alkalinity (as CaCO3)	20	mg/L	< 20	< 20	< 20	-
Total Alkalinity (as CaCO3)	20	mg/L	1800	290	2500	-
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	-
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	-
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Copper (filtered)	0.001	mg/L	0.016	0.014	0.004	-
Iron (filtered)	0.05	mg/L	< 0.05	0.26	< 0.05	-
Lead (filtered)	0.001	mg/L	< 0.001	0.001	< 0.001	-
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	-
Nickel (filtered)	0.001	mg/L	0.016	0.041	0.005	-
Selenium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Zinc (filtered)	0.005	mg/L	0.068	0.071	0.049	-
Alkali Metals						
Calcium	0.5	mg/L	1.5	26	21	-
Magnesium	0.5	mg/L	2.4	140	23	-
Potassium	0.5	mg/L	0.5	< 5	< 0.5	-
Sodium	0.5	mg/L	45	740	300	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Ammonia (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 23, 2024	28 Days
Conductivity (at 25 °C) - Method: LTM-INO-4030 Conductivity	Melbourne	Apr 23, 2024	28 Days
pH (at 25 °C) - Method: LTM-GEN-7090 pH in water by ISE	Melbourne	Apr 23, 2024	0 Hours
Salinity (expressed as TDS)* - Method: LTM-INO-4030	Melbourne	Apr 23, 2024	7 Days
Phosphate total (as P) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 23, 2024	28 Days
Heavy Metals (filtered) - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 23, 2024	180 Days
Mobil Metals : Metals M15 - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Apr 23, 2024	28 Days
Eurofins Suite B11C: Na/K/Ca/Mg - Method: LTM-MET-3040 METALS IN WATERS, SOLIDS,	Melbourne	Apr 26, 2024	180 Days
Eurofins Suite B11E: Cl/SO4/Alkalinity Chloride - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 23, 2024	28 Days
Sulphate (as SO4) - Method: LTM-INO-4270 Anions by Ion Chromatography	Melbourne	Apr 23, 2024	28 Days
Alkalinity (speciated) - Method: LTM-INO-4250 Alkalinity by Electrometric Titration	Melbourne	Apr 24, 2024	14 Days
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 23, 2024	28 Days
Nitrate (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 23, 2024	28 Days
Nitrite (as N) - Method: LTM-INO-4450 Determination of Nitrogen Species by Discrete Analyser	Melbourne	Apr 23, 2024	2 Days
Total Kjeldahl Nitrogen (as N) - Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA	Melbourne	Apr 23, 2024	28 Days
Hardness Set			
Hardness mg equivalent CaCO3/L - Method: APHA 2340B Hardness by Calculation	Melbourne	Apr 23, 2024	28 Days



web: www.eurofins.com.au
email: EnviroSales@eurofins.com

ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road Dandenong South VIC 3175 +61 3 8564 5000 NATA# 1261 Site# 1254	19/8 Lewalan Street Grovedale VIC 3216 +61 3 8564 5000 NATA# 1261 Site# 25403	179 Magowar Road Girraween NSW 2145 +61 2 9900 8400 NATA# 1261 Site# 18217	Unit 1,2 Dacre Street Mitchell ACT 2911 +61 2 6113 8091 NATA# 1261 Site# 25466	1/21 Smallwood Place Murarie QLD 4172 T: +61 7 3902 4600 NATA# 1261 Site# 20794	1/2 Frost Drive Mayfield West NSW 2304 +61 2 4968 8448 NATA# 1261 Site# 25079 & 25289

ABN: 91 05 0159 898

Perth
46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2377 Site# 2370

ABN: 47 009 120 549

Perth ProMicro
46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2561 Site# 2554

NZBN: 9429046024954

Auckland	Auckland (Focus)	Christchurch	Tauranga
35 O'Rorke Road Penrose, Auckland 1061 +64 9 526 4551 IANZ# 1327	Unit C1/4 Pacific Rise, Mount Wellington, Auckland 1061 +64 9 525 0568 IANZ# 1308	43 Detroit Drive Rolleston, Christchurch 7675 +64 3 343 5201 IANZ# 1290	1277 Cameron Road, Gate Pa, Tauranga 3112 +64 9 525 0568 IANZ# 1402

Company Name:

GHD Pty Ltd VIC

Address:

Melbourne

VIC 3000

Project Name:

DEVON MEADOWS GROUNDWATER INVESTIGATIONS

Project ID:

12568833

Order No.:

Report #:

Phone:

Fax:

1089182

8687 8000

8687 8111

Received:

Due:

Priority:

Contact Name:

Apr 18, 2024 5:55 PM

Apr 29, 2024

5 Day

Eurofins Analytical Services Manager :

Sample Detail						Aluminium (filtered)	Ammonia (as N)	Arsenic (filtered)	Cadmium (filtered)	Chromium (filtered)	Conductivity (at 25 °C)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	pH (at 25 °C)	Phosphate total (as P)	Salinity (expressed as TDS)*	Selenium (filtered)	Zinc (filtered)	Total Nitrogen Set (as N)	Hardness Set	Eurofins Suite B11E: Cl/SO4/Alkalinity	Eurofins Suite B11C: Na/K/Ca/Mg
Melbourne Laboratory - NATA # 1261 Site # 1254						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																									
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																				
1	MB04	Apr 18, 2024		Water	M24-Ap0049805	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MB01	Apr 18, 2024		Water	M24-Ap0049806	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MB09	Apr 18, 2024		Water	M24-Ap0049807	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	QA 2	Apr 18, 2024		Water	M24-Ap0049808		X											X				X			
Test Counts						3	4	3	3	3	3	3	3	3	3	3	3	4	3	3	3	4	3	3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Conductivity (at 25 °C)	uS/cm	10			10	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Salinity (expressed as TDS)*	mg/L	< 10			10	Pass	
Sulphate (as SO ₄)	mg/L	< 5			5	Pass	
Hardness mg equivalent CaCO ₃ /L	mg/L	< 5			5	Pass	
Phosphate total (as P)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Chloride	mg/L	< 1			1	Pass	
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Method Blank							
Nitrite (as N)	mg/L	< 0.02			0.02	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.05			0.05	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Selenium (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Nitrate & Nitrite (as N)	mg/L	< 0.05			0.05	Pass	
Total Kjeldahl Nitrogen (as N)	mg/L	< 0.2			0.2	Pass	
LCS - % Recovery							
Ammonia (as N)	%	105			70-130	Pass	
Conductivity (at 25 °C)	%	74			70-130	Pass	
Nitrate & Nitrite (as N)	%	104			70-130	Pass	
Sulphate (as SO ₄)	%	115			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	%	102			70-130	Pass	
Phosphate total (as P)	%	111			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO ₃)	%	77			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	99			80-120	Pass	
Magnesium	%	99			80-120	Pass	
Potassium	%	100			80-120	Pass	
Sodium	%	99			80-120	Pass	
LCS - % Recovery							

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Chloride			%	124			70-130	Pass	
LCS - % Recovery									
Alkalinity (speciated)									
Total Alkalinity (as CaCO3)			%	93			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Aluminium (filtered)			%	105			80-120	Pass	
Arsenic (filtered)			%	99			80-120	Pass	
Cadmium (filtered)			%	97			80-120	Pass	
Chromium (filtered)			%	97			80-120	Pass	
Copper (filtered)			%	95			80-120	Pass	
Iron (filtered)			%	102			80-120	Pass	
Lead (filtered)			%	94			80-120	Pass	
Mercury (filtered)			%	98			80-120	Pass	
Nickel (filtered)			%	98			80-120	Pass	
Selenium (filtered)			%	93			80-120	Pass	
Zinc (filtered)			%	98			80-120	Pass	
LCS - % Recovery									
Alkali Metals									
Calcium			%	98			80-120	Pass	
Magnesium			%	99			80-120	Pass	
Potassium			%	97			80-120	Pass	
Sodium			%	99			80-120	Pass	
LCS - % Recovery									
Nitrite (as N)			%	102			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chloride	M24-Ap0048747	NCP	%	78			70-130	Pass	
Nitrate & Nitrite (as N)	M24-Ap0054127	NCP	%	111			70-130	Pass	
Nitrite (as N)	M24-Ap0054127	NCP	%	102			70-130	Pass	
Sulphate (as SO4)	M24-Ap0047828	NCP	%	110			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	M24-Ap0052084	NCP	%	102			70-130	Pass	
Phosphate total (as P)	G24-Ap0051752	NCP	%	98			70-130	Pass	
Spike - % Recovery									
				Result 1					
Aluminium (filtered)	M24-Ap0049415	NCP	%	89			75-125	Pass	
Arsenic (filtered)	M24-Ap0049415	NCP	%	100			75-125	Pass	
Cadmium (filtered)	M24-Ap0049415	NCP	%	84			75-125	Pass	
Chromium (filtered)	M24-Ap0049415	NCP	%	84			75-125	Pass	
Copper (filtered)	M24-Ap0049415	NCP	%	82			75-125	Pass	
Iron (filtered)	M24-Ap0049415	NCP	%	84			75-125	Pass	
Lead (filtered)	M24-Ap0049415	NCP	%	82			75-125	Pass	
Mercury (filtered)	M24-Ap0049415	NCP	%	124			75-125	Pass	
Nickel (filtered)	M24-Ap0049415	NCP	%	83			75-125	Pass	
Selenium (filtered)	M24-Ap0049415	NCP	%	104			75-125	Pass	
Zinc (filtered)	M24-Ap0049415	NCP	%	88			75-125	Pass	
Spike - % Recovery									
				Result 1					
Alkali Metals									
Sodium	M24-Ap0049805	CP	%	99			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	M24-Ap0054117	NCP	mg/L	0.09	0.10	11	30%	Pass	
Chloride	M24-Ap0047822	NCP	mg/L	33	32	2.7	30%	Pass	
Conductivity (at 25 °C)	M24-Ap0049805	CP	uS/cm	220	230	7.5	30%	Pass	
Nitrate & Nitrite (as N)	M24-Ap0048741	NCP	mg/L	1.3	1.3	1.9	30%	Pass	
Nitrite (as N)	M24-Ap0048741	NCP	mg/L	0.03	0.02	13	30%	Pass	
pH (at 25 °C)	M24-Ap0049805	CP	pH Units	5.7	5.6	pass	30%	Pass	
Sulphate (as SO4)	M24-Ap0047822	NCP	mg/L	240	230	1.4	30%	Pass	
Total Kjeldahl Nitrogen (as N)	B24-Ap0047051	NCP	mg/L	880	760	15	30%	Pass	
Phosphate total (as P)	M24-Ap0049805	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	M24-Ap0049805	CP	mg/L	1800	1700	2.8	30%	Pass	
Carbonate Alkalinity (as CaCO3)	M24-Ap0049805	CP	mg/L	< 10	< 10	<1	30%	Pass	
Hydroxide Alkalinity (as CaCO3)	M24-Ap0049805	CP	mg/L	< 20	< 20	<1	30%	Pass	
Total Alkalinity (as CaCO3)	M24-Ap0049805	CP	mg/L	1800	1700	2.8	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Aluminium (filtered)	M24-Ap0049415	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Arsenic (filtered)	M24-Ap0049415	NCP	mg/L	0.002	0.002	<1	30%	Pass	
Cadmium (filtered)	M24-Ap0049415	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium (filtered)	M24-Ap0049415	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper (filtered)	M24-Ap0049415	NCP	mg/L	0.007	0.007	4.4	30%	Pass	
Iron (filtered)	M24-Ap0049415	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Lead (filtered)	M24-Ap0049415	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	M24-Ap0049415	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	M24-Ap0049415	NCP	mg/L	0.008	0.009	7.6	30%	Pass	
Selenium (filtered)	M24-Ap0049415	NCP	mg/L	0.022	0.020	11	30%	Pass	
Zinc (filtered)	M24-Ap0049415	NCP	mg/L	< 0.005	0.006	48	30%	Fail	Q15
Duplicate									
				Result 1	Result 2	RPD			
Phosphate total (as P)	M24-Ap0049806	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Harry Bacalis	Analytical Services Manager
Caitlin Breeze	Senior Analyst-Inorganic
Emily Rosenberg	Senior Analyst-Metal
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal



Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

Eurofins shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Appendix I

**Field equipment and logger calibration
records and sampling QA results**

Oil / Water Interface Meter

Instrument **Geotech Interface Meter (60M)**
Serial No. **5412**



Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: _____

Calibration date: **08-Apr-24**

Next calibration due: **05-Oct-24**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 17K101079



Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
	Seal		
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. ORP in mV	✓	
	3. EC/Temp.	✓	
	4. D.O.	✓	
Alarms	Beeper		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Value	Standard		Instrument Reading
Temperature	19.8		Checked	19.8 °C
pH	pH 7	399304	Calibrated	0.00 mV
pH	pH 4	399527	Calibrated	177.0 mV
EC	Zero	Air	Checked	0.002 mS/cm
EC	2.76 mS/cm	398327	Calibrated	2.62 mS/cm
ORP (mV)	234.44 mV	400645 / 399854	Calibrated	234.4 mV
DO Zero	Zero	329994	Checked	-2.5 %
DO 100%	100%	Water saturated air	Calibrated	87.2 %

Calibrated by:



Calibration date:

10-Apr-24

Next calibration due

11-May-24

Instrument Details:

Instrument Model: **Rugged BaroTROLL**
Full Scale Depth Range: **0 to 15 Ft (0 to 1 m)**
Serial Number: **1001247**
Hardware Version: **0**
Firmware Version: **1.05**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-01-31 17:35:42 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7475	35.7410	-0.0066	FT
Depth	9.2189	9.2143	-0.0046	FT
Depth	-17.3088	-17.3096	-0.0008	FT
Temperature	19.7240	19.7237	-0.0003	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY47002282
Manu Instrulab Model 406X-031-01 SerialNo 31128-1
Manu Fluke Model 1504 SerialNo C14477
Manu Mensor Model CPC6000 SerialNo 610206

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1083748**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-11-17 11:48:44 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7461	35.7301	-0.0160	FT
Depth	18.0575	18.0595	0.0020	FT
Depth	0.3779	0.3801	0.0022	FT
Temperature	19.8709	19.8706	-0.0003	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY47001576
Manu Instrulab Model 406X-031-01 SerialNo 3-31139
Manu Fluke Model 1504 SerialNo C14477
Manu Mensor Model CPC6000 SerialNo 610206

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.





Calibration Report

Report Number: 20230824095326-1061201

221 East Lincoln Avenue, Fort Collins, CO 80524 USA

1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598

Visit us at www.in-situ.com

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1061201**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-08-24 09:53:26 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7454	35.7365	-0.0089	FT
Depth	18.0589	18.0639	0.0050	FT
Depth	0.3760	0.3750	-0.0011	FT
Temperature	20.0237	20.0506	0.0269	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY40016413
Manu Instrulab Model 406X-031-01 SerialNo 19528-1
Manu Fluke Model 1504 SerialNo C11443
Manu Mensor Model CPC6000 SerialNo 611120

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Performed By: JD



Calibration Report

Report Number: 2024020118821-1102254
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1102254**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: 2024-02-01 18:08:21 (UTC)
Nominal Range of Applied Temperature: 0 C to +50 C
Temperature Accuracy Specification: +/- 0.3 C From 0 C to +50 C
Nominal Range of Applied Pressure: 7 PSI to 30 PSI Absolute
Pressure Accuracy Specification: +/- 0.05% FS From -5 C to +50 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7448	35.7434	-0.0013	FT
Depth	18.0584	18.0588	0.0004	FT
Depth	0.3760	0.3772	0.0012	FT
Temperature	19.8986	19.9479	0.0493	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY40016413
Manu Instrulab Model 406X-031-01 SerialNo 19528-1
Manu Fluke Model 1504 SerialNo C11443
Manu Mensor Model CPC6000 SerialNo 611120

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Performed By: OP

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1072062**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-10-02 22:34:28 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7448	35.7343	-0.0105	FT
Depth	18.0591	18.0560	-0.0031	FT
Depth	0.3765	0.3691	-0.0074	FT
Temperature	19.8430	19.8455	0.0025	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY47000169
Manu Instrulab Model 406X-031-05 SerialNo 1-31125
Manu Fluke Model 1504 SerialNo B91242
Manu Mensor Model CPC6000 SerialNo 610145

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Calibration Report

Report Number: 20240201133041-1102283

221 East Lincoln Avenue, Fort Collins, CO 80524 USA

1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598

Visit us at www.in-situ.com

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1102283**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2024-02-01 13:30:41 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7445	35.7393	-0.0052	FT
Depth	18.0589	18.0597	0.0008	FT
Depth	0.3760	0.3755	-0.0005	FT
Temperature	19.9073	19.9156	0.0083	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY40016413
Manu Instrulab Model 406X-031-01 SerialNo 19528-1
Manu Fluke Model 1504 SerialNo C11443
Manu Mensor Model CPC6000 SerialNo 611120

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Performed By: OP

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1082826**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-11-13 20:47:45 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7445	35.7540	0.0095	FT
Depth	18.0589	18.0685	0.0096	FT
Depth	0.3760	0.3805	0.0045	FT
Temperature	20.1743	20.2252	0.0509	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY4008336
Manu Instrulab Model 406X-0031-01 SerialNo 21489-1
Manu Fluke Model 1504 SerialNo B91241
Manu Mensor Model CPC6000 SerialNo 410004H2

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.





Calibration Report

Report Number: 20231209142015-1089828

221 East Lincoln Avenue, Fort Collins, CO 80524 USA

1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598

Visit us at www.in-situ.com

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1089828**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-12-09 14:20:15 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7448	35.7472	0.0024	FT
Depth	18.0584	18.0615	0.0031	FT
Depth	0.3765	0.3827	0.0062	FT
Temperature	20.1787	20.1849	0.0062	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY4008336
Manu Instrulab Model 406X-0031-01 SerialNo 21489-1
Manu Fluke Model 1504 SerialNo B91241
Manu Mensor Model CPC6000 SerialNo 410004H2

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Performed By: JB

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1082820**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-11-13 23:23:48 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7452	35.7384	-0.0068	FT
Depth	18.0591	18.0669	0.0078	FT
Depth	0.3760	0.3843	0.0082	FT
Temperature	19.8131	19.8617	0.0486	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY47000169
Manu Instrulab Model 406X-031-05 SerialNo 1-31125
Manu Fluke Model 1504 SerialNo B91242
Manu Mensor Model CPC6000 SerialNo 610145

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.

Instrument Details:

Instrument Model: **Rugged TROLL 100**
Full Scale Depth Range: **0 to 30 Ft (0 to 9 m)**
Serial Number: **1050898**
Hardware Version: **0**
Firmware Version: **1.06**

Calibration Details:

Calibration Result: **PASS**
Calibration Date: **2023-07-17 09:47:14 (UTC)**
Nominal Range of Applied Temperature: **0 C to +50 C**
Temperature Accuracy Specification: **+/- 0.3 C From 0 C to +50 C**
Nominal Range of Applied Pressure: **7 PSI to 30 PSI Absolute**
Pressure Accuracy Specification: **+/- 0.05% FS From -5 C to +50 C**

Post-Calibration Check:

Parameter	Applied	Reported	Deviation	Unit
Depth	35.7466	35.7468	0.0002	FT
Depth	18.0584	18.0609	0.0024	FT
Depth	0.3767	0.3797	0.0029	FT
Temperature	19.7338	19.7822	0.0484	C

Calibration Procedures and Equipment Used:

Manu Agilent Model 53131A-010 SerialNo MY47002282
Manu Instrulab Model 406X-031-01 SerialNo 31128-1
Manu Fluke Model 1504 SerialNo C14477
Manu Mensor Model CPC6000 SerialNo 610206

Notes:

- Standards used in this calibration are traceable to the National Institute of Standards and Technology.
- This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
- Pressure calibration is conducted in units of PSI Absolute.
- The total range of applied pressure includes pressure due to both the water column and 1 bar of atmosphere.
- The pressure accuracy specification is in terms of the full-scale capability of the pressure sensor (i.e. maximum water depth + 1 bar atmosphere).
- The Post-Calibration data is expressed, for convenience, in terms of water depth. An ambient barometric pressure of 1 bar is assumed.
- Conversion factors: 2.30666 FT/PSI, 14.50377 PSI/bar.



Location Code Date Field ID Lab Report Number Matrix Type Sample Type			MB05	MB05	RPD
			17 Apr 2024	17 Apr 2024	
			MB05	QA_01	
			1088804	1088804	
			Water	Water	
			Normal	Field_D	
	Unit	EQL			
Field data					
Standing Water Level	m bTOC		4.78	-	-
Field Parameters					
pH (Field)	pH units		6.43	-	-
Electrical conductivity (field)	µS/cm		2,028.0	-	-
Dissolved Oxygen (Field)	mg/L		7.08	-	-
Redox (Field)	mV		155	-	-
Temperature (Field)	°C		16.9	-	-
Inorganics					
pH (Lab)	pH units	0.1	6.6	6.6	0
Electrical conductivity (lab)	µS/cm	10	2,200	2,100	5
Salinity	mg/L	10	1,400	1,400	0
Acidity & Alkalinity					
Alkalinity (Carbonate as CaCO3)	mg/L	10	<10	<10	0
Alkalinity (Bicarbonate as CaCO3)	mg/L	20	230	280	20
Alkalinity (Hydroxide as CaCO3)	mg/L	20	<20	<20	0
Alkalinity (total as CaCO3)	mg/L	20	230	280	20
Hardness as CaCO3	mg/L	5	370	390	5
Major Ions					
Calcium	mg/L	0.5	24	26	8
Magnesium	mg/L	0.5	76	79	4
Potassium	mg/L	0.5	<0.5	<0.5	0
Sodium	mg/L	0.5	340	360	6
Chloride	mg/L	1	1,000	1,000	0
Sulfate	mg/L	5	33	33	0
Nutrients					
Ammonia as N	mg/L	0.01	<0.01	<0.01	0
Nitrate (as N)	mg/L	0.02	0.60	0.68	13
Nitrite (as N)	mg/L	0.02	<0.02	<0.02	0
Nitrogen (Total Oxidised) (as N)	mg/L	0.05	0.60	0.68	13
Nitrogen (Total)	mg/L	0.2	0.6	0.7	15
Kjeldahl Nitrogen Total	mg/L	0.2	<0.2	<0.2	0
Phosphorus (Total)	mg/L	0.01	0.07	0.09	25
Metals					
Aluminium (filtered)	mg/L	0.05	0.21	0.17	21
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001	0
Cadmium (filtered)	mg/L	0.0002	<0.0002	<0.0002	0
Chromium (III+VI) (filtered)	mg/L	0.001	0.002	0.001	67
Copper (filtered)	mg/L	0.001	0.003	0.003	0
Iron (filtered)	mg/L	0.05	0.19	0.33	54
Lead (filtered)	mg/L	0.001	<0.001	<0.001	0
Mercury (filtered)	mg/L	0.0001	<0.0001	<0.0001	0
Nickel (filtered)	mg/L	0.001	0.028	0.027	4
Selenium (filtered)	mg/L	0.001	<0.001	<0.001	0
Zinc (filtered)	mg/L	0.005	0.017	0.014	19



			Date	18 Apr 2024
			Field ID	QA_2
			Lab Report Number	1089182
			Matrix Type	Water
			Sample Type	Rinsate
	Unit	EQL		
Nutrients				
Ammonia as N	mg/L	0.01	<0.01	
Nitrate (as N)	mg/L	0.02	<0.02	
Nitrite (as N)	mg/L	0.02	<0.02	
Nitrogen (Total Oxidised) (as N)	mg/L	0.05	<0.05	
Nitrogen (Total)	mg/L	0.2	<0.2	
Kjeldahl Nitrogen Total	mg/L	0.2	<0.2	
Phosphorus (Total)	mg/L	0.01	<0.01	



ghd.com

→ The Power of Commitment