Surrounding Environment Bore Completion Report

Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan (REPP)

03 | Final

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Barwon Water

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Surrounding Environment Bore Completion Report

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Executive Summary

In June 2017, Barwon Water acknowledged that the historic management of groundwater pumping activities at the Barwon Downs borefield had resulted in water level decline and depressurisation of the Lower Tertiary Aquifer (LTA). When combined with a range of other stressors and the management of offsets, this also led to some unintended consequences, such as the reduction in baseflow to Boundary Creek and the drying out of acid sulfate soils in Big Swamp. Barwon Water are currently working to address these impacts as part of the Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan (REPP). As part of this, further investigations within the broader groundwater catchment are also being undertaken to identify other potentially impacted areas.

This report documents the installation of additional groundwater monitoring wells that will be used to inform these investigations and validate the groundwater model predictions. The program included the installation of 21 monitoring wells at ten nested sites via a combination of mud rotary and reverse air circulation drilling, as well as the development of 4 pre-existing monitoring wells. Solinst groundwater level loggers were installed in all wells excluding one artesian monitoring well and one of the pre-existing bores. Two wells were found to be artesian and were fitted with pressure gauges.

1. Introduction

1.1 Background

In 2019, Barwon Water submitted the Boundary Creek, Big Swamp and surrounding environment Remediation and Environmental Protection Plan (REPP).

The plan recognised that the historical management of groundwater extraction in the Barwon Downs graben had resulted in areas of confirmed impact in the Boundary Creek catchment. Given this, the REPP presented a plan to remediate those areas of confirmed impact.

In addition to this, the REPP also highlighted that other areas throughout the graben where the Lower Tertiary Aquifer (LTA) occurs have the potential to be impacted by drawdown related to the Barwon Downs borefield. While the entire extent of the LTA was considered as part of the "Surrounding Environment Investigation", nine high risk areas were prioritised for investigation through a risk assessment process adapted from the Ministerial Guidelines for Groundwater Licensing and the Protection of High Value Groundwater Dependent Ecosystems (DELWP, 2015), based on the results from reginal groundwater modelling. This includes:

- Barwon River (East branch)
- Barwon River (West Branch)
- Barwon River (downstream of the confluence)
- Gellibrand River
- Ten Mile Creek
- Yahoo Creek
- Groundwater dependent ecosystems west of the graben (North of Yeodene)
- Groundwater dependent ecosystems east of the graben (Barwon Downs-Dean Marsh)
- Groundwater dependent ecosystems south of the graben (along the Gellibrand River)

This report details the outcomes of a monitoring well installation program within the areas listed above. This represents the first step in resolving the data gaps highlighted in the REPP, which need to be resolved to validate the regional groundwater model and therefore verify the risk of impact in the surrounding areas.

1.2 Scope of Work

Jacobs were engaged by Barwon Water to design and undertake a field program including the:

- Preparation of preliminaries (bore construction licences and clearance) for bore construction;
- Provision of technical advice during drilling and construction works;
- Redevelopment of four existing DELWP monitoring wells;
- Sampling and analysis of Acid Sulfate Soils (ASS);
- Deployment of loggers for ongoing monitoring of groundwater levels;

- Survey of new wells and
- Preparation of this factual report including lithological logs, stratigraphic logs, well construction specifications, development details, groundwater levels, survey results and preliminary ASS results.

This report summarises the outcomes of the field program and a preliminary interpretation of the results based on the available data. The results of this report and subsequent groundwater level monitoring are intended to facilitate future updates (as necessary) to the conceptual site models, numerical groundwater modelling and subsequent remediation plan for Big Swamp and the surrounding areas.

2. Site investigations

2.1 Borehole drilling

Drilling investigations were undertaken in two phases; phase one between 5 March and 28 April 2021, and phase two between 29 April and 7 June 2022. Borehole drilling was undertaken by Drilltech Pty Ltd under the supervision of a Jacobs hydrogeologist at key witness points. Key points included borehole drilling, well construction and development. At the start of the project in early 2021, the borehole numbering followed the convention of BH01 to BH21. However, as the same convention had been used previously for wells in Big Swamp, the naming convention was subsequently changed to prevent duplicating existing bore ID's. To allow tracking of ID's throughout the projects evolution, both numbers/names (Final ID and original ID) are shown in each table throughout the report, though only the final ID's have been referred to in text and borehole logs in the appendices. Additional state observation network (SOBN) wells were developed for monitoring as part of the project and have been discussed further in section 2.4.

The boreholes were drilled using a 2008 Boart Longyear model DB520 track mounted drilling rig. Boreholes EBBH01 and EBBH02 were drilled using reverse air circulation; all other boreholes were drilling using mud rotary. All boreholes were drilled using a 150 mm diameter PCD bit with 3 m medsci rods. Boreholes were logged in general accordance with Australian Standard AS 1726-2017, and Jacobs standard work procedures.

A summary of the borehole details is shown in Table 2-1 below and borehole locations are shown in Figure 2.1 to Figure 2.4Figure 2.3. Borehole lithology logs and photos are shown in Appendix A and Appendix B respectively.

Table 2-1 Summary of borehole details

Final Bore ID	Original bore ID	Date Drilled	Location	Coordinates[2]		Surface elevation (m AHD)[2]	Borehole Diameter (mm)	Termination depth	
				Easting	Northing			m bgl[1]	m AHD
BSBH13LTA	BH01	8 – 9 April 2021	Big Swamp	735331.63	5743868.00	147.39	150	30	117.4
EBBH01	BH02	31 May – 7 June 2022	Barwon River East	739256.44	5736319.56	141.49	150	20.3	121.2
EBBH02	BH03			739257.48	5736320.79	141.50	150	10	131.5
WBBH01	BH04	12 – 13 April 2021	Barwon River West	734255.30	5736135.86	141.62	150	36	105.6
WBBH02	BH05			734255.91	5736135.75	141.62	150	5.5	136.1
BRBH01	BH06	6 – 8 April 2021	Barwon River	739461.95	5744513.66	118.93	150	30	88.9
BRBH02	BH07			739462.04	5744514.21	118.91	150	5.5	113.4
GRBH01	BH08	18 – 23 March 2021	Gellibrand River	723434.72	5732307.84	76.24	150	30	46.2
GRBH02	BH09			723434.68	5732307.79	76.24	150	30	46.2
TMCBH01	BH10	29 – 31 March 2021	Ten Mile Creek	726273.02	5740766.62	159.55	150	30.2	129.4
TMCBH02	BH11			726273.35	5740767.31	159.56	150	10.5	149.1
YCBH01	BH12	26 – 28 March 2021	Yahoo Creek	724086.18	5739877.00	143.28	150	30	113.3
YCBH02	BH13			724085.31	5739876.41	143.29	150	15.5	127.8
BCBH01	BH14	10 – 11 April 2021	Barongarook Creek East Branch	733685.17	5749760.11	174.90	150	26.4	148.5
BCBH02	BH15			733685.82	5749760.51	174.92	150	14.5	160.4
NYBH01	BH16	24 – 26 March 2021	North of Yeodene	738189.33	5749301.96	173.98	150	30	144.00
NYBH02	BH17			738188.46	5749301.58	174.03	150	6.5	167.5

Final Bore ID	Original bore ID	Date Drilled	Location	Coordinates[2]		Surface elevation (m AHD)[2]	Borehole Diameter (mm)	Termination depth	
				Easting	Northing			m bgl[1]	m AHD
DMBH01V	BH18	5 – 10 March 2021	Deans Marsh	743191.67	5739706.89	165.21	150	30	135.2
DMBH02V	BH19			743193.25	5739705.99	165.28	150	8	157.3
PCBH01V	BH20	10 – 18 March 2021	Deans Marsh (Pennyroyal Creek)	748893.39	5743876.05	161.48	150	30.1	131.4
PCBH02V	BH21			748893.36	5743876.11	161.48	150	30.1	131.5

Notes

1. Metres below ground level
2. All boreholes were surveyed to an accuracy of ±0.030m in GDA94 MZ54

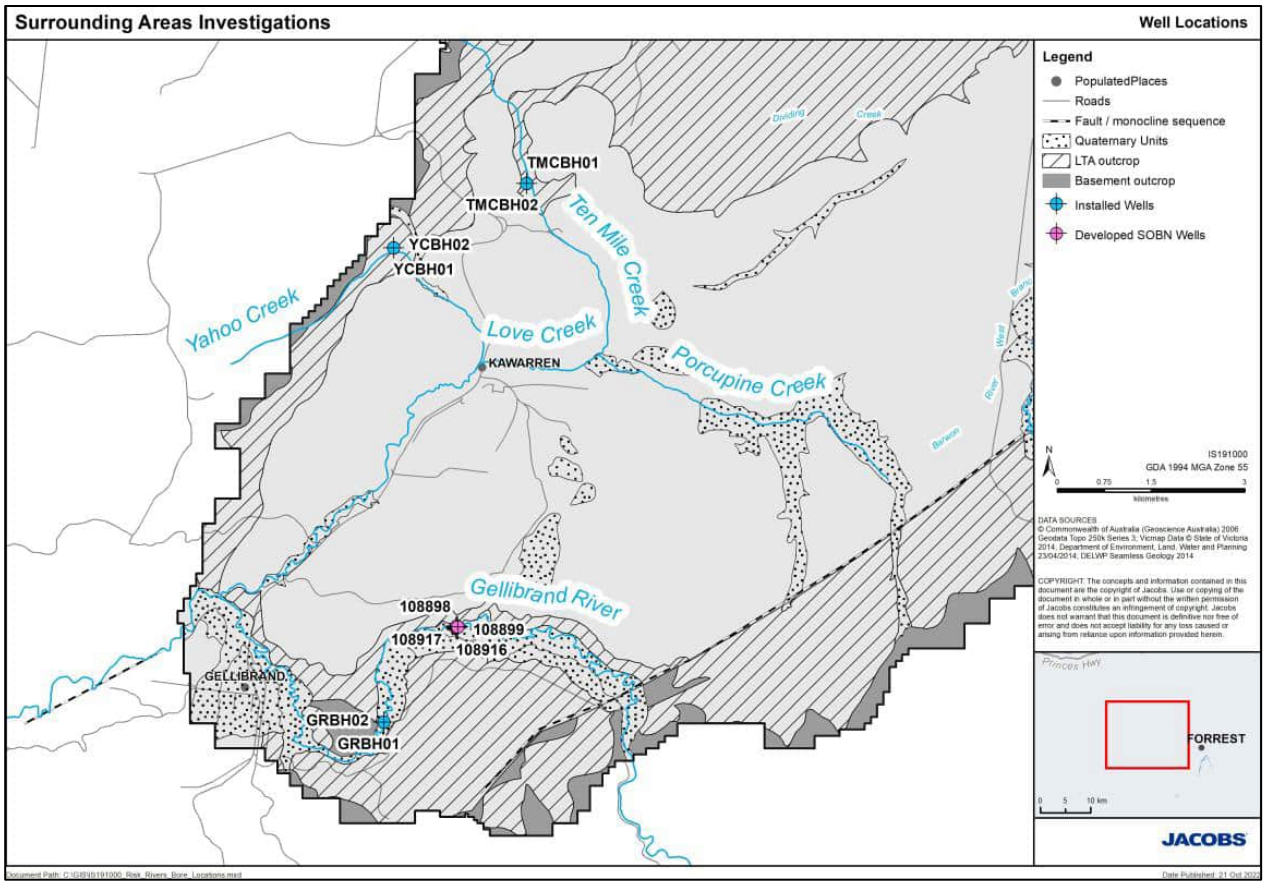


Figure 2.1 Wells on Gellibrand River, Yahoo Creek and Ten Mile Creek

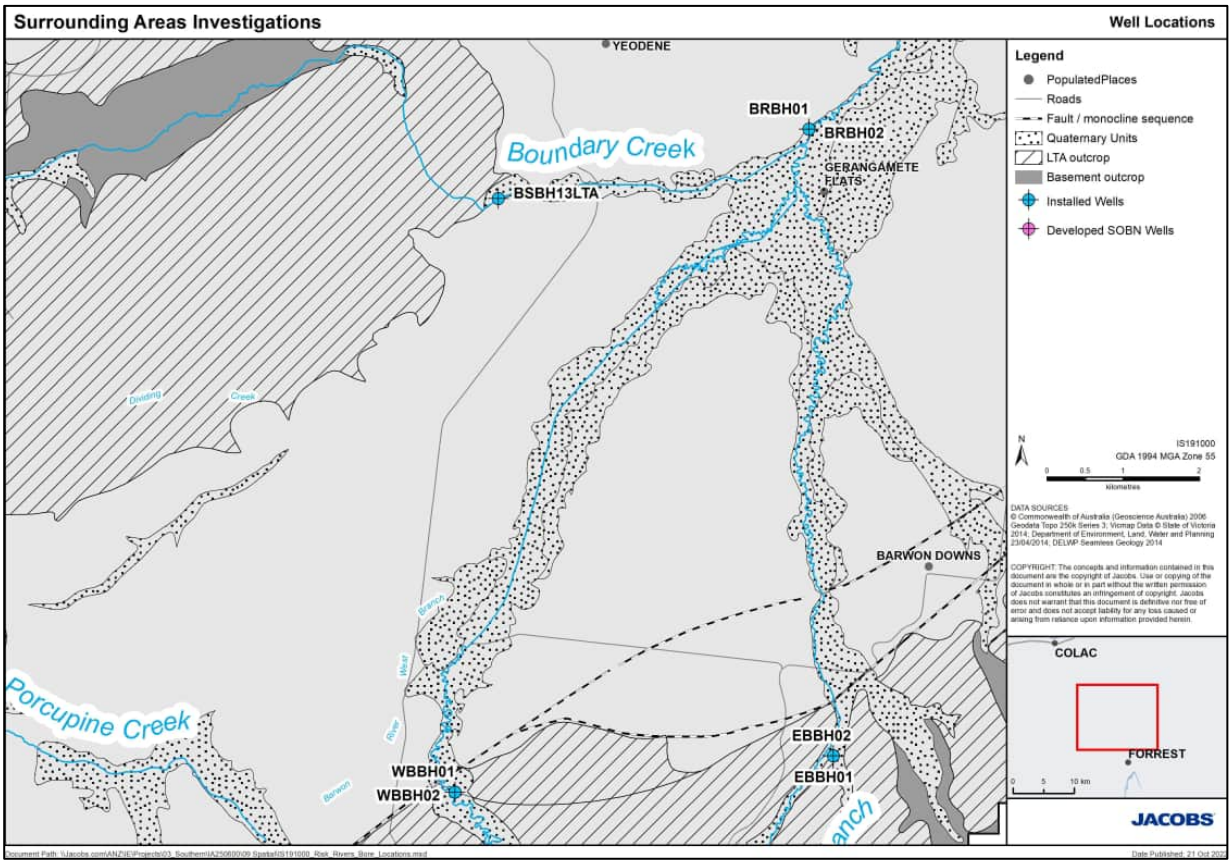


Figure 2.2 Wells on Barwon River and Big Swamp

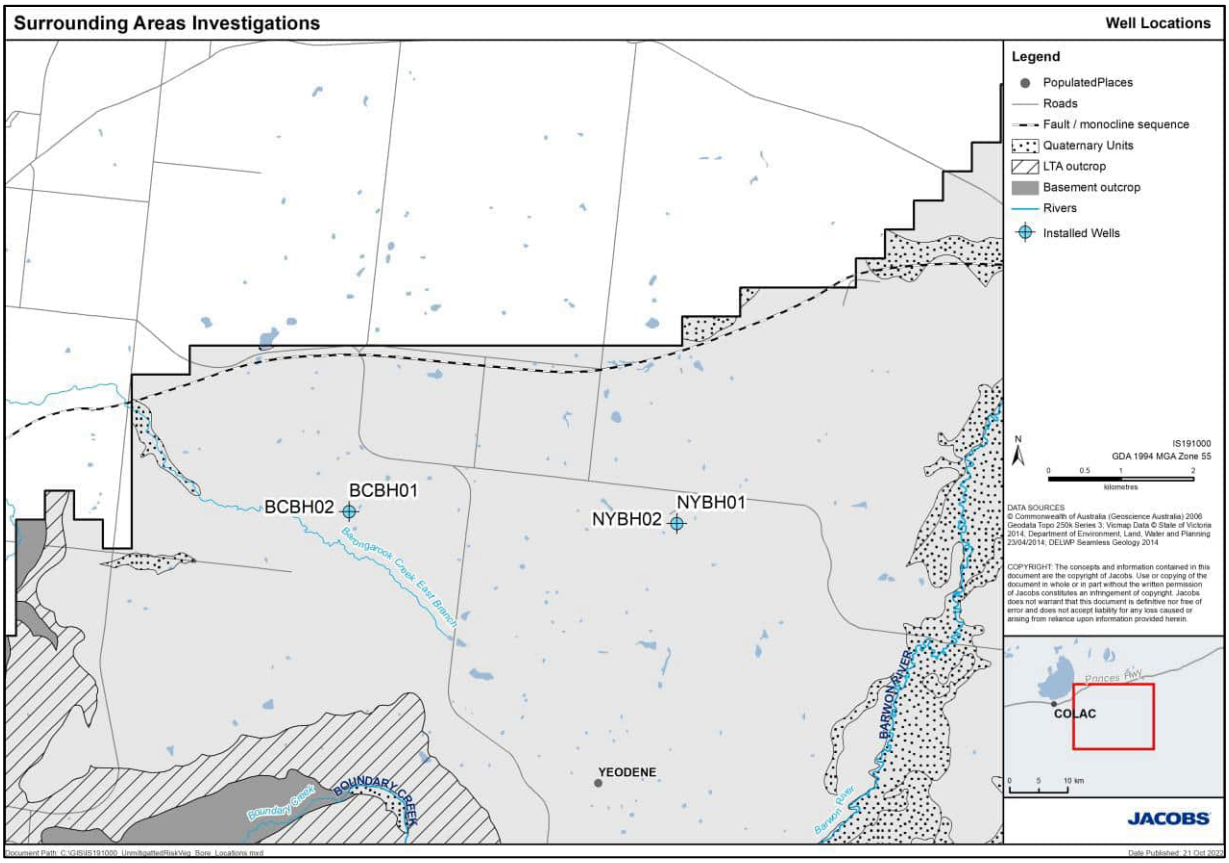


Figure 2.3 Wells north of Yeodene and Barongarook Creek East Branch

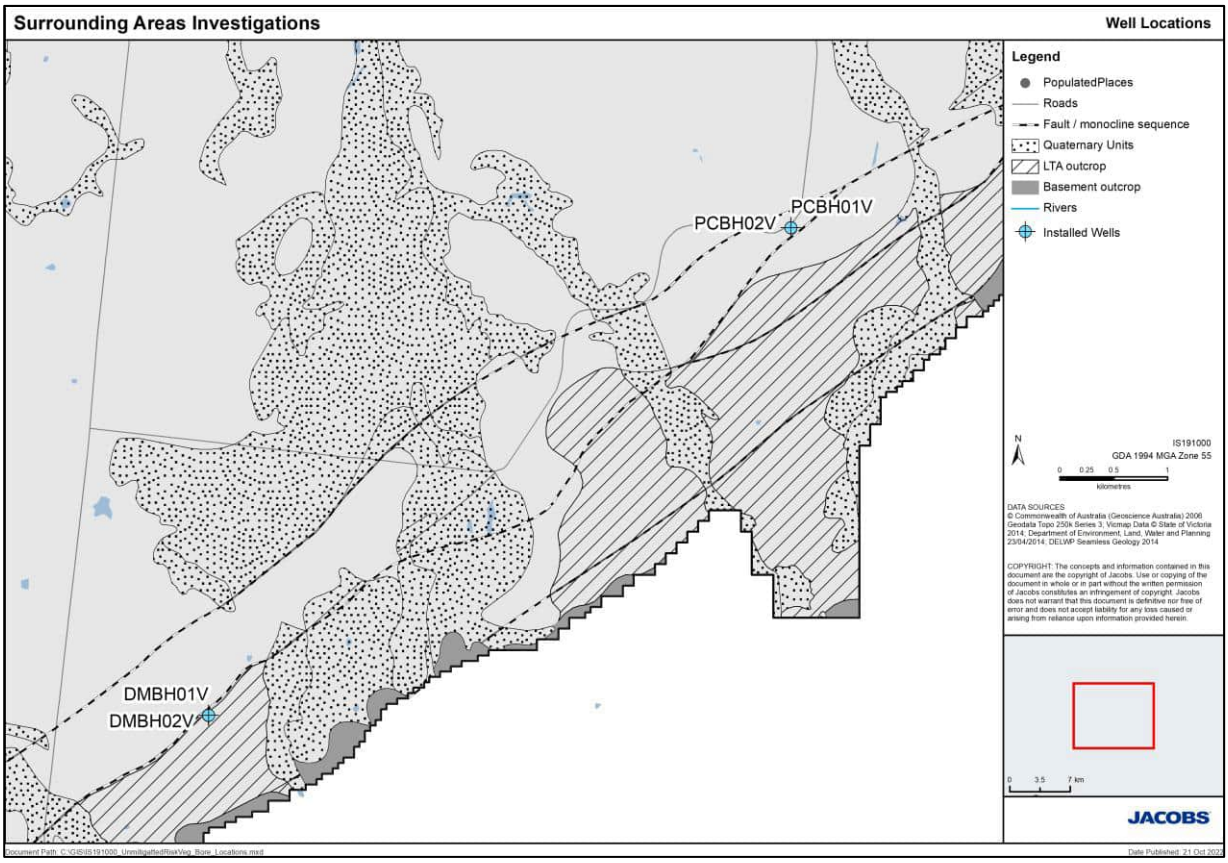


Figure 2.4 Wells at Deans Marsh and Pennyroyal Creek

2.2 Soil sample collection

A total of 34 opportunistic soil samples were taken from a range of depths for acid sulfate soil (ASS) analysis. Samples were collected from boreholes BSBH13LTA, WBBH01/WBBH02, GRBH01/GRBH02, BCBH01/BCBH02, NYBH01/NYBH02 and PCBH01V/PCBH02V. Samples were generally collected from between 0 to 3 m bgl to assess whether drawdown in these areas may have resulted in the oxidation of AAS. At BSBH13LTA located at Big Swamp, samples were collected to 25 m bgl to assess the thickness of ASS within the swamp. A list of samples sent to laboratory for ASS testing is summarised in Table 2-2 below.

Table 2-2 Summary of samples analysed for ASS

Location	Big Swamp	Barwon River West	Gellibrand River	Barongarook Creek East Branch	North of Yeodene	Deans Marsh	Deans Marsh (Pennyroyal Creek)
Bore	BSBH13LTA	WBBH01/ WBBH02	GRBH01/ GRBH02	BCBH01/ BCBH02	NYBH01/ NYBH02	DMBH01V/ DMBH02V	PCBH01V/ PCBH02V
Depth sampled (m)	0-1, 1-2, 2-3, 3-4, 5-6, 6-7, 7-8, 10-11, 11-12, 14-15, 15-16, 16-17, 20-21, 22-23, 23-24	0-1, 1-2, 2-3	0-1, 1-2, 2-3	0-1, 1-2, 2-3 15-22	2-3	0-1, 1-2, 2-3,	0-1, 1-2, 2-3 3-4

Samples were described and handled according to Sullivan et al. (2018) and were sealed in ASS polyethylene zip lock bags provided by Australian Laboratory services (ALS) and placed on ice in coolers in the field. Samples were transferred to a portable freezer upon return from the field on the day of collection. Samples were subsequently sent to ALS for ASS screen test and chromium reducible sulfur analysis in frozen condition. Results of the sampling have been presented in Section 3.1 with full lab reports provided in Appendix G.

2.3 Groundwater well construction

Groundwater monitoring wells were installed between 5 March and 28 April 2021, and 29 April and 7 June 2022. Monitoring wells were constructed by sequentially joining threaded casing and screen lengths and lowering them down the drilled borehole to termination depth. Monitoring wells GRBH01 and GRBH02, and PCBH01V and PCBH02V were constructed in the same 150 mm diameter drilled borehole, all other monitoring wells were installed in individually drilled boreholes.

Casing and screen materials

All monitoring wells except BSBH13LTA were constructed with 50 mm ID, 60 mm OD class 12 uPVC casing. Screens were 3.0 m long and slotted at a 1.0 mm aperture.

BSBH13LTA is located in Big Swamp within 2.0 m of existing shallow well BH15. BSBH13LTA was constructed with 80 mm ID, 90 OD mm class 12uPV casing, a screened interval of 3.0 m slotted at 1.0 m aperture and a 0.5 m sump to facilitate pump testing, if required, to better determine the magnitude of hydraulic connection between deeper and shallower groundwater systems in Big Swamp.

Backfilling

Wells WBBH01, GRBH01, BCBH01 and DMBH01V were backfilled from termination depth with sand or cuttings. A bentonite plug was subsequently installed on top of the cuttings before installation of the monitoring well screen at a shallower target depth.

Sumps

All wells excluding EBBH01, DMBH02V and PCBH02V had 0.5 m sumps installed at the bottom of the screen to capture the potential ingress of sediment via groundwater. At these wells:

- EBBH01 had a 1.0m sump,
- DMBH02V did not have a sump installed so that the well would not pierce the underlying confining layer that was apparent,
- PCBH02V had a 0.2 m sump to allow greater hydraulic separation from PCBH01 during the emplacement of the grout plug.

Gravel pack, bentonite seals and grouting

Gravel pack (8/16 Sibelco gravel) was free poured into the annulus between the well casing and drilled borehole to provide a filter pack around the screened section. All wells excluding EBBH01 and EBBH02 had bentonite slow-release chips free poured on top of the gravel pack to form a seal and to prevent grout or cement from seeping into the gravel pack. EBBH01 and EBBH02 were constructed using standard non slow-release chips. Boreholes were backfilled to surface with a 5% bentonite grout mixture. For the deeper boreholes, a tremmie was used to fill the borehole up from 1 – 2 m above the bentonite plug while it was gravity fed for the shallower boreholes.

Headworks

Constructed wells were finished approximately 0.5 to 1.0 m above ground level and generally encased in a blue steel monument cover, though EBBH01 and EBBH02 wells were finished with bright yellow monument covers. As EBBH01 and BRBH01 exhibited groundwater levels above casing height, these were fitted with a 100 kPa and 250 kPa pressure gauge, respectively. BCBH01 and BCBH02, and NYBH01 and NYBH02 were installed inside paddocks and as such, treated pine fences were erected around the monitoring wells to prevent any damage from livestock.

Summary

A summary of well construction details is shown below in Table 2-3 with further details provided in appendices:

- Well construction and lithology logs are shown in Appendix A
- Lithology photographs are shown in Appendix B
- Well completion photographs are shown in Appendix C
- Well construction licenses are listed in Appendix D
- Well completion reports are detailed in Appendix E

Table 2-3 Well construction details

New Well ID	Original Well ID	BCL	Casing Stickup (m)	Casing ID[1] (mm)	Construction depth (m bgl)	Screen depth, from – to (m bgl)
BSBH13LTA	BH01	WRK125002	0.66	80	30	26.5 – 29.5
EBBH01	BH02	WRK131480	0.91	50	20.3	16.3 -19.3
EBBH02	BH03	WRK131481	0.99	50	10	6.0-9.0
WBBH01	BH04	WRK125001	0.58	50	18.5	15.0 – 18.0
WBBH02	BH05	WRK126121	0.53	50	5.5	2.0 – 5.0
BRBH01	BH06	WRK125003	1.10	50	30	26.5 – 29.5
BRBH02	BH07	WRK125004	0.68	50	5.5	2.0 – 5.0
GRBH01	BH08	WRK125005	0.69	50	13.5	10.0 – 13.0
GRBH02	BH09	WRK125006	0.69	50	5.5	2.0 – 5.0
TMCBH01	BH10	WRK126122	0.74	50	30.2	26.7 – 29.7
TMCBH02	BH11	WRK126123	0.65	50	10.5	7.0 – 10.0
YCBH01	BH12	WRK125007	0.66	50	30	26.5 – 29.5
YCBH02	BH13	WRK125008	0.66	50	15.0	11.5 – 14.5
BCBH01	BH14	WRK126124	0.66	50	23.5	20.0 – 23.0
BCBH02	BH15	WRK126125	0.65	50	14.5	11.0 – 14.0
NYBH01	BH16	WRK126126	0.69	50	30	26.5 – 29.5
NYBH02	BH17	WRK126127	0.70	50	6.5	3.0 – 6.0
DMBH01V	BH18	WRK125009	0.69	50	16.5	12.5 – 15.5
DMBH02V	BH19	WRK125010	0.68	50	8	5.0 – 8.0

New Well ID	Original Well ID	BCL	Casing Stickup (m)	Casing ID[1] (mm)	Construction depth (m bgl)	Screen depth, from – to (m bgl)
PCBH01V	BH20	WRK125011	0.61	50	30.1	26.6 – 29.6
PCBH02V	BH21	WRK125012	0.61	50	7.7	4.5 – 7.5

1. Inner Diameter

2.4 Well development

Groundwater wells were developed between the 5th of March and 28th of April 2021, and the 29th of April and 7th of June 2022 via either airlift purging, water injection and airlifting or bailing. Wells were developed in order to remove products introduced during construction, improve near well permeability, reduce entry loss, reduce entry of suspended solids and increase well efficiency. Accordingly, all wells were developed according to the minimum construction reequipments for water bores in Australia (NUDLC, 2020).

For wells that exhibited sufficient groundwater inflows, airlifting was undertaken. During airlifting, polyethylene tubing was gradually lowered down-hole and a continuous flow of air supplied by a compressor used to displace standing water from the well to surface. Water brought to the surface was allowed to flow through high pressure polyethylene piping secured to top of the well to collect and monitor water quality during development. If yields from the well were adequate, the tubing was left in the well to provide a continuous flow of water from the aquifer to the surface for periods of time ranging from 30 minutes to 1 hour. If yields were insufficient to allow this, wells were allowed to recover before development continued.

For wells with extremely low flow rates during development, fresh water was introduced into the well before being ejected via airlifting. This was done to both bring drilling muds to the surface and draw the introduced water from the gravel pack around screens to aid settling of the gravel pack. Given the low permeability at these wells, mud loss during drilling of the borehole is likely to be limited and as such, the duration of development required to remove muds is also lower. Drilltech Pty Ltd undertook the development, supervised on site by a Jacobs hydrogeologist.

During development, if it was unclear whether all drilling muds had been successfully removed during initial air-lifting, wells were subsequently re-visited by the Jacobs hydrogeologist to bail the well dry of residual drilling muds as a form of subsequent development.

Existing DELWP monitoring wells 108917, 108916, 108898 and 108899 were developed by DrillTech under the supervision of the Barwon Water Project manager. The aim was to remove any build up of debris or sediment that may have been present in the wells to facilitate the deployment of groundwater level loggers.

Field water quality was recorded during development using a calibrated YSI water quality probe and a detailed summary of each wells development is included in Appendix F, along with field water quality records.

2.5 Groundwater levels and logger installation

A total of 23 groundwater level loggers and two barometric pressure loggers were installed as part of the project.

During deployment, groundwater levels were recorded using an electronic water level meter before a Solinst level logger was deployed into the monitoring wells using a stainless steel cable hung from an eyelet attached to the inside of the bore monument. All loggers were set to hang approximately 0.5 to1 m above the bottom of the well excluding PCBH01V (where the logger was hung at 23.7 m from the bottom of the well) and the three DELWP monitoring wells.

Monitoring well BRBH01 located next to the Barwon River at the bottom of a pine planation was fitted with an Artesian well fitting. The well fitting included a Solinst logger and a 250 Kpa pressure gauge for manual measurements and outlet valve. The well fitting is joined together via screw threads and teflon tape and can be taken apart if required. A new steal casing monument head will need to be constructed and installed to accommodate the large artesian fitting.

EBBH01 located on the Barwon River East branch was fit with a 100 kpa pressure gauge. The logger at EBBH02 was installed during the same day as development so may not have fully recovered before logger deployment.

Barometric loggers were installed at sites GRBH01- GRBH02 in Gellibrand and PCBH01V- PCBH02V in Deans Marsh.

All loggers were set to one hour recording intervals to measure short term fluctuations in water level. The loggers have a maximum of 40,000 memory points equating to 4.5 years of continuous logging without downloading and or resetting. It is recommended that the logging frequency is revised (reduced) following the first 12 months of monitoring to preserve logger batter and memory.

Table 2-4 below summarises the logger installation including measured water levels at time of deployment.

Table 2-4 Level logger installation Summary

New Well ID	Original Well ID	Date	Logger serial number	Logger installation depth (m b TOC)	Groundwater level at deployment		
					m b TOC[3]	m bgl[1]	m AHD[4]
BSBH13LTA	BH01	14/07/2021	004-2133351	30.5	0.81	0.15	147.24
EBBH01	BH02	-	No logger	Artesian fitting	6-7 kpa[6]	-0.91	142.4
EBBH02	BH03	06/06/2022	-	10.5[5]	8.40	7.41	134.09
WBBH01	BH04	14/07/2021	004-2133830	18.5	0.34	-0.24	141.86
WBBH02	BH05	14/07/2021	004-2133354	5	0.62	0.09	141.53
BRBH01	BH06	14/07/2021	004-2133360	Artesian fitting	50 kPa[2]	-6.1	123.93
BRBH02	BH07	14/07/2021	004-2133353	5	0.57	-0.11	119.02
GRBH01	BH08	15/07/2021	004-2133352	14	4.46	3.77	72.47
GRBH02	BH09	15/07/2021	004-2133359	5.5	3.34	2.65	73.59
TMCBH01	BH10	15/07/2021	004-2133829	30.5	30.21	29.47	130.08
TMCBH02	BH11	15/07/2021	004-2133355	7	7.28	6.63	152.93
YCBH01	BH12	15/07/2021	004-2133357	29	19.75	19.09	124.19
YCBH02	BH13	15/07/2021	004-2133356	15.5	15.33	14.67	128.62
BCBH01	BH14	14/07/2021	004-2133818	23	10.05	9.39	165.51
BCBH02	BH15	14/07/2021	004-2133828	14	4.07	3.42	171.5
NYBH01	BH16	14/07/2021	004-2133826	29.5	22.8	22.11	151.87
NYBH02	BH17	14/07/2021	004-2133825	6	5.59	4.89	169.14
DMBH01V	BH18	14/07/2021	004-2133358	16	3.54	2.85	162.36
DMBH02V	BH19	14/07/2021	004-2133827	7.9	7.82	7.14	158.14
PCBH01V	BH20	14/07/2021	004-2132708	7	0.24	-0.37	161.85
PCBH02V	BH21	14/07/2021	004-2133817	7.2	1.78	1.17	160.31

New Well ID	Original Well ID	Date	Logger serial number	Logger installation depth (m b TOC)	Groundwater level at deployment		
					m b TOC[3]	m bgl[1]	m AHD[4]
108917	-	23/5/2022	004-2133823	8.1	5.30	5.10	-
108898	-	23/5/2022	004-2133824	10.0	4.69	4.69	-
108899	-	23/5/2022	004-2133388	8.0	1.41	0.35	-
GRBH01 - GRBH02	BH06-BH07	15/07/2021	001-2133508	Barometric logger			
PCBH01V - PCBH02V	BH20-BH21	15/07/2021	001-2133749	Barometric logger			

Note

1. (-) indicates above ground level
2. 50 kPa pressure reading is equal to +5 m of groundwater level above surface
3. Metres below top of casing
4. Metres AHD
5. It is recommended that levels and deployment depths at EBBH02 are confirmed during first monitoring round
6. Pressure reading on artesian fitting following attachment

2.6 Survey

Coordinates and elevations were recorded at the installed groundwater monitoring wells by a Jacobs surveyor on the 14th and 15th of July 2021 for all wells except EBBH01 and EBBH02. Co-ordinates and elevations at EBBH01 and EBBH02 were captured by a Barwon Water on the 5th of August 2022. All surveyed points were cross referenced to control Elliminyt PM78 and recorded to an accuracy of ±0.030m. TMCBH01 and TMCBH02 were cross referenced to control point JA02 (E 727096.581, N 5740481.526, elv 196.453) located on Robinson road. Levels were captured on top of each wells PVC casing, top of concrete and at ground level. All survey points are to datum MGA94 Zone 54.

A complete list of all survey points are shown in Appendix H.

3. Results of investigation

3.1 Stratigraphy

This section provides a description of the lithology encountered at different drilling locations and an interpretation of the stratigraphic units present. The stratigraphic interpretations have been made based on a comparison of the lithological logs with stratigraphic descriptions made in relevant geological reports (Edwards et al., 1996; Tickell et al., 1990), surface geological mapping of the region (Edwards et al., 1996; Tickell, 1990), the Victorian Aquifer Framework – VAF (GHD, 2012) and nearby available drilling logs.

It should be noted that in the absence of sediment dating, delineating the exact boundary between clays of the Demons Bluff Formation, Gellibrand Marl, Narrawaturk Marl and upper Mepunga Formation can be difficult based on lithological logging alone. This is particularly emphasised closer to the margins of the Barwon Downs Graben where many of these units are thinner, interlayered and grade into each other at transgressive-regressive boundaries. Further, it should be noted that certain geological units mapped in the area have been lumped and simplified geochronologically during the development of the VAF (e.g the Narrawaturk Marl, Demons Bluff Formation and Mepunga Formation have been lumped into the Lower Mid-Tertiary Aquitard).

It is also recognised that the Nirranda Group included the Demons Bluff Formation, Narrawaturk Marl and Mepunga Formation during the development of surface geological maps and stratigraphic logs (e.g Edwards et al., 1996; Tickell et al., 1990) and that the Demons Bluff Formation has since been reclassified as a group (the Demons Bluff Group) according to Trupp et al. (1994) and the Australian Stratigraphic Units Database. To allow consistent comparison of the drilling logs to historical mapping and drilling logs, the below discussion has not considered the recent change in the status of the Demons Bluff Formation.

Given the above, the below stratigraphic designations represent a balanced interpretation based on the evidence available, recognising that there is some uncertainty (particularly when trying to split units within the Nirranda Group). Regardless of the stratigraphic interpretations applied, the lithological logs provide a point of truth and may be more important in the future when considering the layers, hydraulic properties and groundwater responses exhibited in each of the areas being considered.

BSBH13LTA and Big swamp

Borehole BSBH13LTA located in Big Swamp intersected silty clays with trace sand and organic matter to a depth of approximately 5 m. High plasticity brown-grey clays with fine sands predominated between 5 and 16 m depth before transitioning into sands at 16 m depth.

The silty clays with sands and high concentrations of organic material to 5 m depth are consistent with alluvial sediments. Between 5 m and 16 m depth, the high plasticity clays are consistent with interlayered Narrawaturk Marl and the Demons Bluff Formation, which has been mapped at the surface in the area (Tickell, 1990).

The transition to sands at 16 m depth is consistent with the occurrence of the Dilwyn Formation.

The lithological logs at BSBH13LTA present a significant finding in that the thickness of high plasticity clays (interpreted as interlayered Demons Bluff/Narrawaturk Marl) is significantly greater at this location than had been previously conceptualised during groundwater-surface water modelling (GHD, 2020). The model assumed that the there was “direct connection between the LTA and alluvium at the upstream end of the swamp” and that the LTA only becomes confined “approximately in the middle of Big Swamp”. The drilling results contrast with these assumptions and indicates that the LTA is confined by more than 10 m of Demons Bluff/Narrawaturk Marl much further upstream than previously conceptualised.

EBBH01 and EBBH02 – Barwon River East Branch

EBBH01 and EBBH02 located on the Barwon River East branch intersected high plasticity brown-grey clays from surface to 13.6 m depth with trace sands in the upper 1 m of the profile and from 3.5 to 4.5 m depth. Sands were absent from the high plasticity clays from 6 to 13.6 m depth before fine to medium grained sands and clays with coarse sands and gravels dominated the profile to 22 m depth.

The interbedded sands within the upper 6 m of the profile are consistent with alluvium. The high plasticity brown clays from 6 to 13.6 m depth are consistent with the Nirranda Group and more specifically, the Narrawaturk Marl which can be distinguished from the Demons Bluff Formation by its higher clay content (Edwards et al., 1996). The fine to medium grained well rounded sands and sandy gravelly clays from 13.6 to 22 m depth are consistent with the Dilwyn formation.

The results from the drilling are relatively consistent with geological mapping which indicates the presence of alluvial deposits along the Barwon River East Branch (Tickell, 1990). In addition, the mapping indicates that the Demons Bluff Formation outcrops some 600 m to the north west of the drilling location and it is likely that deeper marine sediments of the Narrawaturl Marl extend along the palaeovalleys of the Barwon River in the subsurface beyond where they outcrop. This is also consistent with the Victorian Aquifer Framework (GHD, 2012) as well as nearby drilling logs at bores 48252 and 48253 which indicate Nirranda Group deposits to approximately 20 m depth along the Barwon River East Branch approximately 600 m north east of the site. However, the logs suggest that the thickness of these deposits (~7 m) may be greater in this area than indicated by the VAF (<1 m).

WBBH01 and WBBH02 - Barwon River West Branch

Borehole WBBH01 and WBBH02 intersected high plasticity soft brown clays from 0 to 6 m depth, high plasticity grey clays from 6 to 11 m depth, high plasticity brown clays from 11 to 15 m depth, sand from 15 to 20 m depth and high plasticity clays from 20 m to 36 m depth.

The high plasticity soft brown clays from 0 to 6 m depth are consistent with floodplain deposits and colluvium which have been mapped at the surface in the area (Tickell, 1990). As indicted by Tickell et al. (1991), the Nirranda Group and Gellibrand Marl can be difficult to distinguish from each other, however the dominance of grey silty clays from 6 to 11 m depth appears more consistent with the Gellibrand Marl than the Nirranda Group and the brown high plasticity clays from 11 to 15 m depth are more consistent with the Narrawaturk Marl of the Nirranda Group. Sands from 15 to 20 m depth are consistent with the Dilwyn Formation.

The above lithological logs and stratigraphic interpretation suggest that the occurrence of the Gellibrand Marl and Narrawaturk Marl extends a minimum of 300 to 400 m further to the south east along the Barwon River West Branch than is mapped within the VAF (GHD, 2012). The occurrence of the DIlwyn Formation is consistent the VAF.

The high plasticity clays from 20 m depth to 36 m depth may represent weathered basement. This would be consistent with the stratigraphic sequence expected in the area and the grey coloured bentonitic weathered mudstones of 10-30 m thickness expected of the weathered basement (Tickell et al., 1991). However, this would suggest that the basement in this area is significantly shallower than indicated by the VAF (GHD, 2012) which suggests a depth to basement of >50 m at this location.

BRBH01 and BRBH02 - Barwon River central confluence

Boreholes BRBH01 and BRBH02 intersected soft, high plasticity clays with fine sands to 6 m depth before transitioning into medium plasticity green-grey clays from 6 to 10 m depth and grey-brown clays from 10 to 30 m depth.

The sequence is consistent with the presence of alluvial deposits to 6 m depth before transitioning into the Gellibrand Marl at 6 m depth and subsequently the Narrawaturk Marl at 10 m depth. The sequence is relatively

consistent with the VAF (GHD, 2012) which indicates the presence of alluvium, thin deposits of the Gellibrand Marl and a thicker sequence of the Nirranda Group at the drilling location.

GRBH01 and GRBH02 - Gellibrand River

Borehole GRBH01 and GRBH02 intersected alternating sand and clay lenses with organic matter and wood fragments to a depth of 6 m. High plasticity grey clays occurred from 6 to 10 m depth before transitioning to coarse sands from 10 to 12 m depth. High plasticity dark grey clays were present between 12 and 14 m depth with coarse angular loose sands from 14 to 16 m depth. High plasticity grey clays were present from 16 m depth before transitioning to hard blue mudstone from 21 to 30 m depth.

The interlayered sand and clay lenses from 0 to 6 m is consistent with alluvial floodplain deposits which have been mapped locally at the surface in the area (Tickell, 1990). The high plasticity grey clays from 6 to 10 m depth are consistent with the Narrawaturk Marl which tends to have a higher clay content than the Demons Bluff Formation (Edwards et al., 1996) and a grey colour where they increase in clay and/or organic material content (Gallagher et al., 1999). This is consistent with the VAF which indicates the occurrence of the Nirranda Group in the subsurface at the drilling location.

The poorly sorted sands from 10 to 12 m, dark grey clay from 12 to 14 m and coarse/angular lose sands from 14 to 16 m is consistent with a Dilwyn Formation-Pember Mudstone-Pebble Point Formation sequence typical of the Lower Tertiary Aquifer.

The high plasticity clays from 16 m to 21 m depth and mudstone from 21 to 30 m depth are consistent with the transition through weathered basement into basement rock.

TMCBH01 and TMCBH02 - Ten Mile Creek

Lithological logs at Ten Mile Creek were characterised by coal in the upper 1 m, coarse sands from 1 to 10 m depth and interbedded sandy clays and fine sands from 10 to 30 m depth.

The drilling location was near an old rail trail and as such, coal in the upper 1 m is likely to reflect fill from the old rail line. The occurrence of black coal in cuttings from greater depths (as described in the lithological logs) is likely to reflect surficial fill material mixing with natural cuttings as they were brought to surface with the circulating muds.

The sequence of coarse sands and interbedded sandy clays and fine sands from 1 to 30 m depth is consistent with the Dilwyn formation.

The logs are consistent with geological mapping (Edwards et al., 1996) and the VAF (GHD, 2012) which both indicate that the Dilwyn Formation outcrops locally. It also suggests that any alluvial deposits along Ten Mile Creek are relatively localised in this area and do not occur at the drilling location.

YCBH01 and YCBH02 - Yahoo Creek

Lithological logs from YCBH01 and YCBH02 were dominated by coarse sands and clayey sands from surface to 30 m depth and are consistent with the occurrence of the Dilwyn Formation. This is also consistent with surface geological mapping and the VAF (Tickell 1990; GHD 2012) which both indicate that the Dilwyn Formation outcrops at the drilling location.

BCBH01 and BCBH02 - Barongarook Creek East Branch

BCBH01 and BCBH02 intersected high plasticity grey-red clay from surface to 6 m depth. From 6 m depth to 15 m depth the clays became brown with some sandy layers before becoming darker at 15 m depth. The lithology transitioned to fine, rounded sands at 25 m depth before the borehole was terminated at 26.4 m depth.

The logs are consistent with the occurrence of Demons Bluff Formation at the surface which is characterised by red mottled clays where exposed at the surface south of Colac (Edwards et al., 1996). It is possible that the Demons Bluff Formation is interlayered with the Narrawaturk Marl at this location and that the transition to brown and dark brown clays and sandy clays is indicative of the Narrawaturk Marl. However, as such characteristics can also be representative of the Demons Bluff Formation, this remains unclear and as such, the sequence from surface to 25 m depth has been classified as undifferentiated Demons Bluff Formation / Narrawaturk Marl. The rounded sands at 25 m depth are consistent with the Dilwyn Formation.

The stratigraphic sequence is consistent with geological mapping of the area which indicates outcropping Demons Bluff Formation at the borehole location (Tickell, 1990) and the VAF (GHD 2012) which indicates that the Dilwyn Formation directly underlies the Nirranda Group in the area.

NYBH01 and NYBH02 - North of Yeodene

NYBH01 and NYBH02 intersected high to medium plasticity clays from surface to a termination depth of 30 m. The upper 9 m of the profile was softer and exhibited red and brown mottling while the clays from 9 m to 30 m depth were grey and hard.

The upper 9 m of the profile is consistent with the occurrence of the Demons Bluff Formation which is characterised by red mottled clays where exposed at the surface south of Colac (Edwards et al., 1996). This is also consistent with surface geological mapping which indicates that the Demons Bluff Formation outcrops at the site. The transition to hard grey clays from 9 m depth is consistent with the Narrawaturk Marl which tends to have a higher clay content than the Demons Bluff Formation (Edwards et al., 1996) and a grey colour where it increases in clay and/or organic material content (Gallagher et al., 1999).

DMBH01V and DMBH02V – Deans Marsh

DMBH01V and DMBH02V intersected high to medium plasticity grey and brown clays with red and pink mottles from ground surface to a termination depth of 30 m.

The clays are consistent with the Demons Bluff Formation which are characterised by red mottled clays where exposed at the surface (Edwards et al., 1996). In addition, these have been mapped at surface approximately 50 m north west of the drilling site, on the north west side of the Bambra Fault Line (Edwards et al., 1996).

While previous work has suggested that the Demons Bluff Formation occurs locally, its occurrence at the drilling site is slightly inconsistent with surface mapping and the VAF (GHD, 2012), which suggest that the Dilwyn Formation should outcrop at the site. This is likely to represent the discrepancy between mapping which was undertaken at a regional scale and the effects of faulting on stratigraphy which can be highly heterogeneous and result in variable effects on stratigraphic sequences at a local scale. The drilling suggests that the Demons Bluff Formation extends slightly further to the south east than represented in geological maps.

PCBH01V and PCBH02V - Deans Marsh (Pennyroyal Creek)

PCBH01V and PCBH02V intersected silty sands and sandy silts from surface to approximately 7 m depth before transitioning into high plasticity brown-grey clays with some sand. From 24 m depth the clays became grey and sands were absent.

The lithology is consistent with the occurrence of localised alluvial deposits from ground surface to 7 m which have been mapped locally (Edwards et al., 1996). The sandy brown clays from 7 m to 24 m depth are consistent with those of the of the Demons Bluff Formation while the reduction in grain size from 24 to 30 m depth and grey colour could be indicative of the of the Narrawaturk Marl (Edwards et al., 1996; Gallagher et al., 1999).

It is possible that the Demons Bluff Formation is interlayered with the Narrawaturk Marl at this location or that the transition to dark brown clays at 18 m is representative of the Narrawaturk Marl. However, as such characteristics can also be representative of the Demons Bluff Formation, this remains unclear and as such, the

sequence from 7 m to 30 m depth has been classified as undifferentiated Demons Bluff Formation / Narrawaturk Marl.

This is consistent with surface geological mapping which indicates that the Demons Bluff Formation occurs near the surface locally (Edwards et al., 1996) and the VAF (GHD, 2012) which indicates that the Nirranda Group (including the Demons Bluff Formation and Narrawaturk Marl) is the major unit underlying local alluvial deposits in the area.

DELWP wells (108898, 108917 & 108919) Gellibrand River

DELWP boreholes next to the Gellibrand River are reported to have intersected undifferentiated Quaternary sediments from 0 to 11 m bgl, Eastern View Formation from 11 to 74 m bgl and undifferentiated sedimentary basement rocks below 74 m depth (VVG, 2022).

3.2 Soil Testing

As discribed in Section 2.2, oppertunistic acid sulfate soil (ASS) samples were taken during the drilling at six locations including:

- Big Swamp - BSBH13LTA
- West Barwon - WBBH01/ WBBH02
- Gellibrand River - GRBH01/ GRBH02
- Barongarook Creek - BCBH01/BCBH02
- North Yeodene - NYBH01/ NYBH02
- Pennyroyal Creek - PCBH01V/ PCBH02V

Samples were taken opportunistically at locations where lithological indicators suggested the presence of ASS and as such, samples were not collected from Ten Mile Creek and Yahoo creek, where fill and sands of the LTA dominated the stratigraphy.

A total of 34 samples were subject to ASS screen tests. These tests are indicative and can help inform the likelihood of ASS occurrence and hence, which samples should be prioritised for further analysis. The results were used to indicate which samples contained the highest concentration of acidity, reduced inorganic sulfur and acid neutralizing capacity. The results were interpreted as per EPA publication 665.1 (EPA, 2009). The results of the screen tests have been illustrated in Figure 3.1 below.

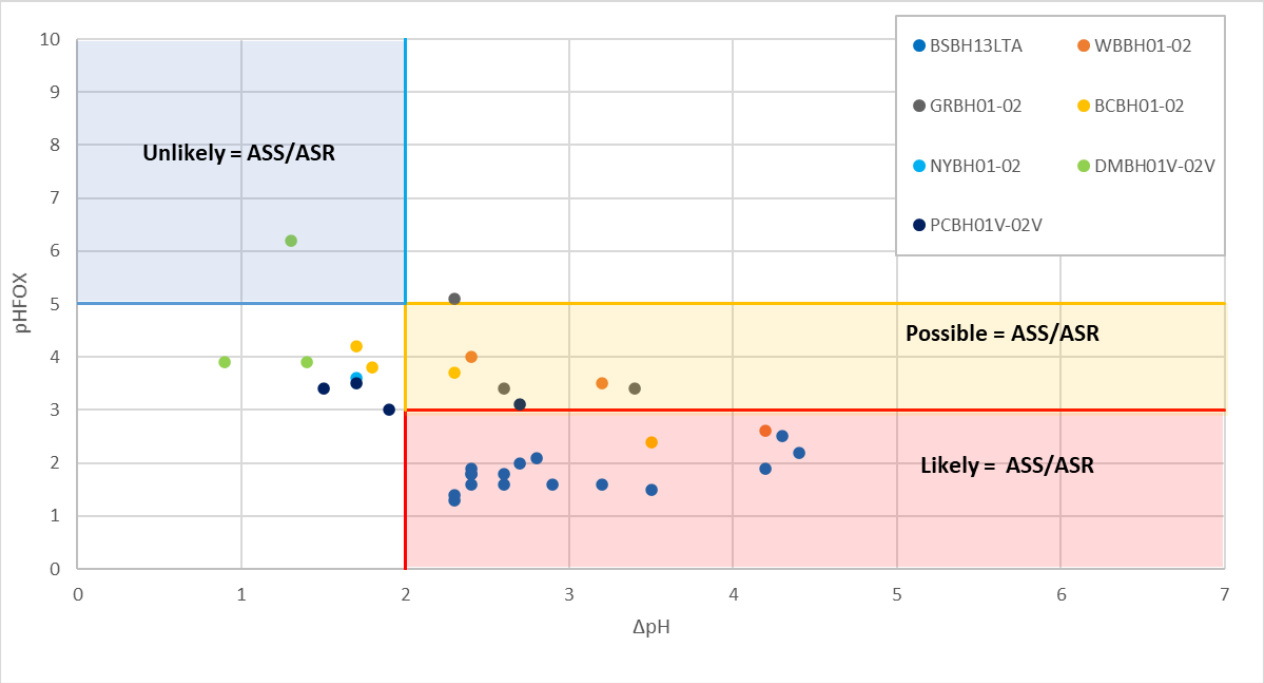


Figure 3.1 Summary of pH_{FOX} and ΔpH screen test results by borehole sample

Accordingly, the screen test results indicate that:

- pH_F values were below 4 in two samples from Big Swamp (BSBH13LTA) suggesting the likely occurrence of actual ASS.
- pH_F values were between 4 and 5 in fourteen additional samples, suggesting the possible occurrence of actual ASS. Eleven of these results were recorded at Big Swamp (BSBH13LTA), one at Deans Marsh (DMBH01V/ DMBH02V) and two from Pennyroyal Creek (PCBH01V/ PCBH02V).
- pH_{FOX} values were below 3 in eighteen samples, suggesting that potential ASS are likely. Sixteen of these results were from Big Swamp (BSBH13LTA) to a depth of 24 m. One sample was from West Barwon (WBBH01/WBBH02) and one sample from Barongarook Creek (BCBH01/BCBH02).
- pH_{FOX} values were between 3 and 5 in fourteen additional samples, suggesting that potential ASS are possible. These samples were from boreholes along the West Barwon (WBBH01/WBBH02), Gellibrand River (GRBH01/GRBH02), Barongarook Creek (BCBH01/BCBH02), North Yeodene (NYBH01/ NYBH02), Deans Marsh (DMBH01V/ DMBH02V) and Pennyroyal Creek (PCBH01V/ PCBH02V).
- ∆ pH values were greater than 2 in twenty-five samples, suggesting that sulfides are likely to be present. These samples were from Big Swamp (BSBH13LTA), West Barwon (WBBH01/ WBBH02), Gellibrand River (GRBH01/GRBH02), Barongarook Creek (BCBH01/BCBH02) and Pennyroyal Creek (PCBH01V/ PCBH02V).

Screen tests results are shown in full in Appendix G.

While the screen test data suggest that ASS may be present in other areas besides Big Swamp (Figure 3.1), screen tests commonly overestimate the likelihood of ASS occurrence as they conservatively assume that:

1- all acidity (and hence low pH_F values) in samples is related to prior sulfide oxidation, when other sources of acidity (such as humic acids) may be present.

2- all potential acidity (and hence pH_{FOX} and ΔpH values) in samples is related to sulfide oxidation, when other sources, such as organic carbon may also yield lower pH_{FOX} and higher ΔpH values following peroxide addition.

As such, to confirm the presence or absence of ASS, more detailed analysis via the chromium reducible sulfur suite was undertaken. Accordingly, the 10 samples most likely contain ASS based on the screen test results (while allowing for a spatial spread throughout the project area) underwent further testing via chromium reducible sulfur analysis.

Table 3-1 below summarises the chromium suite analysis undertaken on samples. The net acidity (actual + potential - neutralising capacity) takes into account any neutralising capacity that the soil may have. However, if carbonates are present as shells, these may react too slowly or become coated in hydroxides, limiting their ability to buffer acidity derived from reduced inorganic sulfur (RIS) oxidation. Therefore, the net acidity excluding acid neutralising capacity may be a more accurate indication of the amount of acidity that may be realised upon disturbance and oxidisation of ASS (Sullivan et al 2018).

Given this, net acidity excluding acid neutralising capacity has been used as the basis for the below reporting. In addition, the criteria for ASS occurrence adopted has been set at 18 mole H^+/tonne on the assumption that drawdown broad enough to affect these areas would results in the disturbance of ≥1,000 tonnes of material, which would require assessment against the 18 mole H^+/tonne criterion set by publication 665.1 (EPA, 2009).

At BSBH13LTA located in Big Swamp, the net acidity (excluding acid neutralising capacity) decreased from 463 mole H^+/t at 15 m depth to 31 mole H^+/t at 21 m depth. This suggests that the highest concentrations of sulfides occur within the upper ~16 m of the stratigraphy, while concentrations decline as the lithology transitions into deeper units (recognising that this represents only one point spatially and that the thickness of sulfide deposits may vary throughout the swamp).

Samples at boreholes outside of Big Swamp including along the West Barwon, Gellibrand River, Barongarook Creek and Pennyroyal Creek (WBBH01/WBBH0, GRBH01/GRBH02, BCBH01/ BCBH02 and PCBH01V/PCBH02V) exhibited lower concentrations of net acidity (excluding acid neutralising capacity) ranging from <10 mol H^+/t at 2.0 m at GRBH01 GRBH02 to 24 mol H^+/t at BCBH01/ BCBH02. The proportion of acidity present as reduced inorganic sulfur ranged from 21% at 3 m at GRBH01/ GRBH02 to 70% at WBBH01/ WBBH02.

The net acidity criteria of 18 mole H^+/t was exceeded at two locations outside of Big Swamp, including the West Barwon (23 mole H+/t) and Barongarook Creek East branch (24 mole H+/t), indicating the occurrence of low concentration ASS at these locations.

In summary, following the collection of 34 samples and prioritisation of those most likely to contain the highest concentrations of acidity, ASS were identified at two locations outside of Big Swamp (along the West Barwon and Barongarook Creek East Branch). However, the concentration of net acidity at these locations was ≤24 mole H^+/t. These marginally exceed the 18 mole H^+/t criteria for classification as ASS and represent acidity concentrations 2 orders of magnitude lower than the average net acidity identified in Big Swamp. Given this, it can be concluded that ASS similar in nature to those in Big Swamp were not identified as part of this programme.

Laboratory chromium sulfur analysis reports are shown in Appendix G.

Table 3-1 Summary of chromium analysis

Lab sample ID	Borehole number	Titratable Actual Acidity [mol H+/t]	Potential Acidity [mol H+/t]	Net Acidity Excluding Acid Neutralising Capacity [mol H+/t]	Proportion of acidity derived from RIS (%)
PB-BH01_1.0	BSBH13LTA	103	69	247	58
PB-BH01_11	BSBH13LTA	46	625	671	93
PB-BH01_15.0	BSBH13LTA	23	440	463	95
PB-BH01_21	BSBH13LTA	<2	31	31	-
PB-BH01_24	BSBH13LTA	2	26	28	93
BH04_BH05_2.0	WBBH01/ WBBH02	7	16	23	70
BH08_09_2.0	GRBH01/ GRBH02	<2	<10	<10	-
BH08_09_3.0	GRBH01/ GRBH02	11	<10	14	21
BH14_15_2	BCBH01/ BCBH02	13	11	24	46
BH20_21-1.0	PCBH01V/ PCBH02V	4	<10	11	64

4. Summary and conclusions

The well installation program described within this report included the installation of 21 monitoring wells at ten nested sites via a combination of mud rotary and reverse air circulation drilling. One well was installed in Big Swamp to allow for assessment of interaction between groundwater in the LTA with that of the overlying alluvium. All wells except one (EBBH01) were fitted with Solinst groundwater level loggers along with two barometric pressure loggers. Two wells (EBBH01 and BRBH01) exhibited groundwater levels above top of casing. The former was fit with a pressure gauge and the latter with a pressure gauge and logger.

Redevelopment was undertaken at three DELWP monitoring bores (108917, 108898 and 108899) located off Frys Road in Gellibrand and solinst level loggers were installed in all three.

Preliminary conclusions with respect to the hydrogeological conceptualisation and opportunistic acid sulfate soil sampling have been summarised below.

4.1 Hydrogeological conceptualisation

With respect to the drilling program, lithological logs and hydrogeological conceptualisation, major findings include:

- The thickness of high plasticity clays at BSBH13LTA (interpreted as interlayered Demons Bluff/Narrawaturk Marl) is significantly greater than had been previously conceptualised during groundwater-surface water modelling (GHD, 2020). The model assumed that the there was "direct connection between the LTA and alluvium at the upstream end of the swamp" and that the LTA only becomes confined "approximately in the middle of Big Swamp". In contrast, the logs indicate that the LTA is confined by more than 10 m of Demons Bluff/Narrawaturk Marl much further upstream than previously conceptualised.

- The thickness of Nirranda Group deposits at EBBH01 and EBBH02 (i.e. the Narrawaturk Marl) along the East Barwon River are greater (~7 m) than indicated by the VAF (<1 m). In addition, groundwater levels in the LTA are above ground level at this location. This indicates that the LTA may be more confined in this area than previously conceptualised.

- Lithological logs and stratigraphic interpretation at WBBH01 and WBBH02 suggest that the occurrence of the Gellibrand Marl and Narrawaturk Marl extends a minimum of 300 to 400 m further to the south east along the Barwon River West Branch than is mapped within the VAF (GHD, 2012). In addition, groundwater levels in the LTA are above ground level at this location. This indicates that the LTA may be more confined in this area than previously conceptualised.

- At Ten Mile Creek (TMCBH01 and TMCBH02) and Yahoo Creek (YCBH01 and YCBH02), the LTA was identified near the surface, indicating that alluvial deposits in these locations are not laterally extensive.

- The Demons Bluff formation was identified from surface to 30 m depth at Deans Marsh (DMBH01V and DMBH02V), indicating that it extends further south that indicated in geological maps and that the LTA does not outcrop at this location.

At other locations, investigations were more consistent with previous conceptualisations including:

- The presence of alluvium to 6 m depth, Narrawaturk Marl from 6 to 10 m depth, LTA from 10 to 16 m depth was identified along the Gellibrand River (GRBH01 and GRBH02).

- The presence of alluvial deposits to 6 m depth before transitioning into the Gellibrand Marl at 6 m depth and subsequently the Narrawaturk Marl at 10 m depth was identified at BRBH01 and BRBH02 at the Barwon River central confluence.

- The presence of 25 m of Demons Bluff Formation / Narrawaturk Marl overlying the LTA at BCBH01 and BCBH02 and Barongarook Creek East Branch was identified.

- The presence of Narrawaturk Marl from surface to 30 m depth North of Yeodene at NYBH01 and NYBH02 was identified.

- The presence of alluvial deposits from ground surface to 7 m before transitioning into the Demons Bluff Formation / Narrawaturk Marl to 30 m depth was identified.

4.2 Soil testing

Following the collection of 34 samples and prioritisation of those most likely to contain the highest concentrations of acidity:

- ASS were identified at two locations outside of Big Swamp, including those along the West Barwon and Barongarook Creek East Branch.

- The concentration of net acidity excluding ANC at these locations was ≤24 mole H^+/t. These marginally exceed the 18 mole H^+/t criteria for classification as ASS and represent acidity concentrations 2 orders of magnitude lower than the average net acidity identified in Big Swamp.

- Given this, it can be concluded that ASS similar in nature to those in Big Swamp were not identified as part of this programme.

5. Recommendations

Due to the timing and access limitations encountered as part of this programme, there remain some outstanding items to ensure the ongoing collection of high-quality data to facilitate the development of revised conceptual site models and validation of the numerical groundwater model at the monitoring locations. This includes:

- A new steal casing monument will need to be construction and installed to accommodate the large pressure fitting at BRBH01 located next to the Barwon River.
- It is recommended that the logger details and groundwater levels at EBBH02 (serial number, deployment depth, groundwater level) are confirmed during the first monitoring period.
- All loggers were set to one hour recording intervals to measure short term fluctuations in water level. The loggers have a maximum of 40,000 memory points equating to 4.5 years of continuous logging without downloading and or resetting. It is recommended that the logging frequency is revised (reduced) following the first 12 months of monitoring to preserve logger batter and memory.
- Re-survey of the DELWP wells developed (108917, 108898 and 108899) is recommended to ensure accurate calculation of groundwater elevations.
- The survey of surface water features or other features of interest is recommended to allow assessment of hydraulic gradients or the potential implications of groundwater levels on other features.
- It is recommended that a pump test is undertaken at BSBH13LTA and monitored at other nearby shallow monitoring wells (including BSBH15 and potentially others) to improve the understanding of hydraulic connection between the LTA and the overlying alluvial system.

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Appendix A. Borehole logs and groundwater monitoring well construction details

Jacobs — Piezometer Installation Details

BSBH13LTA

Project: Otway Drilling
Client: Barwon Water
Location: Big Swamp
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	735331.63	**Elevation:**	147.39	**Started:**	08/04/2021
Plant:	Boart Longyear	**Northing:**	5743868.00	**Datum:**	m AHD	**Finished:**	09/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS
Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID / Type / Stick Up / Tip Depth & RL
						BSBH13LTA / Standpipe / 0.66 m / 30.00 m
						Monument cover
	0.15 m bgl 14/07/2021				Silty CLAY with trace sand: low plasticity, black brown, moist, soft, cohesive, fine sand with some organic matter (Alluvium)	
			5		Sandy CLAY: high plasticity, brown and grey, soft to firm, cohesive clumps, fine sand (Demons Bluff/Narrawaturk Marl)	
			10		CLAY: high plasticity, brown to grey, soft	Grout with 5% bentonite Grout
					Sandy CLAY: high plasticity, brown-cream-grey, fine sand becoming coarse with depth, soft	80mm diameter Class 12 PVC casing
			15			Tremmie line depth
					Clayey SAND: angular coarse sand, red and cream, loose to medium dense	
					SAND with trace clay (Dilwyn Formation) , angular coarse sand, red and cream, loose to medium dense	
					SAND: medium grained sand, loose to medium dese, becoming fine with depth	
			20			Bentonite slow release pellets Bentonite
						80mm diameter Class12 PVC 1.5 mm slotted screen
			25		SAND: fine to very fine grained, well sorted, rounded, loose	26.50 m
						8/16 graded Gravel
						29.50 m
			30		Hole Terminated at 30.00 m Target depth	80mm diameter Class 12 PVC sump PVC end cap

Piezometer Installation Details

EBBH01

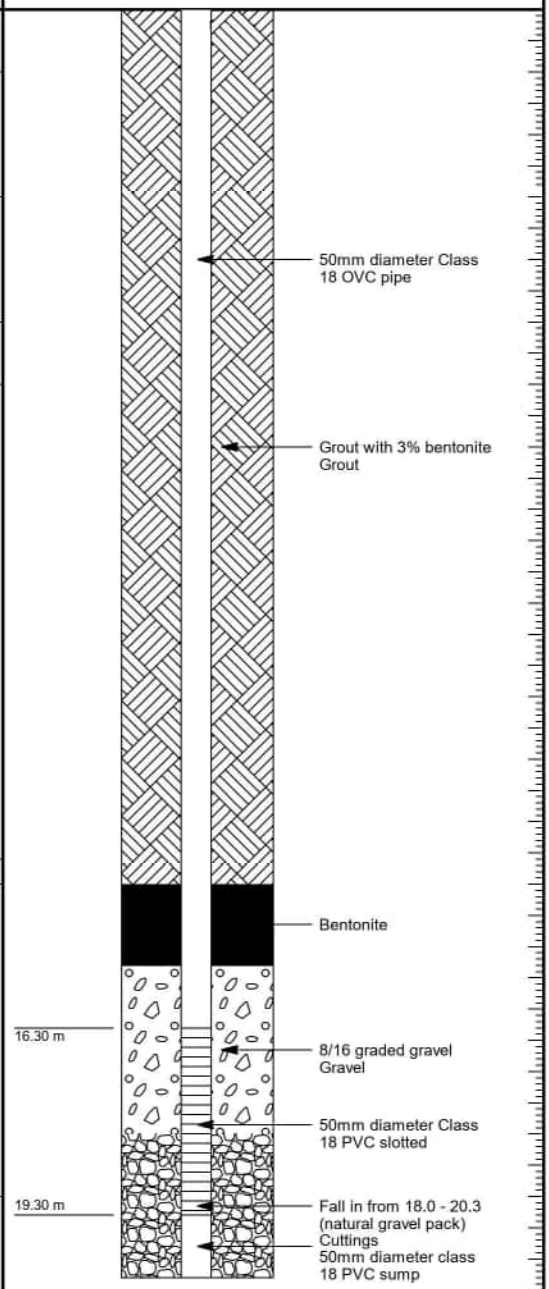
Project: Otway Drilling
Client: Barwon Water
Location: Barwon River East
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	739245.0	**Elevation:**		**Started:**	31/05/2022
Plant:	Boart Longyear	**Northing:**	5736285.0	**Datum:**		**Finished:**	07/06/2022
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
6-7 kPa 6/06/2022			2		CLAY with trace sand: high plasticity, brown, moist (Alluvium)
					CLAY: high plasticity, brown, moist
			4		CLAY with trace sand: high plasticity, brown with some grey, moist trace find sand
					CLAY: high plasticity, mottled brown and dark grey colour, moist
			6		CLAY: high plasticity, brown, moist (Narrawaturk Marl)
			8		
			10		
			12		
			14		SAND with trace clay and organic matter: fine rounded sand, 1-3mm wood fragments, (Dilwyn Formation)
					SAND: fine to medium grained, well rounded
			16		
			18		
			20		CLAY with some coarse sand and gravel: high plasticity clay, dark brown, moist, coarse angular sand and quartz gravel
					CLAY: high plasticity, mottled grey with brown colour, moist. EOH
			22		Hole Terminated at 22.00 m
			24		

ID	Type	Stick Up	Tip Depth & RL
EBBH01	Standpipe	0.85 m	20.30 m



JACOBS Piezometer Installation Details

EBBH02

Project: Otway Drilling
Client: Barwon Water
Location: Barwon River East
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	739245.0	**Elevation:**		**Started:**	31/05/2022
Plant:	Boart Longyear	**Northing:**	5736285.0	**Datum:**		**Finished:**	31/05/2022
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata** — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
EBBH02	Standpipe	0.69 m	10.00 m

Monument cover

CLAY with trace sand: high plasticity, brown, moist (Alluvium)

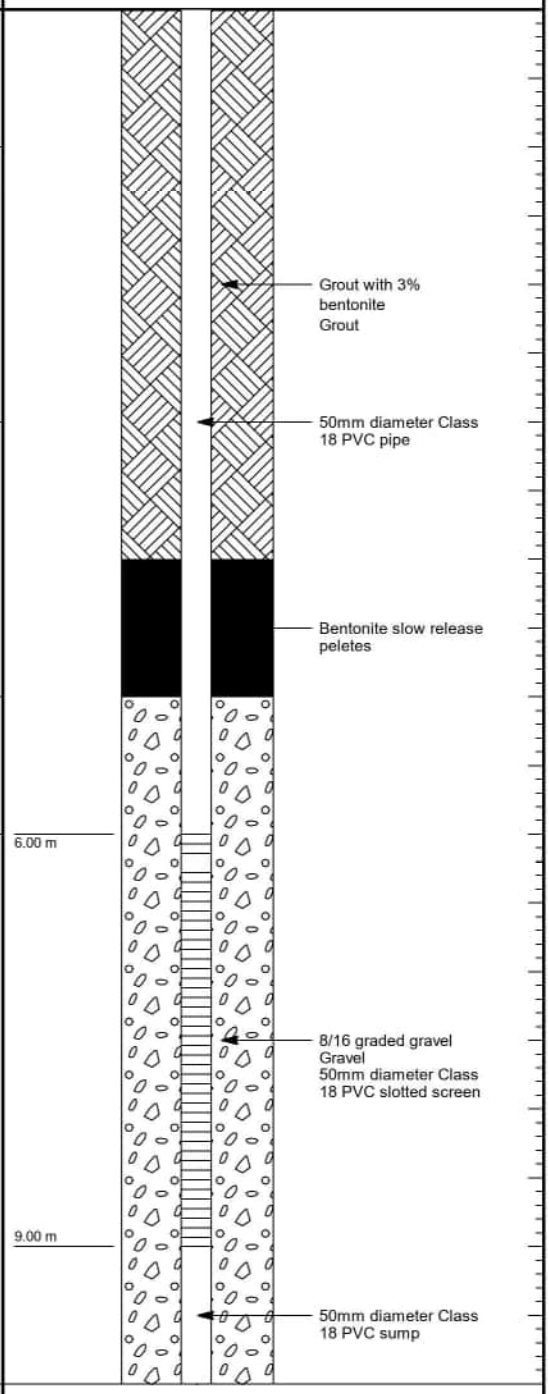
CLAY: high plasticity, brown, moist

CLAY with trace sand: high plasticity, brown with some grey, moist trace fine sand

CLAY: high plasticity, mottled brown and dark grey colour, moist

CLAY: high plasticity, brown, moist
(Narrawaturk Marl)

Hole Terminated at 10.00 m



7.41 m bgl 6/06/2022

Piezometer Installation Details

WBBH01

Project: Otway Drilling
Client: Barwon Water
Location: Barwon River West
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	734255.30	**Elevation:**	141.62	**Started:**	12/04/2021
Plant:	Boart Longyear	**Northing:**	5736135.86	**Datum:**	m AHD	**Finished:**	13/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support: -0.24 m m bgl 14/07/2021
Water
RL (m)
Depth (m)
Graphic Log

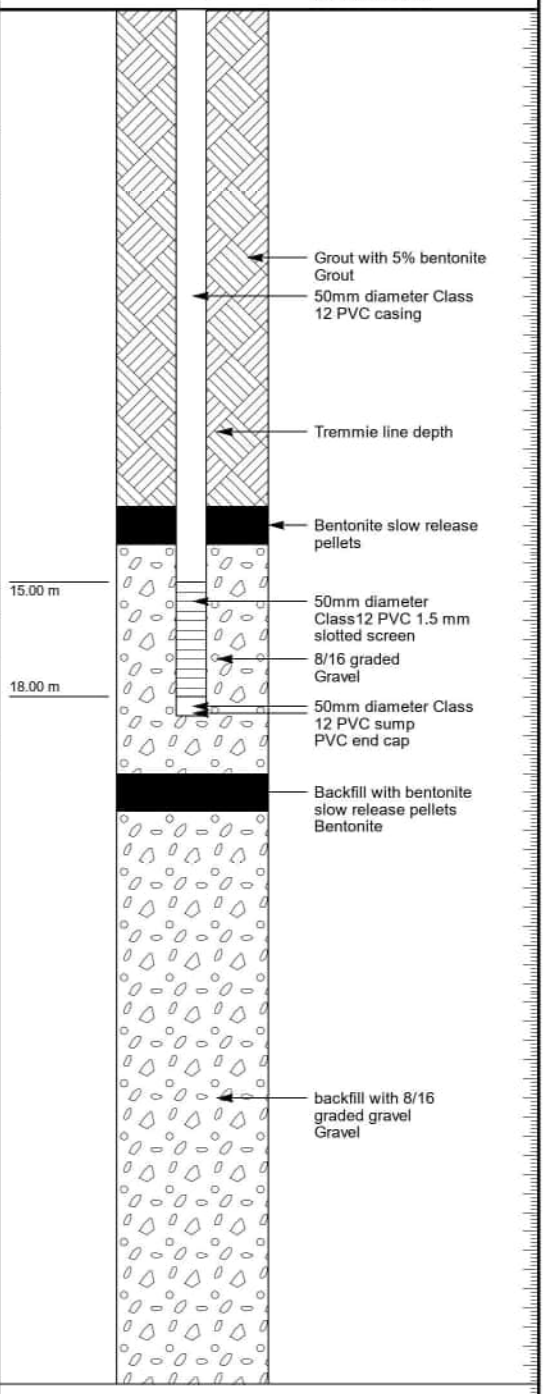
Description of Strata

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

Depth (m)	Description of Strata
0	CLAY: high plasticity, brown, soft (Alluvium)
3	CLAY: high plasticity, brown and grey mottling, soft
5	CLAY: high plasticity, brown with some grey green mottling, soft
6	Silty CLAY: high plasticity, grey to off green, soft, cohesive (Gellibrand Marl)
9	Silty CLAY: high plasticity, grey, soft, cohesive
10	CLAY: high plasticity, brown grey mottling, soft
11	CLAY: high plasticity, brown, soft (Narrawaturk Marl)
15	Clayey SAND: fine to coarse grained, loose, brown clay (Dilwyn formation)
16	SAND with some clay: fine to coarse grained, loose (Dilwyn formation)
17	SAND (Dilwyn formation) : coarse, angular
19	Clayey SAND (Dilwyn formation) : coarse, high plasticity, grey clay
20	CLAY: high plasticity, grey, soft, cohesive (Potential weathered basement)
36	Hole Terminated at 36.00 m Target depth

INSTALLATION DETAILS

ID	Type	Stick Up	Tip Depth & RL
WBBH01	Standpipe	0.58 m	18.50 m



Piezometer Installation Details

WBBH02

Project: Otway Drilling
Client: Barwon Water
Location: Barwon River West
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	734255.91	**Elevation:**	141.62	**Started:**	12/04/2021
Plant:	Boart Longyear	**Northing:**	5736135.75	**Datum:**	m AHD	**Finished:**	13/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | Description of Strata

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

0.09 m bgl 14/07/2021

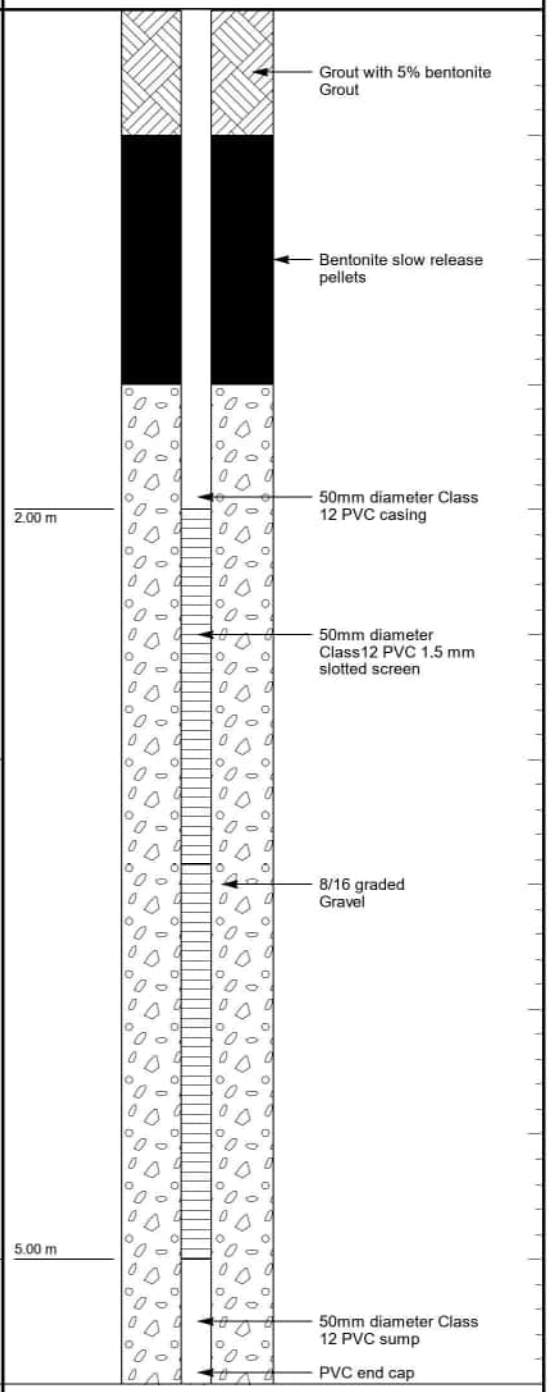
CLAY: high plasticity, brown, soft
(Alluvium)

CLAY: high plasticity, brown and grey mottling, soft

CLAY: high plasticity, brown with some grey green mottling, soft

Hole Terminated at 5.50 m
Target depth

ID	Type	Stick Up	Tip Depth & RL
WBBH02	Standpipe	0.53	5.50 m



Jacobs Piezometer Installation Details

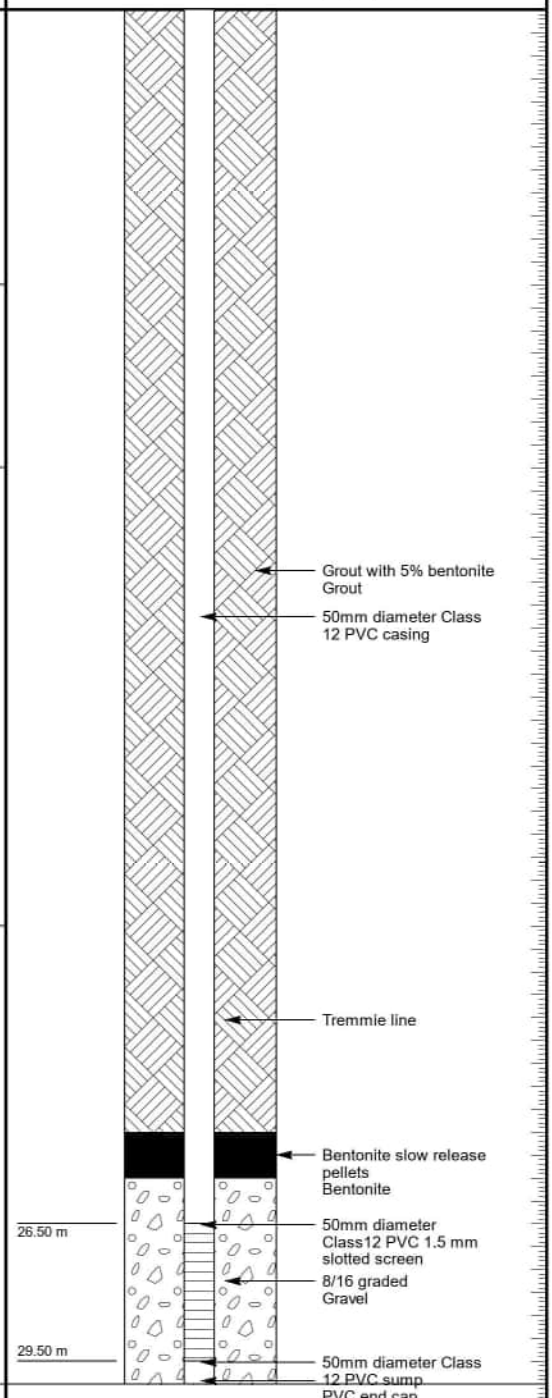
BRBH01

Project: Otway Drilling
Client: Barwon Water
Location: Barwon River
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	739461.95	**Elevation:**	118.93	**Started:**	06/04/2021
Plant:	Boart Longyear	**Northing:**	5744513.66	**Datum:**	m AHD	**Finished:**	08/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
50 kPa 14/07/2021			5		CLAY with trace stand: high plasticity, brown, soft, fine sand (Alluvium)
			10		CLAY: medium plasticity, off green to grey, very soft to soft (Gellibrand Marl)
			15		CLAY: medium plasticity, grey, very soft to soft (Narrawaturk Marl)
			20		CLAY: medium plasticity, light grey, very soft to soft
			25		
			30		Hole Terminated at 30.00 m Target depth



Piezometer Installation Details

BRBH02

Project: Otway Drilling
Client: Barwon Water
Location: Barwon River
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	739462.04	**Elevation:**	118.91	**Started:**	06/04/2021
Plant:	Boart Longyear	**Northing:**	5744514.21	**Datum:**	m AHD	**Finished:**	08/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support: -0.11 m bgl 14/07/2021
Water:
RL (m):
Depth (m): 1, 2, 3, 4, 5, 6
Graphic Log:

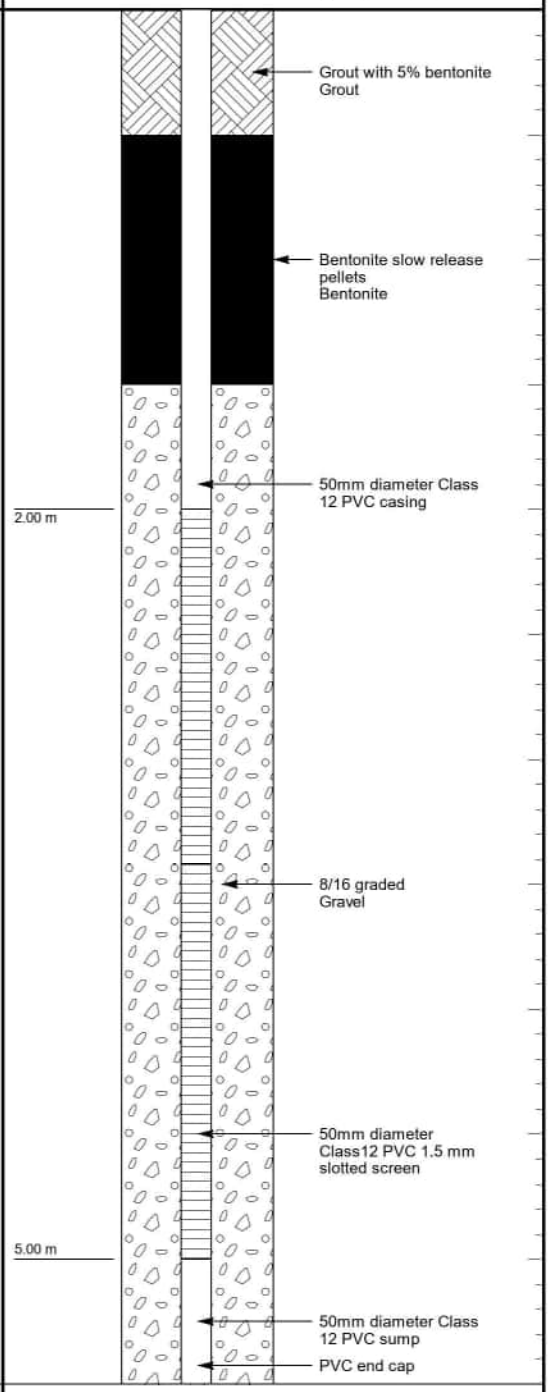
Description of Strata

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

CLAY with trace stand: high plasticity, brown, soft, fine sand (Alluvium)

Hole Terminated at 5.50 m
Target depth

ID	Type	Stick Up	Tip Depth & RL
BRBH02	Standpipe	0.68	5.50 m



Jacobs Piezometer Installation Details

GRBH01

Project: Otway Drilling
Client: Barwon Water
Location: Gellibrand River
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	723434.72	**Elevation:**	76.24	**Started:**	18/03/2021
Plant:	Boart Longyear	**Northing:**	5732307.84	**Datum:**	m AHD	**Finished:**	23/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | Description of Strata

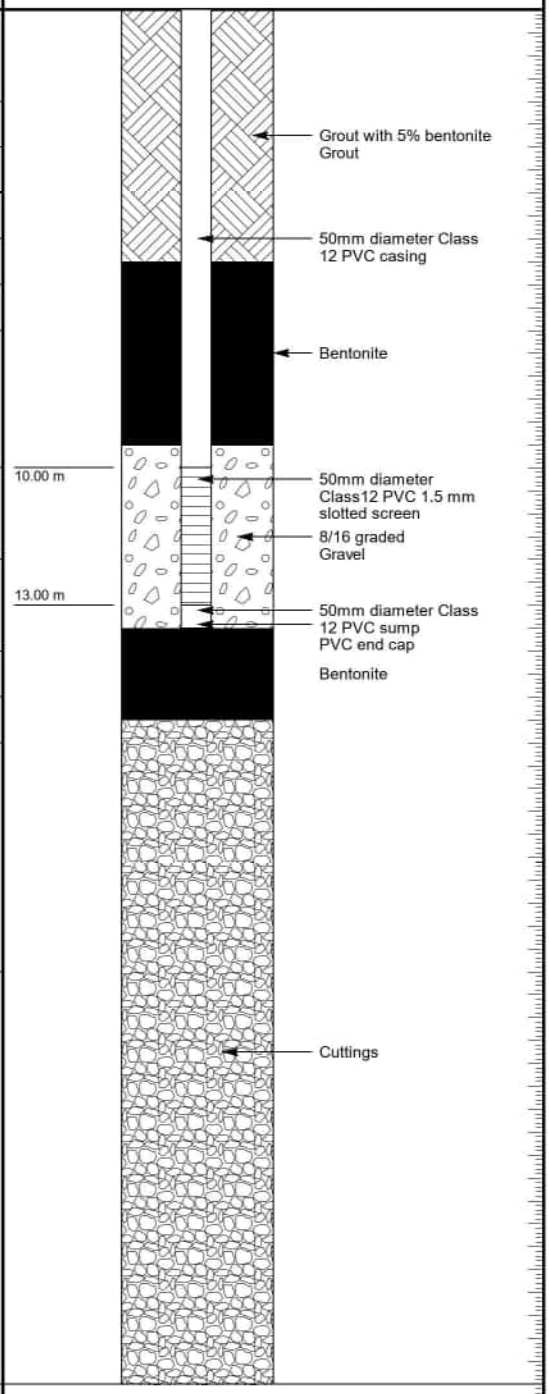
ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

3.77 m bgl 15/07/2021

- CLAY with some sand: high plasticity, brown soft (Alluvium)
- SAND: fine, rounded, loose
- CLAY with some sand: high plasticity, light brown, soft, cohesive
- CLAY with some sand: high plasticity, brown and grey, soft, cohesive
- SAND with organic matter: rounded coarse sand, loose, large wood fragments
- CLAY with some sand and organic matter: high plasticity, grey, fine sand, large wood fragments
- CLAY: high plasticity, grey, soft (Narrawaturk Marl)
- SAND: coarse, poorly sorted, loose (Dilwyn Formation)
- CLAY with some sand: high plasticity, grey, coarse sand (Pember Mudstone)
- SAND: coarse, angular, loose (Pebble Point Formation)
- SAND with some clay and trace organic matter: poorly sorted coarse angular sand, high plasticity grey clay, brown coal/small wood chips
- CLAY: high plasticity, grey, soft, few small wood chips (Weathered Basement)
- Mudstone, with trace sand, grey, blue, hard (Basement)
- Hole Terminated at 30.00 m
  Target depth

INSTALLATION DETAILS

ID	Type	Stick Up	Tip Depth & RL
GBBH01	Standpipe	0.69 m	13.50 m



Piezometer Installation Details

GRBH02

Project: Otway Drilling
Client: Barwon Water
Location: Gellibrand River
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	723434.68	**Elevation:**	76.24	**Started:**	18/03/2021
Plant:	Boart Longyear	**Northing:**	5732307.79	**Datum:**	m AHD	**Finished:**	23/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS
Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID / Type / Stick Up / Tip Depth & RL
						GRBH02 / Standpipe / 0.69 m / 5.50 m
						Monument cover
			0		CLAY with some sand: high plasticity, brown soft (Alluvium)	Grout with 5% bentonite Grout
			1			Bentonite
						50mm diameter Class 12 PVC casing
			2		SAND: fine, rounded, loose	2.00 m
2.65 m bgl 15/07/2021			3		CLAY with some sand: high plasticity, light brown, soft, cohesive	8/16 graded Gravel
			4		CLAY with some sand: high plasticity, brown and grey, soft, cohesive	50mm diameter Class12 PVC 1.5 mm slotted screen
			5		SAND with organic matter: rounded coarse sand, loose, large wood fragments	5.00 m
						50mm diameter Class 12 PVC sump
						PVC end cap
			6		Hole Terminated at 5.50 m Target depth	

Jacobs — Piezometer Installation Details

TMCBH01

Project: Otway Drilling
Client: Barwon Water
Location: Ten Mile Creek
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	726273.02	**Elevation:**	159.55	**Started:**	29/03/2021
Plant:	Boart Longyear	**Northing:**	5740766.62	**Datum:**	m AHD	**Finished:**	31/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
					Fill: coal - fill from Old Rail Trail
					SAND: coarse, well rounded (Dilwyn Formation)
			5		SAND: medium to coarse grained, loose
					SAND: poorly sorted, small to coarse grained, rounded to angular
					SAND with some coal poorly sorted, small to coarse grained rounded to angular
			10		Clayey SAND: fine to coarse, poorly sorted, some black coal
					CLAY with some sand: medium plasticity, brown, angular coarse sand
			15		
					CLAY with trace sand: medium plasticity, brown, angular coarse sand
			20		Fine sand
					Sandy CLAY: medium plasticity, brown, fine sand
					Fine sand
			25		CLAY with some sand: medium plasticity, brown, fine sand
▼ 29.47 m bgl 15/07/2021			30		Hole Terminated at 30.20 m Target depth

ID	Type	Stick Up	Tip Depth & RL
TMCBH01	Standpipe	0.74 m	30.20 m

Monument cover

50mm diameter Class 12 PVC casing

Grout with 5% bentonite Grout

Tremmie line depth

Bentonite

26.70 m

50mm diameter Class12 PVC 1.5 mm slotted screen

8/16 graded Gravel

29.70 m

50mm diameter Class 12 PVC sump PVC end cap

Jacobs Piezometer Installation Details

TMCBH02

Project: Otway Drilling
Client: Barwon Water
Location: Ten Mile Creek
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	726273.35	**Elevation:**	159.56	**Started:**	29/03/2021
Plant:	Boart Longyear	**Northing:**	5740767.31	**Datum:**	m AHD	**Finished:**	31/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS
Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID / Type / Stick Up / Tip Depth & RL TMCBH02 / Standpipe / 0.65 / 10.50 m Monument cover
			0		Fill: coal - fill from Old Rail Trail	
			1		SAND: coarse, well rounded (Dilwyn Formation)	50mm diameter Class 12 PVC casing
			2			Grout with 5% bentonite Grout
			3			
			4		SAND: medium to coarse grained, loose	Tremmie line depth
			5			Bentonite slow release pelletes Bentonite
			6		SAND: poorly sorted, small to coarse grained, rounded to angular	
6.63 m bgl 15/07/2021			7		SAND with some coal poorly sorted, small to coarse grained rounded to angular	7.00 m 50mm diameter Class12 PVC 1.5 mm slotted screen
			8			8/16 graded Gravel
			9			
			10		Clayey SAND: fine to coarse, poorly sorted, some black coal	10.00 m 50mm diameter Class 12 PVC sump PVC end cap
			11		Hole Terminated at 10.50 m Target depth	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring
TCR % core run recovered
RQD % core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

Piezometer Installation Details

YCBH01

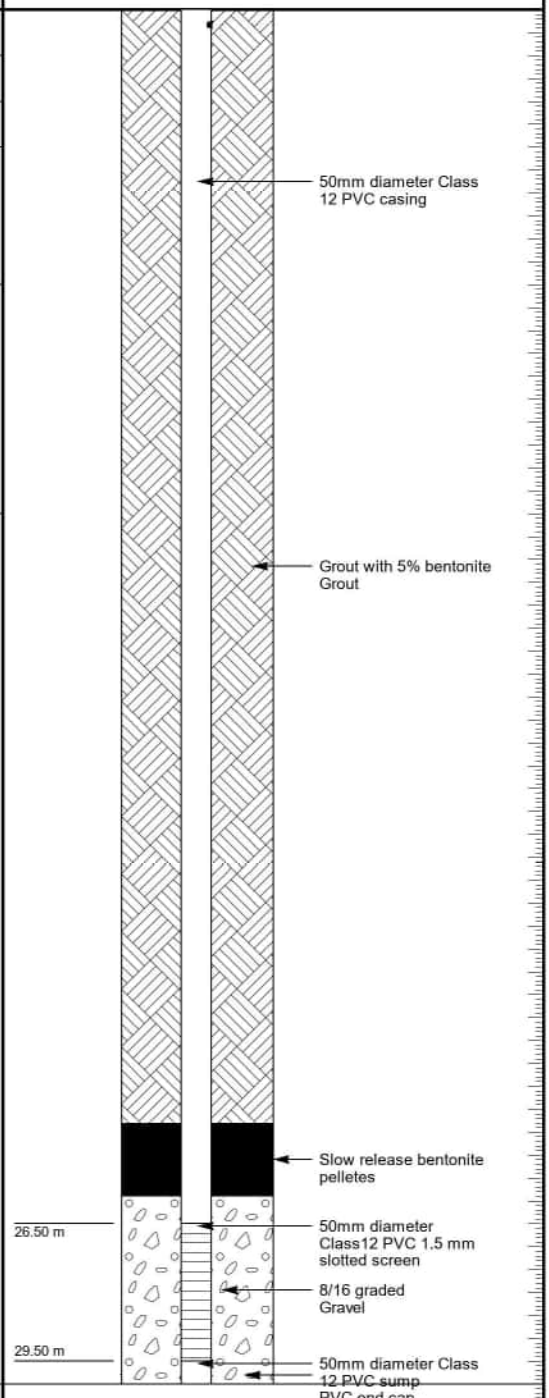
Project: Otway Drilling
Client: Barwon Water
Location: Yahoo Creek
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	724086.18	**Elevation:**	143.28	**Started:**	26/03/2021
Plant:	Boart Longyear	**Northing:**	5739877.00	**Datum:**	m AHD	**Finished:**	28/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
					SAND with some silt: medium grained red brown (Dilwyn Formation)
					SAND: medium brown coarse grained, sub rounded 1 - 2 mm
					SAND: fine to medium grained, red-brown rounded
			5		SAND: yellow brown medium to carse grained, rounded to sub-rounded
			10		Clayey SAND: orange/yellow brown, medium grained, slightly cohesive, soft texture
			15		SAND with trace silt: orange brown coarse, rounded, loose
			20		
19.09 m bgl 15/07/2021			25		
			30		Hole Terminated at 30.00 m Target depth

ID	Type	Stick Up	Tip Depth & RL
YCBH01	Standpipe	0.66 m	30.00 m



Piezometer Installation Details

YCBH02

Project: Otway Drilling
Client: Barwon Water
Location: Yahoo Creek
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	724085.31	**Elevation:**	143.29	**Started:**	26/03/2021
Plant:	Boart Longyear	**Northing:**	5739876.41	**Datum:**	m AHD	**Finished:**	28/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata** — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
YCBH02	Standpipe	0.66 m	15.00 m

Monument cover

SAND with some silt: medium grained red brown (Dilwyn Formation)

SAND: medium brown coarse grained, sub rounded 1 - 2 mm

SAND: fine to medium grained, red-brown rounded

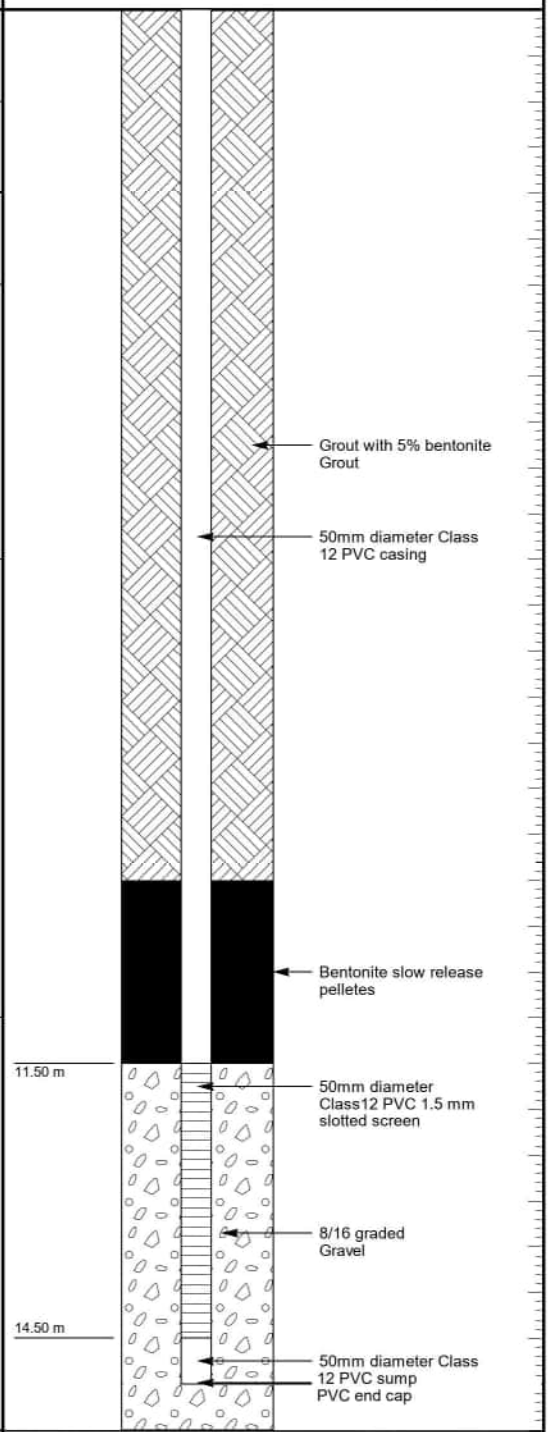
SAND: yellow brown medium to carse grained, rounded to sub-rounded

Clayey SAND: orange/yellow brown, medium grained, slightly cohesive, soft texture

SAND with trace silt: orange brown coarse, rounded, loose

Hole Terminated at 15.50 m
Target depth

14.67 m bgl 15/07/2021



Piezometer Installation Details

BCBH01

Project: Otway Drilling
Client: Barwon Water
Location: Barongarook Creek East Branch
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	733685.17	**Elevation:**	174.9	**Started:**	10/04/2021
Plant:	Boart Longyear	**Northing:**	5749760.11	**Datum:**	m AHD	**Finished:**	11/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata** — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
BCBH01	Standpipe	0.66 m	23.50 m

Monument cover

9.39 m bgl 14/07/2021

CLAY: high plasticity, mottled brown and red, soft, cohesive
(Demons Bluff/Narrawaturk Marl)

Silty CLAY: high plasticity, mottled red, cream, brown, soft, cohesive

Silty CLAY: high plasticity, mottled red, cream, brown, very soft, cohesive

CLAY: high plasticity, cream and red , brown, very soft, cohesive

CLAY: high plasticity, becoming more red, brown, very soft, cohesive

Silty CLAY with some sand: high plasticity, brown, fine sand

Silty CLAY with some sand: high plasticity, brown, fine to coarse sand

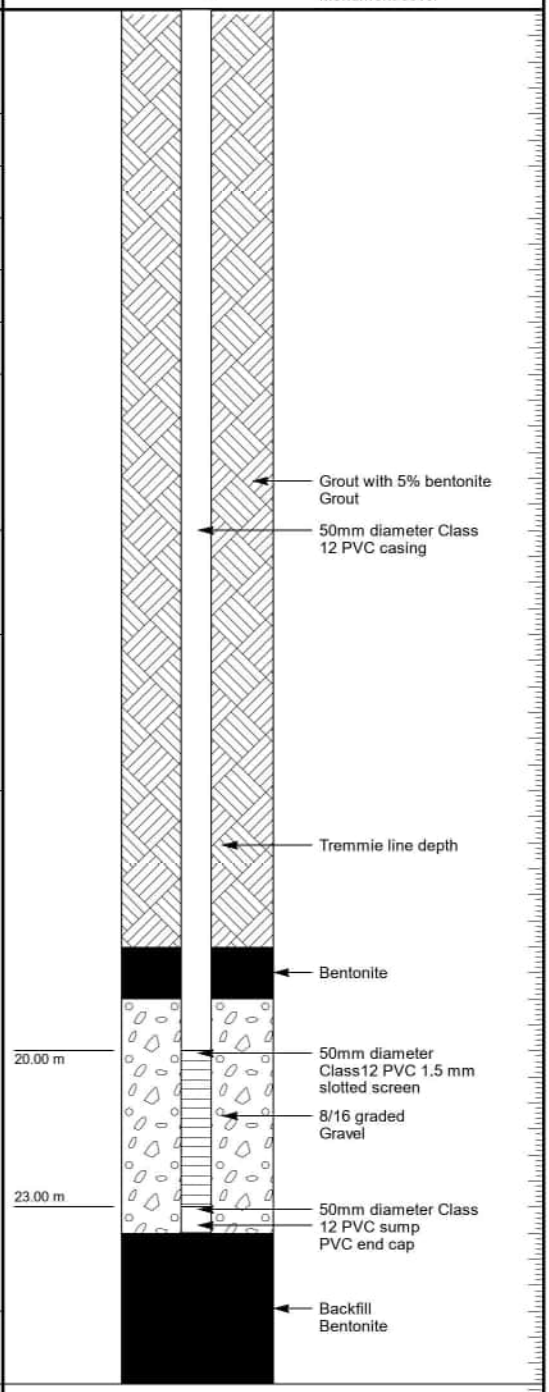
CLAY: high plasticity, brown, soft

CLAY with trace sand: high plasticity, brown, soft

Silty CLAY: high plasticity, grey, soft, cohesive

SAND: fine, rounded
(Dilwyn Formation)

Hole Terminated at 26.40 m
Target depth



Jacobs — Piezometer Installation Details

BCBH02

Project: Otway Drilling
Client: Barwon Water
Location: Barongarook Creek East Branch
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	733685.82	**Elevation:**	174.92	**Started:**	10/04/2021
Plant:	Boart Longyear	**Northing:**	5749760.51	**Datum:**	m AHD	**Finished:**	11/04/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING				MATERIAL SUBSTANCE		INSTALLATION DETAILS
Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)	ID / Type / Stick Up / Tip Depth & RL BCBH02 / Standpipe / 0.65 m / 14.50 m Monument cover
			0		CLAY: high plasticity, mottled brown and red, soft, cohesive (Demons Bluff/Narrawaturk Marl)	
			2		Silty CLAY: high plasticity, mottled red, cream, brown, soft, cohesive	
▼ 3.42 m bgl 14/07/2021					Silty CLAY: high plasticity, mottled red, cream, brown, very soft, cohesive	
			4		CLAY: high plasticity, cream and red , brown, very soft, cohesive	Grout with 5% bentonite Grout
					CLAY: high plasticity, becoming more red, brown, very soft, cohesive	50mm diameter Class 12 PVC casing
			6		Silty CLAY with some sand: high plasticity, brown, fine sand	
					Silty CLAY with some sand: high plasticity, brown, fine to coarse sand	Tremmie line depth
			8			Bentonite slow release pelletes
			10		CLAY: high plasticity, brown, soft	11.00 m
			12		CLAY with trace sand: high plasticity, brown, soft	50mm diameter Class12 PVC 1.5 mm slotted screen 8/16 graded Gravel
			14			14.00 m 50mm diameter Class 12 PVC sump PVC end cap
					Hole Terminated at 14.50 m Target depth	

DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring
TCR % core run recovered
RQD % core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

Piezometer Installation Details

NYBH01

Project: Otway Drilling
Client: Barwon Water
Location: North of Yeodene
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	738189.33	**Elevation:**	173.98	**Started:**	24/03/2021
Plant:	Boart Longyear	**Northing:**	5749301.96	**Datum:**	m AHD	**Finished:**	26/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata** — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
NYBH01	Standpipe	0.69 m	30.00 m

- CLAY: high plasticity, brown, cohesive, soft (Demons Bluff)
- CLAY: high plasticity, grey, cohesive, soft
- CLAY: high plasticity, mottled red, brown and grey, soft, cohesive
- CLAY: high plasticity, mottled brown and grey, soft, cohesive
- CLAY: high plasticity, mottled brown and grey, soft, cohesive, soft
- CLAY: medium plasticity, grey, hard (Narrawaturk Marl)
- CLAY: medium plasticity, off-green, hard
- Hole Terminated at 30.00 m
  Target depth

22.11 m bgl 14/07/2021

Depth (m): 5, 10, 15, 20, 25, 30

Monument cover
Grout with 5% bentonite
50mm diameter Class 12 PVC casing
Bentonite slow release pellets
26.50 m
50mm diameter Class12 PVC 1.5 mm slotted screen
8/16 graded Gravel
29.50 m
50mm diameter Class 12 PVC sump
PVC end cap

Jacobs Piezometer Installation Details

NYBH02

Project: Otway Drilling
Client: Barwon Water
Location: North of Yeodene
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	738188.46	**Elevation:**	174.03	**Started:**	24/03/2021
Plant:	Boart Longyear	**Northing:**	5749301.58	**Datum:**	m AHD	**Finished:**	26/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata**

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
NYBH02	Standpipe	0.70 m	6.50 m

Monument cover

4.89 m bgl 14/07/2021

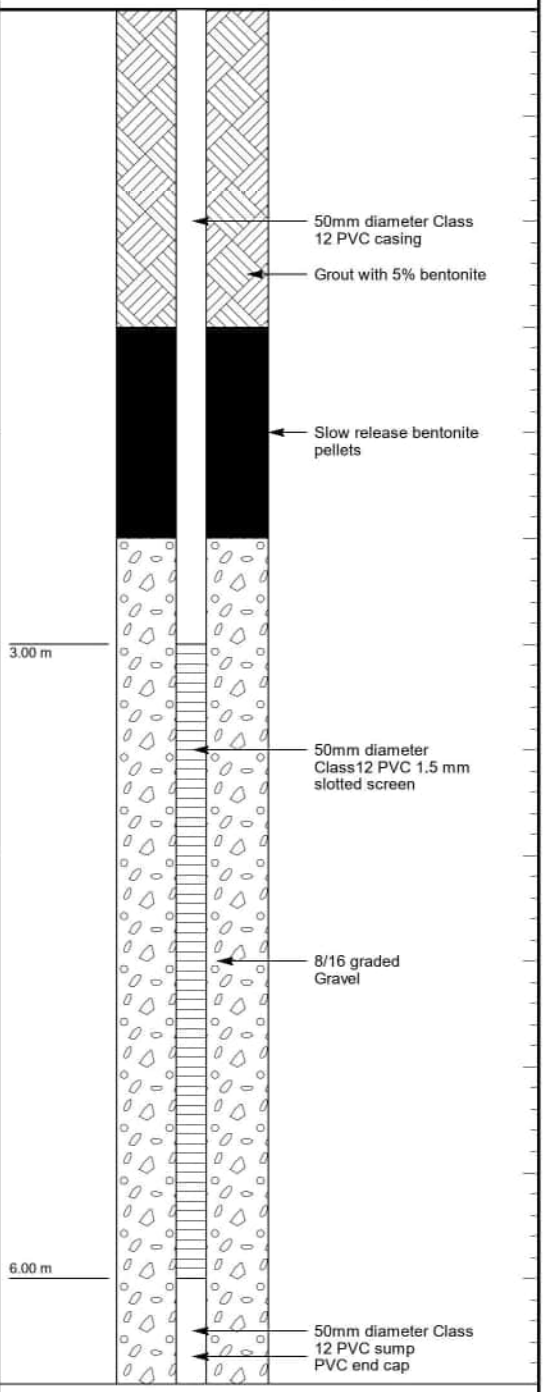
CLAY: high plasticity, brown, cohesive, soft
(Demons Bluff)

CLAY: high plasticity, grey, cohesive, soft

CLAY: high plasticity, mottled red, brown and grey, soft, cohesive

CLAY: high plasticity, mottled brown and grey, soft, cohesive

Hole Terminated at 6.50 m
Target depth



DRILLING

NMLC NMLC Coring
NQ NQ Coring
HQ HQ Coring
PQ PQ Coring
TCR % core run recovered
RQD % core run > 100mm long (rock fraction only measured)

GROUNDWATER SYMBOLS

▼ = Water level (static)
▽ = Water level (during drilling)

Jacobs Piezometer Installation Details

DMBH01V

Project: Otway Drilling
Client: Barwon Water
Location: Deans Marsh
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	743191.67	**Elevation:**	165.21	**Started:**	05/03/2021
Plant:	Boart Longyear	**Northing:**	5739706.89	**Datum:**	m AHD	**Finished:**	10/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | Description of Strata

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

2.85 m bgl 14/07/2021

CLAY: high plasticity, brown and grey, moist, soft, cohesive (Demons Bluff)

CLAY: high plasticity, mottled red, grey and brown, firm, moist

CLAY: high plasticity, red, firm, moist

CLAY: high plasticity, white mottling, firm, moist

CLAY: high plasticity, grey, moist, firm to stiff, cohesive

CLAY: high plasticity, grey, Increase in moisture, firm to stiff, cohesive

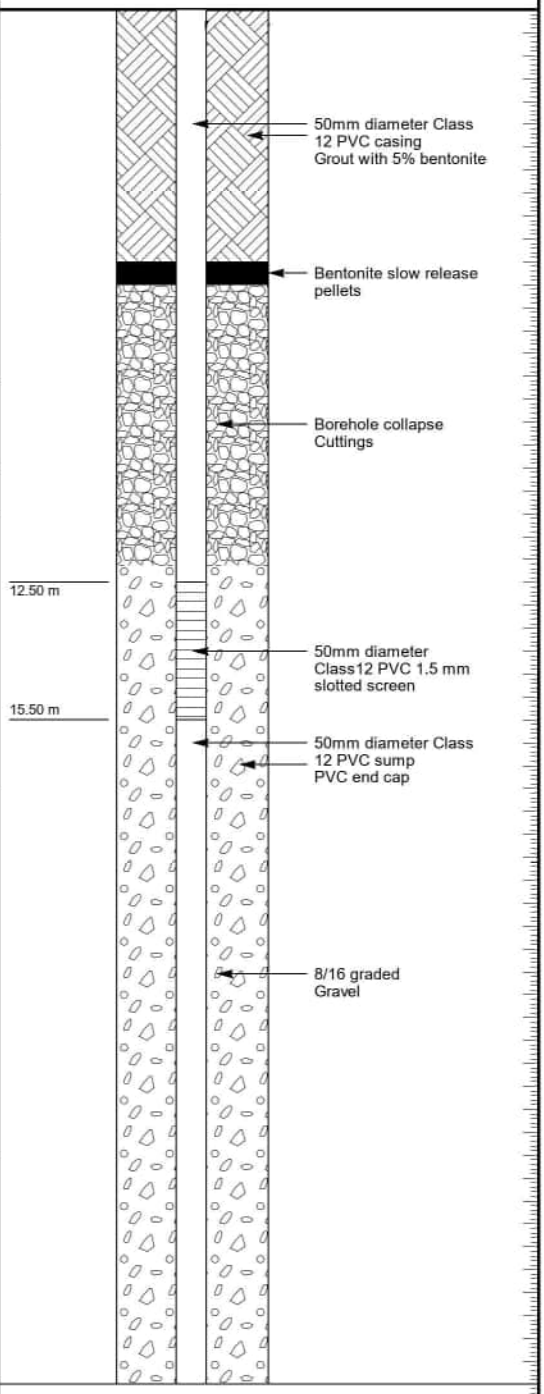
Silty CLAY: high plasticity, cream and pink mottling, soft and sticky, moist

Silty CLAY: grey with bright pink streaks

Silty CLAY: grey with increase in pink colour

Silty CLAY: white with pink colour

Hole Terminated at 30.00 m
Target depth



Jacobs — Piezometer Installation Details

DMBH02V

Project: Otway Drilling
Client: Barwon Water
Location: Deans Marsh
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	743193.25	**Elevation:**	165.28	**Started:**	05/03/2021
Plant:	Boart Longyear	**Northing:**	5739705.99	**Datum:**	m AHD	**Finished:**	10/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support | Water | RL (m) | Depth (m) | Graphic Log | Description of Strata

ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
DMBH02V	Standpipe	0.68 m	8.00 m

Monument cover

CLAY: high plasticity, brown and grey, moist, soft, cohesive
(Demons Bluff)

CLAY: high plasticity, mottled red, grey and brown, firm, moist

CLAY: high plasticity, mottled red, firm, moist

CLAY: high plasticity, white mottling, firm, moist

CLAY: high plasticity, grey, moist, firm to stiff, cohesive

Hole Terminated at 8.00 m
Target depth

Grout with 5% bentonite Grout

Bentonite slow release pellets

50mm diameter Class 12 PVC casing

5.00 m

8/16 graded Gravel

50mm diameter Class12 PVC 1.5 mm slotted screen

8.00 m

PVC end cap

▼ 7.14 m bgl 14/07/2021

Piezometer Installation Details

PCBH01V

Project: Otway Drilling
Client: Barwon Water
Location: Deans Marsh (Pennyroyal Creek)
Page: 1 of 1
Project No: IA250600

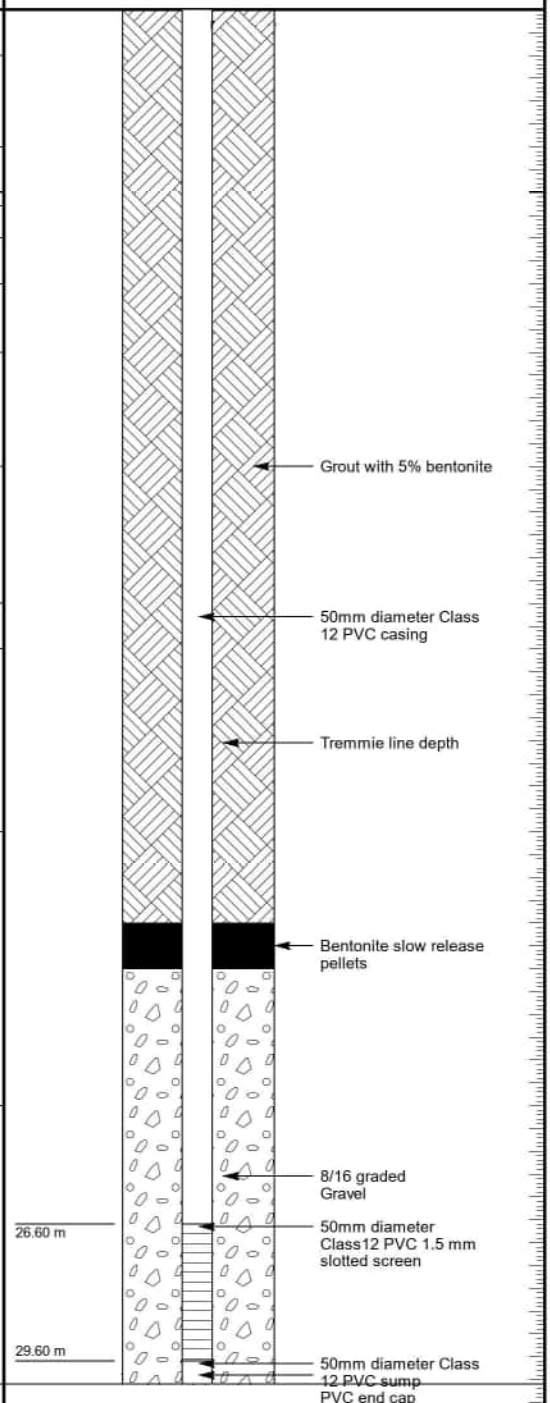
Contractor:	Drilltec Pty Ltd	**Easting:**	748893.39	**Elevation:**	161.48	**Started:**	10/03/2021
Plant:	Boart Longyear	**Northing:**	5743876.05	**Datum:**	m AHD	**Finished:**	18/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

Method & Support	Water	RL (m)	Depth (m)	Graphic Log	Description of Strata ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)
					Silty SAND: brown, fine grained, dry, loose (Alluvium)
					Sandy SILT: high plasticity, brown, soft, becoming moist, fine sand
					Sandy SILT: high plasticity, brown and grey mottling, soft, becoming moist, fine sand
					Silty SAND: cream, grey and red mottling, dry, loose, cohesive, fine sand
					Silty SAND: cream, grey and red mottling, fine, loose, moist to wet
			5		Sandy SILT: grey, high plasticity, grey, fine rounded sand
					SAND: fine, angular
					CLAY: high plasticity, brown, grey and grey mottling, soft (Demons Bluff/Narrawaturk Marl)
			10		CLAY: high plasticity, brown, grey, red mottling, soft
					CLAY with some sand: low plasticity, brown, soft, fine sand
					CLAY with trace sand: low plasticity, brown, soft, fine sand
			15		
					CLAY: high plasticity, brown, soft
			20		
					CLAY: high plasticity, grey, soft
			25		
			30		Hole Terminated at 30.10 m Target depth

-0.37 m bgl 14/07/2021

ID	Type	Stick Up	Tip Depth & RL
PCBH01V	Standpipe	0.61 m	30.10 m



Jacobs — Piezometer Installation Details

PCBH02V

Project: Otway Drilling
Client: Barwon Water
Location: Deans Marsh (Pennyroyal Creek)
Page: 1 of 1
Project No: IA250600

Contractor:	Drilltec Pty Ltd	**Easting:**	748893.36	**Elevation:**	161.48	**Started:**	10/03/2021
Plant:	Boart Longyear	**Northing:**	5743876.11	**Datum:**	m AHD	**Finished:**	18/03/2021
Logged by:	SS **Checked by:** NU	**Grid:**	MGA94 Zone 54	**Inclination:**	-90°	**Orientation:**	

DRILLING | MATERIAL SUBSTANCE | INSTALLATION DETAILS

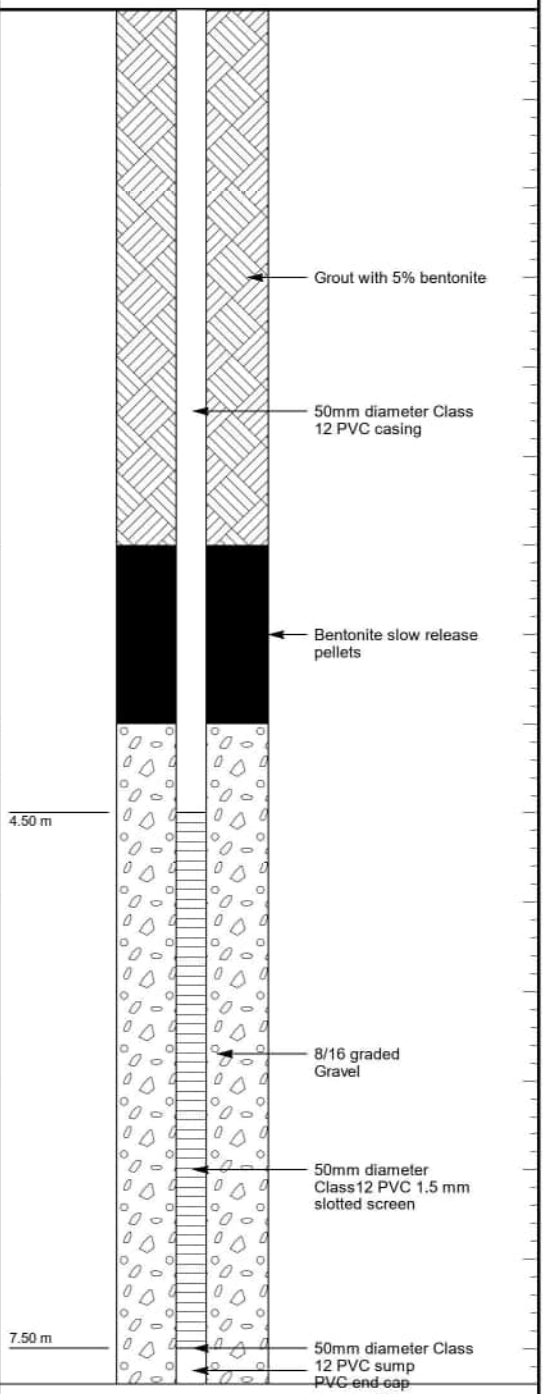
Method & Support | Water | RL (m) | Depth (m) | Graphic Log | **Description of Strata** — ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, major defect type)

ID	Type	Stick Up	Tip Depth & RL
PCBH02V	Standpipe	0.61 m	7.70 m

Monument cover

1.17 m bgl 14/07/2021

- Silty SAND: brown, fine grained, dry, loose (Quaternary Alluvium)
- Sandy SILT: high plasticity, brown, soft, becoming moist, fine sand
- Sandy SILT: high plasticity, brown and grey mottling, soft, becoming moist, fine sand
- Silty SAND: cream, grey and red mottling, dry, loose, cohesive, fine sand
- Silty SAND: cream, grey and red mottling, fine, loose, moist to wet
- Sandy SILT: grey, high plasticity, grey, fine rounded sand
- SAND: fine, angular
- CLAY: high plasticity, brown, grey and grey mottling, soft
- Hole Terminated at 7.70 m
  Target depth



Appendix B. Lithology photographs



BSBH13LTA located in Big Swamp



Fine sands (LTA) passing through the filter pack during development of BH-PB01



EBBH01 and EBBH02 0-22 m bgl



WBBH01 and WBBH02 borehole: 0 to 36 m bgl



BRBH01 and BRBH02: 0 to 30 m bgl



GRBH01 and GRBH02: 0 to 30 m bgl



TMCBH01 and TMCBH02: 0 to 30 m bgl





YCBH01 and YCBH02: 0 to 30 m bgl



BCBH01 and BCBH02: 0 to 27 m bgl



NYBH01 and NYBH02: 0 – 30 m bgl



DMBH01V and DMBH02V: 0 to 30 m bgl



PCBH01V and PCBH02V: 0 to 30 m bgl

Appendix C. Completed well photographs



BSBH13LTA



Logger hanging from eyelet



EBBH01 (right) and EBBH02 (left)



EBBH02



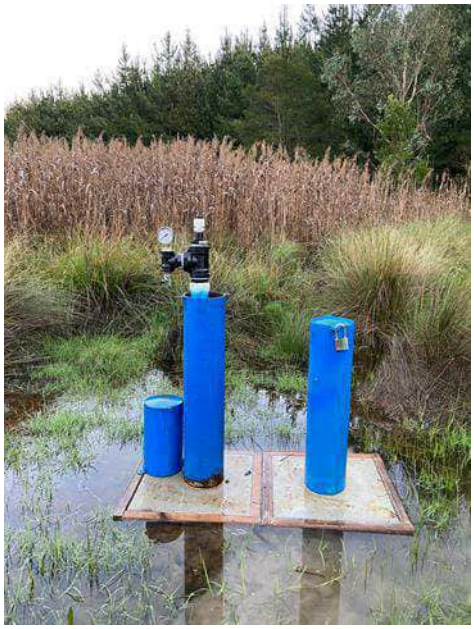
EBBH02 and pressure gauge



WBBH01 and WBBH02



BRBH01 artesian well fitting with logger, gauge and outlet





BRBH01 and BRBH02



GRBH01 and GRBH02 installed in the same borehole



TMCBH01 and TMCBH02



YCBH01 and YCBH02



BCBH01 and BCBH02

NYBH01 and NYBH02



DMBH01V and DMBH02V



PCBH01V and PCBH02V installed in the same borehole

Appendix D. Well construction licence

Works Licence ID:

WLE080801

Printed on: 19 Apr 2021 12:58:23 pm

COPY OF RECORD IN THE VICTORIAN WATER REGISTER

LICENCE TO CONSTRUCT WORKS

under Section 67 of the Water Act 1989

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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)

BARWON WATER of 44 LONSDALE STREET
SOUTH GEELONG VIC 3220

Licence Contact Details

BARWON WATER	44 LONSDALE STREET
	SOUTH GEELONG VIC 3220

Licence Details

Expiry date	19 Apr 2022
Status	Active
Authority	Southern Rural Water
Name of waterway or aquifer	NA for construct/decommission
Water system	Gellibrand (GMU)

Summary of Licensed Works

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

Works ID	*Works type*	*Use of water*
WRK126121	Bore	Observation
WRK126122	Bore	Observation
WRK126123	Bore	Observation
WRK126124	Bore	Observation
WRK126125	Bore	Observation
WRK126126	Bore	Observation
WRK126127	Bore	Observation

Description of Licensed Works

WORKS ID WRK126121

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
734231.457	5736133.794	Zone 54

Other land description

92 C9

Description of Licensed Works

WORKS ID WRK126122

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
726266.829	5740844.554	Zone 54

Land description

CA 58F Parish of Barongarook

Property address

MAGGIOS ROAD, BARONGAROOK, VIC 3249

Description of Licensed Works

WORKS ID WRK126123

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
726265.088	5740850.635	Zone 54

Land description
CA 58F Parish of Barongarook

Property address
MAGGIOS ROAD, BARONGAROOK, VIC 3249

Description of Licensed Works

WORKS ID WRK126124

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
733687.856	5749758.250	Zone 54

Other land description
92 C9

Description of Licensed Works

WORKS ID WRK126125

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
733690.597	5749752.126	Zone 54

Other land description
92 C9

Description of Licensed Works

WORKS ID WRK126126

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
738206.767	5749316.907	Zone 54

Land description

Volume 845 Folio 897
Lot 1 of Plan TP861478B

Property address

550 COLAC-LORNE ROAD, YEODENE, VIC 3249

Description of Licensed Works

WORKS ID WRK126127

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
738206.552	5749311.910	Zone 54

Land description

Volume 845 Folio 897
Lot 1 of Plan TP861478B

Property address

550 COLAC-LORNE ROAD, YEODENE, VIC 3249

Related Instruments

Related entitlements	Nil
Related water-use entities	Nil

Application History

Reference	*Type*	*Status*	*Lodged date*	*Approved date*	*Recorded date*
WLI614757	Issue	Approved	19 Apr 2021	19 Apr 2021	

Conditions

Licence WLE080801 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.

Drilling licence and supervision requirements

6 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.

7 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

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

Protecting water resources

9 No more than 7 bore(s) may be brought to final development under this licence.

10 At the completion of drilling and before the drilling rig leaves the site, all but 7 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.

11 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

12 Drilling must not exceed the maximum depth.

13 The bore(s) must be constructed so as to prevent aquifer contamination caused by vertical flow outside the casing.

14 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.

15 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

16 The diameter of the drill casing must not exceed 130 millimetres.

17 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

18 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

Works Licence ID:

WLE080300

Printed on: 12 Feb 2021 9:43:28 am

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LICENCE TO CONSTRUCT WORKS

under Section 67 of the Water Act 1989

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

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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)

BARWON WATER of 44 LONSDALE STREET
SOUTH GEELONG VIC 3220

Licence Contact Details

BARWON WATER	44 LONSDALE STREET
	SOUTH GEELONG VIC 3220

Licence Details

Expiry date	12 Feb 2022
Status	Active
Authority	Southern Rural Water
Name of waterway or aquifer	NA for construct/decommission
Water system	Gellibrand (GMU)

Summary of Licensed Works

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

Works ID	*Works type*	*Use of water*
WRK125000	Bore	Observation
WRK125001	Bore	Observation
WRK125002	Bore	Observation
WRK125003	Bore	Observation
WRK125004	Bore	Observation
WRK125005	Bore	Observation
WRK125006	Bore	Observation
WRK125007	Bore	Observation
WRK125008	Bore	Observation
WRK125009	Bore	Observation
WRK125010	Bore	Observation
WRK125011	Bore	Observation
WRK125012	Bore	Observation
WRK125013	Bore	Observation
WRK125014	Bore	Observation

Description of Licensed Works

WORKS ID WRK125000

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
734404.194	5736100.336	Zone 54

Other land description

92 D9

Description of Licensed Works

WORKS ID WRK125001

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
734394.245	5736101.765	Zone 54

Other land description

92 D9

Description of Licensed Works

WORKS ID WRK125002

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
735417.588	5743883.830	Zone 54

Land description

Volume 4177 Folio 273
CA 115A Parish of Yeo

Property address

25 POSSUM RIDGE ROAD, YEODENE, VIC 3249

Description of Licensed Works

WORKS ID WRK125003

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
739377.852	5744374.296	Zone 54

Land description

Volume 7844 Folio 121
Lot 2 of Plan TP381003C

Property address

340 BIRREGURRA-YEODENE ROAD, BIRREGURRA, VIC 3242

Description of Licensed Works

WORKS ID WRK125004

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
739360.436	5744365.034	Zone 54

Land description
Volume 7844 Folio 121
Lot 2 of Plan TP381003C

Property address
340 BIRREGURRA-YEODENE ROAD, BIRREGURRA, VIC 3242

Description of Licensed Works

WORKS ID WRK125005

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
723421.754	5732405.628	Zone 54

Land description
Section A

Property address
16 RAFFERTYS ROAD, GELLIBRAND, VIC 3239

Description of Licensed Works

WORKS ID WRK125006

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
723421.152	5732391.641	Zone 54

Land description
Section A

Property address
16 RAFFERTYS ROAD, GELLIBRAND, VIC 3239

Description of Licensed Works

WORKS ID WRK125007

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
723357.064	5739541.166	Zone 54

Land description

Volume 11185 Folio 908
Lot 1 of Plan TP224587B

Property address

25 HOVEYS ROAD, BARONGAROOK WEST, VIC 3249

Description of Licensed Works

WORKS ID WRK125008

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
723274.602	5739485.651	Zone 54

Land description

Volume 11185 Folio 908
Lot 1 of Plan TP224587B

Property address

25 HOVEYS ROAD, BARONGAROOK WEST, VIC 3249

Description of Licensed Works

WORKS ID WRK125009

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
743253.789	5739690.708	Zone 54

Other land description

92 D9

Description of Licensed Works

WORKS ID WRK125010

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
743231.720	5739689.655	Zone 54

Other land description
92 D9

Description of Licensed Works

WORKS ID WRK125011

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
748887.546	5743890.181	Zone 54

Other land description
92 D9

Description of Licensed Works

WORKS ID WRK125012

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
748895.111	5743879.844	Zone 54

Other land description
92 D9

Description of Licensed Works

WORKS ID WRK125013

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
725712.212	5733832.582	Zone 54

Land description

Volume 6741 Folio 056
CA 19C Section A Parish of Yaugher

Property address

370 FRYS ROAD, KAWARREN, VIC 3249

Description of Licensed Works

WORKS ID WRK125014

Works type	Bore
Works subtype	Drilled bore
Proposed maximum depth	60.000 metres

Works location

Easting	*Northing*	*Zone MGA*
725711.889	5733871.633	Zone 54

Land description

Volume 6741 Folio 056
CA 19C Section A Parish of Yaugher

Property address

370 FRYS ROAD, KAWARREN, VIC 3249

Related Instruments

Related entitlements Nil

Related water-use entities Nil

Application History

Reference	*Type*	*Status*	*Lodged date*	*Approved date*	*Recorded date*
WLI614352	Issue	Approved	12 Feb 2021	12 Feb 2021	

Conditions

Licence WLE080300 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.

Drilling licence and supervision requirements

6 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.

7 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

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

Protecting water resources

9 No more than 15 bore(s) may be brought to final development under this licence.

10 At the completion of drilling and before the drilling rig leaves the site, all but 15 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.

11 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

12 Drilling must not exceed the maximum depth.

13 The bore(s) must be constructed so as to prevent aquifer contamination caused by vertical flow outside the casing.

14 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.

15 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

16 The diameter of the drill casing must not exceed 130 millimetres.

17 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

18 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

Appendix E. Well completion reports

BSBH13LTA

38110

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080306

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 735417 N 5743883

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: 25 Possum Ridge rd Teodene 3249

Date Commenced: 9/4/21 Date Completed: 10/4/21 Total Depth: 30 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	30	155	26.5	29.5	AL	0	0.4		30	27		

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL Type						CASING			SCREENS / SLOTS						OFFICE USE
CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	0	26.5	75	85	PN12 PVC							
☐	☐	☑	☐	26.5	29.5	75	85		75	85	PN12 PVC	0.5			
☑	☐	☐	☐	29.5	30	75	85								
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☑	☐	☐	☐	☐	0	22.5	16	300				
☐	☑	☐	☐	☐	22.5	24.5			Bentonite Chips			
☐	☐	☐	☐	☑	24.5	30					Pour from top.	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)
	0.4		60		0	

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From 0 (m)
Have water samples been taken? Yes ☑ No ☐ To 30 (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay.	0	16
Sand, becoming more coarse with depth.	16	30

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: Bryce Macgibbon

EBBH01

38135

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE08292O

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 739257 N 5736326

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER WRK131480
BORE USES
GMA ..... ZONE .....

Bore Owner BARWON WATER

Site Address 55-67 RYRIE ST GEELONG

Date Commenced 31/5/2022 Date Completed 7/6/2022 Total Depth 22 (m)

Was Bore Decommissioned? Y / N N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
RM	0	22	150										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☒	☐	☐	☐	0	18	50	56	PVC							
☐	☒	☐	☐	18	21				50	55	PVC	.08	F		
☒	☐	☐	☐	21	22	50	56	PVC	(SUMP)						
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS | Casing Shoe Y / N ☐ | Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☐	☐	☐	☐	☒	22	16					POURED	8/16
☐	☒	☐	☐	☐	16	14						
☒	☐	☐	☐	☐	14	0	8	155				
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)
AL	1.5		120		Flowing	

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)
A.L	0	1	20				

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☒ No ☐ If Yes From 0 (m)
Have water samples been taken? Yes ☒ No ☐ To 22 (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☐

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☒
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

Driller's Name Craig Buhagiar Driller's Licence No.
Driller's Signature Date 17/6/22
Name of Plant Operator 1075

9. DRILLER'S LOG

Material	From (m)	To (m)
soil	0	1
clay	1	10
sandy clay	10	16
fine Sand	16	19
fine to Coarse Sand	19	21
clay	21	22

EBBH02

38136

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE082920

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 739257 N 5736326

Drilled Bore ☒ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

Bore Owner: BARWON WATER

Site Address: 55-67 RYRIE ST GEELONG

Date Commenced: 2/6/22 Date Completed: 6/6/22 Total Depth: 10 (m)

OFFICE USE ONLY	
BORE NUMBER	WRK131481
BORE USES	
GMA	ZONE

Was Bore Decommissioned? Y / N: N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
RM	0	10											

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☒	0	7	50	56	PVC							
SC ☒	7	10				50	55	PVC	.08			

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
G ☒	10	6						
B ☒	6	5						
C ☒	5	0	3	50				

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)
AL	–	–	–	–	–	–

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☒ No ☐ If Yes From 0 (m)
Have water samples been taken? Yes ☐ No ☒ To 10 (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☐

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☒
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

9. DRILLER'S LOG

Material	From (m)	To (m)
Soil	0	1
Clays with some sand	1	10

Driller's Name: Craig Buhagiar Driller's Licence No.
Driller's Signature: [signature] Date 17/6/22
Name of Plant Operator: 1075

WBBH01

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

38121

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 733862 N 5749872

ZONE: 54 / 55 delete as applicable
GDA 94/ADG66 delete as applicable

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

Bore Owner: Barwon Water

Site Address: 92 C9

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE

Date Commenced: 10/4/21 Date Completed: 11/4/21 Total Depth: 23.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	23.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	20	50	60	PN12 PVC							
SL ☑	20	23			PN12 PVC	50	60	PN12 PVC	0.5			
CA ☑	23	23.5	50	60								

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	18	17	350				
B ☑	18	19			bentonite chips			
G ☑	19	23.5					pour from top	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)
Have water samples been taken? Yes ☑ No ☐ To ....(m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay	0	12
& silty clay	12	23.5

Driller's Name: Craig Gordon Driller's Licence No. 847
Driller's Signature: [signature] Date: 1/5/21
Name of Plant Operator: Bryce Macgibbon

WBBH02

38122

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989
BORE COMPLETION REPORT

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 733862 N 5749872

Drilled Bore ☐ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner Barwon Water

Site Address 92 C9

Date Commenced 10/4/21 Date Completed 11/4/21 Total Depth 14.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE Method	From (m)	To (m)	Bit diam (mm)	WATER INTERSECTIONS From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	OFFICE USE Lithology
R.M	0	14.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

Type (CA/SC/SL/OH)	From (m)	To (m)	CASING Inner diam (mm)	Outer diam (mm)	Material	SCREENS / SLOTS Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	OFFICE USE Lithology
CA ☑	+1	11	50	60	Pn12 PVC							
SL ☑	11	14				50	60	Pn12 PVC	0.5			
CA ☑	14	14.5	50	60	Pn12 PVC							

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material (C/B/S/P/G)	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	9	8	180				
B ☑	9	10			bentonite chips			
G ☑	10	14.5					pour from top	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)
Have water samples been taken? Yes ☑ No ☐ To .... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay	0	12
tight silty clay.	12	14.5

Driller's Name Craig Gordon Driller's Licence No. 847

Driller's Signature [signature] Date 1/5/21

Name of Plant Operator Bryce Maegibbon

BRBH01

38113

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 739544 N 5744531

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

Bore Owner: Barwon Water

Site Address: 340 Birregurra-Yeodene rd, Birregurra 3242

Date Commenced: 7/4/21 Date Completed: 8/4/21 Total Depth: 30 (m)

OFFICE USE ONLY
BORE NUMBER: W R K
BORE USES:
GMA .... ZONE ....

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
RM	0	30	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	+1	26.5	50	60	Cl12 PVC							
☐	☐	☑	☐	26.5	29.5				50	60	Cl12 PVC	0.5			
☑	☐	☐	☐	29.5	30	50	60	Cl12 PVC							
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS: Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☒	☐	☐	☐	☐	0	24.5	12	300				
☐	☒	☐	☐	☐	24.5	25.5			bentonite chips			
☐	☐	☐	☐	☒	25.5	30					pour from top.	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)
					+7m	

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)
Have water samples been taken? Yes ☑ No ☐ To .... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay.	0	30

Driller's Name: Craig Gordon Driller's Licence No. 847
Driller's Signature: [signature] Date: 1/5/21
Name of Plant Operator: Bryce Macgibbon

BRBH02

38114

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 739544 N 5744531

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: 340 Birregurra - Yeodene rd, Birregurra 3242

Date Commenced: 8 / 4 / 21 Date Completed: 8 / 4 / 21 Total Depth: 5.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
RM	0	5.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	+1	2	50	60	Pn12 PVC							
☐	☐	☑	☐	2	5				50	60	Pn12 PVC	0.5			
☑	☐	☐	☐	5	5.5	50	60	Pn12 PVC							
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☑	☐	☐	☐	☐	0	0.5	1	10				
☐	☑	☐	☐	☐	0.5	1.5			bentonite chips			
☐	☐	☐	☐	☑	1.5	5.5					pour from top	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)

Have water samples been taken? Yes ☑ No ☐ To .... (m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay.	0	5.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1 / 5 / 21

Name of Plant Operator: Bryce Macgibbon

GRBH01

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. 38115 WLE080300

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 723432 N 5732310

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER WRK
BORE USES
GMA ZONE

Bore Owner Barwon Water

Site Address 16 Rafferty's rd Gellibrand 3239

Date Commenced 18/4/21 Date Completed 23/4/21 Total Depth 30 (m)

Was Bore Decommissioned? Y / N N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	30	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	+1	10	50	60	PN12 PVC							
☐	☐	☑	☐	10	13				50	60	PN12 PVC	0.5			
☑	☐	☐	☐	13	13.5	50	60	PN12 PVC							
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☑	☐	☐	☐	☐	0	0.5	1	10				
☐	☑	☐	☐	☐	5.5	9.5			bentonite chips			
☐	☐	☑	☐	☑	9.5	13.5					pour from top	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From (m)
Have water samples been taken? Yes ☑ No ☐ To (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☐
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

Driller's Name Aaron Reed Driller's Licence No. 796
Driller's Signature Date 2/5/21
Name of Plant Operator THOMAS KURT PINKERTON

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay	0	10
Sand	10	15
clay and marl	15	30

GRBH02

38116

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 723432 N 5732310

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER WRK
BORE USES
GMA ..... ZONE .....

Bore Owner Barwon Water

Site Address 16 Rafferty's rd Gellibrand 3239

Date Commenced 18/4/21 Date Completed 23/4/21 Total Depth 5.5 (m)

Was Bore Decommissioned? Y / N N If Yes, State Method .....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☒	☐	☐	☐	+1	2	50	60								
☐	☐	☑	☐	2	5				50	60	PVC	0.5			
☑	☐	☐	☐	5	5.5	50	60								
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☒	☐	☐	☐	☐	0	0.5	1	10				
☐	☒	☐	☐	☐	0.5	1			bentonite chips			
☐	☐	☐	☐	☒	1	5					pour from top	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ..... (m)
Have water samples been taken? Yes ☑ No ☐ To ..... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☐
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: .....

Driller's Name Aaron Feast Driller's Licence No. 796

Driller's Signature ..... Date 2/5/21

Name of Plant Operator THOMAS KURT PINKERTON

9. DRILLER'S LOG

Material	From (m)	To (m)
WRK 125005		
WRK 125006		
both installed		
in one bore		
hole.		

TMCBH01

38117

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 726345 N 5740786

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: CA Maggio's rd Barongarook 3249

Date Commenced: 29/3/21 Date Completed: 31/3/21 Total Depth: 30.2 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	30.2	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	26.7	50	60	Pn12 PVC							
SL ☑	26.7	29.7	50	60		50	60	Pn12PVC	0.5			
CA ☑	29.7	30.2	50	60								

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	25	16	450				
B ☑	25	26			bentonite chips			
G ☑	26	30.2					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)
Have water samples been taken? Yes ☑ No ☐ To .... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

Driller's Name: Craig Gordon Driller's Licence No. 847
Driller's Signature: [signature] Date: 1/5/21
Name of Plant Operator: Bryce Macgibbon

9. DRILLER'S LOG

Material	From (m)	To (m)
Fill	0	1
Sandy clay	1	21
Fine sand + clay	21	30.2

TMCBH02

38118

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 726345 N 5740786

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE ....

Bore Owner: Barwon Water

Site Address: Maggio's rd Barongarook 3249

Date Commenced: 29/3/21 Date Completed: 31/3/21 Total Depth: 10.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	10.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
~~CA ☑~~	~~+1~~	~~10.5~~										
CA ☑	+1	7	50	60	PN12 PVC							
SL ☑	7	10				50	60	PN12 PVC	0.5			
CA ☑	10	10.5	50	60								

WELL HEAD FITTINGS: Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	5	4	80				
B ☑	5	6			bentonite chips			
G ☑	6	10.5					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)

Have water samples been taken? Yes ☑ No ☐ To ....(m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
fill	0	1
sandy clay.	1	10.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: Bryce Macgibbon

YCBH01

38119

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 724068 N 5739871

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: 25 Hovey's rd Barongarook 3249

Date Commenced: 26/3/21 Date Completed: 28/3/21 Total Depth: 30 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	30	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL Type	From (m)	To (m)	CASING Inner diam (mm)	Outer diam (mm)	Material	SCREENS / SLOTS Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	OFFICE USE Lithology
CA ☑	+1	26.5	50	60	Pn12 PVC							
SL ☑	26.5	29.5				50	60	Pn12 PVC	0.5			
CA ☑	29.5	30	50	60								

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material (C B S P G)	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	24.3	16	450				
B ☑	24.3	25.9			bentonite chips			
G ☑	25.9	30					pour from top	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)
Have water samples been taken? Yes ☑ No ☐ To ....(m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy top soil	0	5
Sandy clay	5	11
Sand.	11	30

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: Bryce Macgibbon

YCBH02

38120

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 724068 N 5739871

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE ....

Bore Owner: Barwon Water

Site Address: 25 Hovey's rd Barongarook 3249

Date Commenced: 26/3/21 Date Completed: 28/3/21 Total Depth: 15.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	15.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	11.5	50	60	PN12 PVC							
SL ☑	11.5	14.5				50	60	PN12 PVC	0.5			
CA ☑	14.5	15	50	60								

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	9.5	6	150				
B ☑	9.5	11.5			bentonite chips			
G ☑	11.5	15.5					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)
Have water samples been taken? Yes ☑ No ☐ To ....(m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy top soil	0	5
Sandy clay	5	11
Sand.	11	15.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: Bryce Macgibbon

BCBH01

38111

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 734400 N 5736096

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER WRK
BORE USES
GMA ..... ZONE .....

Bore Owner Barwon Water

Site Address Boundry rd 92 D9

Date Commenced 13/4/21 Date Completed 13/4/21 Total Depth 36 (m)

Was Bore Decommissioned? Y / N N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	36	155	15	18	AL	+0.1	0.4		18.5	18		

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	+1	15	50	60	P.12 PVC							
☐	☐	☑	☐	15	18				50	60	P.12 PVC	0.5			
☑	☐	☐	☐	18	18.5	50	60	PVC							
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☒	☐	☐	☐	☐	0	13	8	200				
☐	☒	☐	☐	☐	13	14			Bentonite Chips			
☐	☐	☐	☐	☒	14	36					pour from top	8/16
☐	☒	☐	☐	☐	20	21			Bentonite Chips			

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)
	0.5		60		+0.1	

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From 0 (m)
Have water samples been taken? Yes ☑ No ☐ To 36 (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

Driller's Name Craig Gordon Driller's Licence No. 847

Driller's Signature [signature] Date 1/5/21

Name of Plant Operator Bryce Macgibbon

9. DRILLER'S LOG

Material	From (m)	To (m)
Sady clay	0	15
coarse sand	15	19
clay.	19	36
20 – 36m		
back filled		
with cuttings		
and sand		

BCBH02

38112

Southern Rural Water
Managing Water, Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY – To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1 ☑ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 734231 N 5736096

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

Bore Owner: Barwon Water

Site Address: Boundry rd 92 D9

Date Commenced: 14/4/21 Date Completed: 14/4/21 Total Depth: 5.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	5.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL						CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☒	☐	☐	☐	+1	2	50	60	Pn12 PVC							
☐	☐	☑	☐	2	5	50	60		50	60	Pn12 PVC	0.5			
☑	☐	☐	☐	5	5.5	50	60	Pn12 PVC							
☐	☐	☐	☐												
☐	☐	☐	☐												

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☑	☐	☐	☐	☐	0	0.5	1	10				
☐	☑	☐	☐	☐	0.5	1.5			bentonite chips			
☐	☐	☐	☐	☑	1.5	5.5					Pour from top.	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)

Have water samples been taken? Yes ☑ No ☐ To .... (m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify:

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay.	0	5.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: [signature] Bryce Macgibbon

NYBH01

38123

WATER ACT 1989
BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 738263 N 5749320

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE

Bore Owner: Barwon Water

Site Address: 550 Colac-Lorne rd Yeodene 3249

Date Commenced: 24/3/21 Date Completed: 26/3/21 Total Depth: 30 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	30	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	26.5	50	60	Pn12 PVC							
SL ☑	26.5	29.5				50	60	Pn12 PVC	0.5			
CA ☑	29.5	30	50	60	Pn12 PVC							

WELL HEAD FITTINGS: Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	24.5	18	400				
B ☑	24.5	25.5			bentonite chips			
G ☑	25.5	30					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)

Have water samples been taken? Yes ☑ No ☐ To .... (m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☐

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify:

9. DRILLER'S LOG

Material	From (m)	To (m)
Silty clay	0	30

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date 1/5/21

Name of Plant Operator: Bryce Macgibbon

NYBH02

38124

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080801

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 738263 N 5749320

Drilled Bore ☐ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY	
BORE NUMBER	W R K
BORE USES	
GMA	ZONE ....

Bore Owner: Barwon Water

Site Address: 550 Colac-Lorne rd Yeodene 3249

Date Commenced: 24/3/21 Date Completed: 26/3/21 Total Depth: 6.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.M	0	6.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	3	50	60	Pn12 PVC							
SL ☑	3	6				50	60	Pn12 PVC	0.5			
CA ☑	6	6.5	50	60	Pn12 PVC							

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	2.5	4	35				
B ☑	2.5	3			bentonite chips			
G ☑	3	6.5					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)

Have water samples been taken? Yes ☑ No ☐ To ....(m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Silty clay.	0	6.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1/5/21

Name of Plant Operator: Bryce Macgibbon

DMBH01V

38125

Southern Rural Water
Managing Water. Serving Communities.

WATER ACT 1989

BORE COMPLETION REPORT

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 743206 N 5739707

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: 92 D9

Date Commenced: 5 / 3 / 21 Date Completed: 10 / 3 / 21 Total Depth: 16.5 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method ....

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R.A	0	16.5	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL			CASING			SCREENS / SLOTS						OFFICE USE
Type CA SC SL OH	From (m)	To (m)	Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
CA ☑	+1	12.5	50	60	PN12 PVC							
SL ☑	12.5	15.5				50	60	PN12 PVC				
CA ☑	15.5	16.5	50	60	PN12 PVC							

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C B S P G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	5.5	6	130				
B ☑	5.5	6.0			bentonite chips			
G ☑	6	30					pour from top.	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ....(m)

Have water samples been taken? Yes ☑ No ☐ To ....(m)

Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑

If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐

Other, please specify: ....

9. DRILLER'S LOG

Material	From (m)	To (m)
Silty sand	0	8
Sandy clay.	8	16.5

Driller's Name: Craig Gordon Driller's Licence No. 847

Driller's Signature: [signature] Date: 1 / 5 / 21

Name of Plant Operator: Bryce Macgibbon

DMBH02V

38126

WATER ACT 1989

BORE COMPLETION REPORT

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

BORE CONSTRUCTION LICENCE No. WLE080300

Report on site 1☐ 2☐ 3☐ 4☐ 5☐

GPS CO-ORDS: E 743206 N 5739707

Drilled Bore ☑ Spearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER W R K
BORE USES
GMA .... ZONE ....

Bore Owner: Barwon Water

Site Address: 92, D9 Creamery rd

Date Commenced: 5/3/21 Date Completed: 10/3/21 Total Depth: 8 (m)

Was Bore Decommissioned? Y / N: N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE Method	From (m)	To (m)	Bit diam (mm)	WATER INTERSECTIONS (while drilling, measurements taken from natural surface) From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	OFFICE USE Lithology
R.A	0	8	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL Type	From (m)	To (m)	CASING Inner diam (mm)	Outer diam (mm)	Material	SCREENS / SLOTS Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	OFFICE USE Lithology
CA ☑	+1	5	50	60	Pn12PVC							
SL ☑	5	8				50	60	Pn12PVC	0.5			

WELL HEAD FITTINGS Casing Shoe Y / N ☐ Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
C ☑	0	1.8	3	40				
B ☑	1.8	3.3			bentonite chips			
G ☑	3.3	8					pour from top	8/16

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From .... (m)
Have water samples been taken? Yes ☑ No ☐ To .... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify:

9. DRILLER'S LOG

Material	From (m)	To (m)
Silty Sand	0	8

Driller's Name: Aaron Frood Driller's Licence No. 796

Driller's Signature: [signature] Date: 2/5/21

Name of Plant Operator: Thomas Pinkerton

PCBH01V and PCBH02V

WATER ACT 1989

BORE COMPLETION REPORT

38127

BORE CONSTRUCTION LICENCE No. WLE080300

Southern Rural Water
Managing Water. Serving Communities.

SRW COPY –
To be sent to Southern Rural Water within 28 days of completion of bore.

Report on site 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

GPS CO-ORDS: E 748379 N 5743893

Drilled Bore ☑ Sprearpoint ☐ Well or Shaft ☐ Dragline ☐

ZONE: 54 / 55 (delete as applicable) GDA 94/ADG66 (delete as applicable)

OFFICE USE ONLY
BORE NUMBER WRK
BORE USES
GMA ..... ZONE .....

Bore Owner Barwon Water

Site Address 92 D9

Date Commenced 10/3/21 Date Completed 18/3/21 Total Depth 30.1 (m)

Was Bore Decommissioned? Y / N N If Yes, State Method

1. DRILLING AND WATER INTERSECTION DETAILS

DRILLING TECHNIQUE				WATER INTERSECTIONS (while drilling, measurements taken from natural surface)									OFFICE USE
Method	From (m)	To (m)	Bit diam (mm)	From (m)	To (m)	Test Method	Static Level (m)	Est. yield l/sec	Draw down (m)	Casing at test (m)	Depth at test (m)	Ec at 25 C (µS/cm)	Lithology
R-M	0	30.1	155										

2. CASINGS (CA) SCREENS (SC) SLOTS (SL) OPEN HOLE (OH)

GENERAL							CASING			SCREENS / SLOTS						OFFICE USE
Type CA	SC	SL	OH	From (m)	To (m)		Inner diam (mm)	Outer diam (mm)	Material	Inner diam (mm)	Outer diam (mm)	Material	Aperture (mm)	Filter Y / N	Trade Name	Lithology
☑	☐	☐	☐	+1	26.6		50	60	PN12 PVC							
☐	☐	☑	☐	26.6	29.6					50	60	PN12 PVC	0.5			
☑	☐	☐	☐	29.6	30.1		50	60	PN12 PVC							
☐	☐	☐	☐													
☐	☐	☐	☐													

WELL HEAD FITTINGS — Casing Shoe Y / N ☐ — Bullnose / Endcap Y / N ☐

3. CEMENT (C) BENTONITE (B) SEALS (S) PACKERS (P) GRAVEL (G)

Material C	B	S	P	G	From (m)	To (m)	Cement (bags)	Water (litres)	Seal / Packer type	Outer diam of seal (mm)	Artificial Gravel Packing Method of placement	Gravel size mesh passing (mm)
☑	☐	☐	☐	☐	10	20	8	160				
☐	☑	☐	☐	☐	20	21			bentonite chips			
☐	☐	☐	☐	☑	21	30.1					pour from top	8/16
☐	☐	☐	☐	☐								

4. FINAL BORE DEVELOPMENT

Method	Yield l/sec	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Final Static Level	Ec at 25 C (µS/cm)

5. DRILLER'S PUMPING TEST

Method	Static Level (m)	Yield l/sec	Pumping Level (m)	Draw down (m)	Pumping Time (min)	Recovery Time (min)	Ec at 25 C (µS/cm)

6. IF NOT A DRILLED BORE

Type	Length (m)	Width (m)	Diam (m)	Lining Material	From (m)	To (m)

7. SAMPLES

Have material samples been taken? Yes ☑ No ☐ If Yes From ..... (m)
Have water samples been taken? Yes ☑ No ☐ To ..... (m)
Samples taken by: Bore Owner ☐ Driller ☐ Project Geologist ☑

8. DISINFECTION

Was the Bore Disinfected? Yes ☐ No ☑
If yes, state method of disinfection: Chlorine Washed ☐ Steam Cleaned ☐
Other, please specify: .....

Driller's Name Aaron Frood Driller's Licence No. 796

Driller's Signature ..... Date 2/5/21

Name of Plant Operator Thomas Pinkerton

9. DRILLER'S LOG

Material	From (m)	To (m)
Sandy clay.	0	30.1
WRK 125011		
WRK 125012		
both installed in		
one bore hole.		

Appendix F. Well Development records

Table 6-1 Well development record

Bore		Date	Time	Volume (L)	EC µS/cm	pH	Redox (mV)	DO (mg/L)	Temp (c)	Comment
BSBH13LTA	BH01	10/04/2021	7:00 – 17:00	BH01-PB pumping well had no recharge during initial development, airlifting and jetting of water into the well occurred for 8 hr, total of 5000 L of water was injected into the well. Towards the end of the day flow was measured to be approximately 02 to 0.4 L/s. The well was further developed on the 11/04/2021 where water quality measurements were collected. Water level was measured to be 0.26 m bgl, similar to that of the shallow wells screened in the quaternary alluvium from 3 to 6 m in Big Swamp.						
		11/04/2021	13:40	200	352	7.26	34.7	9.92	15.2	Flow during airlifting measured between 0.2 and 0.4 L/s
			13:50	400	372	6.82	19	9.7	13.4	
			14:00	600	352	6.65	26	9.46	13.8	
			14:10	800	351	6.58	32	9.04	14.4	
			14:20	100	352	6.45	28	10	14	
			14:30		350	6.37	32	9.9	13.9	
			13:40	1200	345	6.33	27	13.9	9.74	
EBBH01	BH02	06/06/2022	16:29	Estimated 05.-1.0 L/s, however no T bar was used	644	8.08	209.6	5.58	13.4	Development was undertaken without a T bar so volumes flow rate estimate was very rough, development continued following day with T bar available for a more accurate measurement
			16:38		596.2	8.10	204.7	5.53	12.9	
			16:54		174.8	8.09	163.5	8.76	13.3	
			16:59		166.0	7.94	135.0	8.99	13.3	
			17:05		160.5	7.72	110.2	9.08	13.4	
			17:09		158.1	7.59	82.8	8.11	13.5	
			17:16		157.2	7.40	90.2	9.17	13.1	
		07/06/2022	9:43	10	164.3	8.19	100.5	9.56	12.4	Flow rate measured at 0.2 L/s with a T bar. Lightly turbid yellow water
			9:52	118	158.2	7.53	53.1	9.52	12.5	
			9:59	202	156.4	7.34	65.1	9.41	12.4	
			10:06	286	154.6	7.20	72.0	9.46	12.6	
			10:12	358	153.6	7.22	54.9	9.28	12.8	

Bore		Date	Time	Volume (L)	EC µS/cm	pH	Redox (mV)	DO (mg/L)	Temp (c)	Comment
			10:18	430	153.0	7.16	40.9	8.97	12.8	
EBBH02	BH03	06/06/2022	11:18	4	793	7.94	48.6	9.11	12.3	Very slow recharge, came out as mud, added 60L of water after 11:58 and surged to compact gravel. No readings were taken after 11:58
			11:28	8	786	7.76	37.6	9.66	11.1	
			11:40	12	765	7.65	55.0	9.19	12.1	
			11:58	16	762	7.64	21.4	9.06	12.5	
WBBH01	BH04	15/04/2021	8:00	10	874	8.07	76	10.1	15	SWL at surface at the start of development, good recharge
			8:10	20	856	7.94	72	10.8	12.9	
			8:15	40	833	7.94	75	9.9	14	
			8:20	60	833	7.86	75	9.1	14	
			8:30	80	840	7.91	74	9.8	14	
			8:40	100	840	8.48	74	7.8	14	
WBBH02	BH05	15/04/2021	SWL at 0.6 (mud only), all mud removed from bore and gravel pack. Very low recharge, well dry when left at 9:50 am. No field readings collected.							
BRBH01	BH06	15/04/2021	Bore overflowing before development started (artesian), however very slowly (low K). All mud removed before development started due to being artesian							
			8:20	20	3200	6.83	276	5.37		
			8:35	30	2121	8.83	246	12.8		
			8:45	35	2497	8.8	222	12		
			9:30	45	2312	8.83	243	11.6		
BRBH02	BH07	8/04/2021	Water level 2.1 m bgl at start of development, bore dry at end. No recharge, total of 6 L of water injected and airlifted. All drilling mud removed. No water quality parameters collected as it was either mud or injected water, no recharge at time of development.							
GRBH01	BH08	23/03/2021	10:10	10	1455	8.42	104	7.4	17.9	Slow recharge, clear water. all drilling muds removed
			10:20	20	865	8.5	83	9.5	16.4	
			10:25	30	540	7.93	57	9.6	16	
			10:30	35	412	7.71	30	9.5	15.9	
			10:40	40	259	7.69	29	9.4	16	
			10:45	50	319	7.61	29	8.9	16	
			10:55	55	300	7.53	12	9	16	
			11:00	65	321	7.42	23	9	16	
			11:05	70	330	7.45	31	9	16	
GRBH02	BH09	23/03/2021	11:15	5						

Bore		Date	Time	Volume (L)	EC µS/cm	pH	Redox (mV)	DO (mg/L)	Temp (c)	Comment
			11:30	10	All mud removed; water quality measurements likely not represent of aquifer material. Water level measurements will be collected when recharged. Very little recharge, if any.					
			11:50	10	1451	7.81	113	9.3	18	
			12:15	10	1200	8.31	85	9.3	18	
TMCBH01	BH10	31/01/2021	7:00 to 8:30	SWL at 4 m bgl and depth of bore at 20 m before development. 10 m of sand at the bottom of the bore that may have come in as the screen was being placed into the bore and before the gravel pack was in place. Development including the injection of water (200L) removed all sand, bottom of bore measured to be 30 m bgl. very low recharge in bore, fine mist coming out of bore, unable to collect discharge and a water quality reading. Bore dry at the completion of development						
TMCBH02	BH11	31/01/2021	8:30 to 10:00	SWL 6.57 before development and bore dry at the completion of development. All mud removed via airlifting and jetting. Minimal recharge, unable to measure total volume ejected and water quality						
YCBH01	BH12		3:45	20	821	8.01	-	8.48	15.8	Bore well developed, good flow into screen
			4:00	40	762	8.03	-	12.27	14.9	
			4:10	60	730	8.17	-	13.35	14.5	
			4:20	80	707	8.23	-	11.98	14.8	
			4:30	100	655	8.23	-	9.98	14.6	
			4:40	120	652	8.22	-	9.9	14.5	
			4:45	130	615	8.17	-	9.6	14.5	
YCBH02	BH13	28/03/2021	No flow, mud removed. Potentially dry							
BCBH01	BH14	11/04/2021	7:10		7808	12.76	100	11	11	Groundwater well developed, all mud removed and groundwater recharge
			7:20		7700	12	94	10.11	11.1	
			7:30		6575	12.1	99	10.2	11.2	
			7:40		6601	12.09	95	9.81	9.81	
			7:50		5292	10	113	9.7	12.4	
			8:00		5301	9.88	114	9.33	12.2	
			8:10		6742	9.5	117	9.27	12.9	
			8:20		6833	9.44	120	9.45	12.2	
BCBH02	BH15	11/04/2021	Bore installed into aquitard, mud ejected, no flow, no field readings collected							
NYBH01	BH16	11/04/2021	Bore installed into aquitard, mud ejected, no flow, no field readings collected							
NYBH02	BH17	11/04/2021	Bore installed into aquitard, mud ejected, no flow, no field readings collected							
DMBH01V	BH18	10/03/2021	14:45		749	4.38	119	9.14	15.5	7.7 L/min flow rate
			15:03		802	4.47	133	11.9	14.4	
			15:10		891	4.55	145	11.3	14.2	
			15:30		922	5.58	150	12.7	14.2	

Bore		Date	Time	Volume (L)	EC µS/cm	pH	Redox (mV)	DO (mg/L)	Temp (c)	Comment
			15:40		930	4.63	168	14.5	14.2	
			BH1916:00		958	4.63	178	13.04	14.2	
			16:15		980	4.63	179	12.2	14.1	
			16:30		993	4.49	179	12.2	14	
DMBH02V	BH19	10/03/2021	Borehole dry, not developed. Borehole drilled via reverse air circulation, no muds to eject.							
PCBH01V	BH20	11/04/2021	Bore installed into aquitard, mud ejected, no flow, no field readings collected							
PCBH02V	BH21	11/04/2021	Bore installed into aquitard, mud ejected, no flow, no field readings collected							
108917	DELWP bore	29/04/2022	12:50	0.7L/s	168.6	7	-	-	14.5	-
			13:10	0.7L/s	188.7	6.8	-	-	14	-
			13:20	0.7L/s	193.1	6.8	-	-	14.1	-
			13:30	0.7L/s	196.2	6.8	-	-	14.1	-
			13:37	0.7L/s	168.6	7	-	-	14.5	-
108898	DELWP bore	29/04/2022	10:30	2.5L/s	-	-	-	-	-	-
			10:38	2.5L/s	-	-	-	-	-	-
			11:00	2.5L/s	-	-	-	-	-	-
			11:10	2.5L/s	350	8.4	-	-	15.4	-
			11:20	2.5L/s	360	7.4	-	-	15.4	-
			11:40	2.5L/s	367	7.7	-		15.4	-
108899	DELWP bore	29/04/2022	11:50	1.0L/s	235	7.3	-	-	14.6	-
			12:00	1.0L/s	232	7.4	-	-	14.5	-
			12:10	1.0L/s	233	7.5	-	-	14.6	-
			12:20	1.0L/s	232	7.6	-	-	14.5	-
			12:30	1.0L/s	233	7.7	-	-	14.5	-
			12:40	1.0L/s	231	7.6	-	-	14.6	-
			12:50	1.0L/s			-	-		-

Appendix G. Laboratory results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2111571**	Page	: 1 of 9
Client	: **JACOBS GROUP (AUSTRALIA) PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: SAMUEL SHEPPARD	Contact	: Peter Ravlic
Address	: PO BOX 312 FLINDERS LANE MELBOURNE VIC AUSTRALIA 8009	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +6138549 9645
Project	: IA250600	Date Samples Received	: 17-Jun-2021 13:25
Order number	: Not supplied	Date Analysis Commenced	: 28-Jun-2021
C-O-C number	: ----	Issue Date	: 28-Jun-2021 11:58
Sampler	: SS		
Site	: ----		
Quote number	: ME/313/21		
No. of samples received	: 39		
No. of samples analysed	: 34		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	BH18/19_0-1	BH18/19_2-3	BH18/19_1-2	BH01-21	BH01-23
				Sampling date / time	05-Mar-2021 00:00	05-Mar-2021 00:00	05-Mar-2021 00:00	11-Apr-2021 00:00	11-Apr-2021 00:00
					EM2111571-001	EM2111571-002	EM2111571-003	EM2111571-004	EM2111571-005
					Result	Result	Result	Result	Result
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		**7.5**	**4.8**	**5.3**	**6.8**	**6.1**
pH (Fox)	----	0.1	pH Unit		**6.2**	**3.9**	**3.9**	**2.5**	**1.9**
Reaction Rate	----	1	Reaction Unit		**3**	**1**	**1**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH01-11	BH01-4.0	BH01-24	BH08_09_2.0	BH08_09_1.0
			Sampling date / time	11-Apr-2021 00:00	11-Apr-2021 00:00	11-Apr-2021 00:00	21-Mar-2021 00:00	21-Mar-2021 00:00
Compound	CAS Number	LOR	Unit	EM2111571-006	EM2111571-007	EM2111571-008	EM2111571-009	EM2111571-010
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**4.2**	**4.0**	**6.6**	**7.4**	**6.8**
pH (Fox)	----	0.1	pH Unit	**1.6**	**1.6**	**2.2**	**5.1**	**3.4**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**2**	**2**	**2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH08_09_3.0	BH01-8.0	BH20-21_2.0	BH01-12	BH14_15-22
			Sampling date / time	21-Mar-2021 00:00	11-Apr-2021 00:00	11-Mar-2021 00:00	11-Apr-2021 00:00	11-Apr-2021 00:00
Compound	CAS Number	LOR	Unit	EM2111571-011	EM2111571-012	EM2111571-013	EM2111571-014	EM2111571-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**6.0**	**4.2**	**4.9**	**4.7**	**5.9**
pH (Fox)	----	0.1	pH Unit	**3.4**	**1.8**	**3.4**	**2.0**	**2.4**
Reaction Rate	----	1	Reaction Unit	**2**	**2**	**2**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH14_15-1	BH14_15-2	BH14_15-3	BH20_21_4.0	BH20_21_3.0
			Sampling date / time	11-Apr-2021 00:00	11-Apr-2021 00:00	11-Apr-2021 00:00	11-Mar-2021 00:00	11-Mar-2021 00:00
Compound	CAS Number	LOR	Unit	EM2111571-016	EM2111571-017	EM2111571-018	EM2111571-019	EM2111571-020
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.9**	**6.0**	**5.6**	**5.2**	**4.9**
pH (Fox)	----	0.1	pH Unit	**4.2**	**3.7**	**3.8**	**3.5**	**3.0**
Reaction Rate	----	1	Reaction Unit	**1**	**1**	**1**	**2**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH01_3.0	BH01_16.0	BH20-21-1.0	BH01_2.0	BH01_1.0
			Sampling date / time	09-Apr-2021 00:00	09-Apr-2021 00:00	11-Mar-2021 00:00	09-Apr-2021 00:00	09-Apr-2021 00:00
Compound	CAS Number	LOR	Unit	EM2111571-021	EM2111571-022	EM2111571-023	EM2111571-024	EM2111571-025
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**3.7**	**4.9**	**5.8**	**3.6**	**4.8**
pH (Fox)	----	0.1	pH Unit	**1.4**	**2.1**	**3.1**	**1.3**	**1.6**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**1**	**4**	**4**

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	BH01_15.0	BH01_17.0	BH01_7.0	BH01_6.0	BH01_1.0
				Sampling date / time	09-Apr-2021 00:00	09-Apr-2021 00:00	09-Apr-2021 00:00	09-Apr-2021 00:00	09-Apr-2021 00:00
					EM2111571-026	EM2111571-027	EM2111571-028	EM2111571-029	EM2111571-030
					Result	Result	Result	Result	Result
EA003 :pH (field/fox)									
pH (F)	----	0.1	pH Unit		**4.5**	**5.0**	**4.4**	**4.3**	**4.2**
pH (Fox)	----	0.1	pH Unit		**1.6**	**1.5**	**1.8**	**1.9**	**1.8**
Reaction Rate	----	1	Reaction Unit		**4**	**3**	**3**	**2**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH16_BH17-3.0	BH04_BH05-2.0	BH04_BH05-1.0	BH04_BH05-3.0	----
			Sampling date / time	24-Mar-2021 00:00	12-Apr-2021 00:00	12-Apr-2021 00:00	12-Apr-2021 00:00	----
Compound	CAS Number	LOR	Unit	EM2111571-031	EM2111571-032	EM2111571-033	EM2111571-034	--------
				Result	Result	Result	Result	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**5.3**	**6.7**	**6.8**	**6.4**	**----**
pH (Fox)	----	0.1	pH Unit	**3.6**	**3.5**	**2.6**	**4.0**	**----**
Reaction Rate	----	1	Reaction Unit	**1**	**3**	**3**	**4**	**----**

Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry) 18958 (Biology).

(SOIL) EA003 :pH (field/fox)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2118370**	Page	: 1 of 4
Client	: **JACOBS GROUP (AUSTRALIA) PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: SAMUEL SHEPPARD	Contact	: Tyler Anderson
Address	: PO BOX 312 FLINDERS LANE MELBOURNE VIC AUSTRALIA 8009	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: IA250600	Date Samples Received	: 30-Jun-2021 14:45
Order number	: 2077	Date Analysis Commenced	: 02-Jul-2021
C-O-C number	: ----	Issue Date	: 05-Jul-2021 11:28
Sampler	: SS		
Site	: ----		
Quote number	: ME/313/21		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH01_1.0	BH01_11	BH01_15.0	BH01_21	BH01_24
			Sampling date / time	09-Apr-2021 00:00	11-Apr-2021 00:00	09-Apr-2021 00:00	11-Apr-2021 00:00	11-Apr-2021 00:00
Compound	CAS Number	LOR	Unit	EB2118370-001	EB2118370-002	EB2118370-003	EB2118370-004	EB2118370-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	3.3	4.6	4.9	6.3	6.0
Titratable Actual Acidity (23F)	----	2	mole H+ / t	103	46	23	<2	2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.16	0.07	0.04	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.110	1.00	0.705	0.050	0.042
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	69	625	440	31	26
EA033-D: Retained Acidity								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	----	----	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	0.08	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	0.16	----	----	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	75	----	----	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	0.12	----	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.40	1.08	0.74	0.05	0.04
Net Acidity (acidity units)	----	10	mole H+ / t	247	671	463	31	28
Liming Rate	----	1	kg CaCO3/t	18	50	35	2	2
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.40	1.08	0.74	0.05	0.04
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	247	671	463	31	28
Liming Rate excluding ANC	----	1	kg CaCO3/t	18	50	35	2	2

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Sample ID	BH04_BH05_2.0	BH08_09_2.0	BH08_09_3.0	BH14_15_2	BH20_21-1.0
				Sampling date / time	12-Apr-2021 00:00	21-Mar-2021 00:00	21-Mar-2021 00:00	11-Apr-2021 00:00	11-Mar-2021 00:00
					EB2118370-006	EB2118370-007	EB2118370-008	EB2118370-009	EB2118370-010
					Result	Result	Result	Result	Result
EA033-A: Actual Acidity									
pH KCl (23A)	----	0.1	pH Unit		**5.7**	**6.6**	**5.2**	**5.4**	**5.9**
Titratable Actual Acidity (23F)	----	2	mole H+ / t		**7**	<2	**11**	**13**	**4**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S		<0.02	<0.02	<0.02	**0.02**	<0.02
EA033-B: Potential Acidity									
Chromium Reducible Sulfur (22B)	----	0.005	% S		**0.026**	**0.014**	**0.005**	**0.017**	**0.012**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t		**16**	<10	<10	**11**	<10
EA033-C: Acid Neutralising Capacity									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3		**----**	**0.35**	**----**	**----**	**----**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t		**----**	**70**	**----**	**----**	**----**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S		**----**	**0.11**	**----**	**----**	**----**
EA033-E: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		**0.04**	<0.02	**0.02**	**0.04**	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		**23**	<10	**14**	**24**	**11**
Liming Rate	----	1	kg CaCO3/t		**2**	<1	**1**	**2**	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S		**0.04**	<0.02	**0.02**	**0.04**	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t		**23**	<10	**14**	**24**	**11**
Liming Rate excluding ANC	----	1	kg CaCO3/t		**2**	<1	**1**	**2**	<1

Appendix H. Survey Results

Old ID	New ID	Survey Point	EASTING[1]	NORTHING[1]	ELEVATION (m AHD)
BH01	BSBH13LTA	BORE/WELL	735331.635	5743868.950	148.046
BH01	BSBH13LTA	TOP OF CONCRETE	735331.513	5743869.004	147.429
BH01	BSBH13LTA	NATURAL SURFACE	735331.371	5743869.338	147.385
BH02	EBBH01	BORE/WELL	215936.73	5734858.098	142.402
BH02	EBBH01	TOP OF CONCRETE	215936.73	5734858.098	141.553
BH02	EBBH01	NATURAL SURFACE	215936.73	5734858.098	141.491
BH03	EBBH02	BORE/WELL	215937.69	5734859.385	142.493
BH03	EBBH02	TOP OF CONCRETE	215937.69	5734859.385	141.572
BH03	EBBH02	NATURAL SURFACE	215937.69	5734859.385	141.501
BH04	WBBH01	BORE/WELL	734255.297	5736135.861	142.192
BH04	WBBH01	TOP OF CONCRETE	734255.281	5736135.666	141.651
BH04	WBBH01	NATURAL SURFACE	734255.142	5736135.360	141.616
BH05	WBBH02	BORE/WELL	734255.912	5736135.748	142.158
BH05	WBBH02	TOP OF CONCRETE	734255.872	5736135.620	141.650
BH05	WBBH02	NATURAL SURFACE	734255.828	5736135.201	141.623
BH06	BRBH01	BORE/WELL (TOP OF GAUGE ARTESIAN)	739461.945	5744513.658	120.030
BH06	BRBH01	TOP OF CONCRETE	739462.091	5744513.664	119.020
BH06	BRBH01	NATURAL SURFACE	739462.394	5744513.602	118.926
BH07	BRBH02	BORE/WELL	739462.043	5744514.214	119.587
BH07	BRBH02	TOP OF CONCRETE	739462.223	5744514.190	119.019
BH07	BRBH02	NATURAL SURFACE	739462.602	5744514.066	118.906
BH08	GRBH01	BORE/WELL	723434.718	5732307.841	76.923
BH09	GRBH02	BORE/WELL	723434.682	5732307.794	76.925
BH08/09	GRBH01/ GRBH02	TOP OF CONCRETE	723434.588	5732307.915	76.365
BH08/09		NATURAL SURFACE	723434.278	5732308.209	76.237
BH10	TMCBH01	BORE/WELL	726273.017	5740766.621	160.291
BH10	TMCBH01	TOP OF CONCRETE	726273.181	5740766.589	159.721
BH10	TMCBH01	NATURAL SURFACE	726273.484	5740766.481	159.547
BH11	TMCBH02	BORE/WELL	726273.346	5740767.310	160.210
BH11	TMCBH02	TOP OF CONCRETE	726273.444	5740767.271	159.723
BH11	TMCBH02	NATURAL SURFACE	726273.796	5740767.160	159.558
BH12	YCBH01	BORE/WELL	724086.176	5739877.000	143.933
BH12	YCBH01	TOP OF CONCRETE	724086.065	5739877.129	143.336
BH12	YCBH01	NATURAL SURFACE	724085.881	5739877.392	143.277
BH13	YCBH02	BORE/WELL	724085.313	5739876.410	143.947

Old ID	New ID	Survey Point	EASTING[1]	NORTHING[1]	ELEVATION (m AHD)
BH13	YCBH02	TOP OF CONCRETE	724085.200	5739876.590	143.371
BH13	YCBH02	NATURAL SURFACE	724084.897	5739876.914	143.286
BH14	BCBH01	BORE/WELL	733685.168	5749760.114	175.559
BH14	BCBH01	TOP OF CONCRETE	733685.069	5749760.266	175.014
BH14	BCBH01	NATURAL SURFACE	733684.838	5749760.333	174.903
BH15	BCBH02	BORE/WELL	733685.823	5749760.510	175.572
BH15	BCBH02	TOP OF CONCRETE	733685.760	5749760.656	175.010
BH15	BCBH02	NATURAL SURFACE	733685.520	5749760.748	174.923
BH16	NYBH01	BORE/WELL	738189.326	5749301.964	174.666
BH16	NYBH01	TOP OF CONCRETE	738189.165	5749302.103	174.087
BH16	NYBH01	NATURAL SURFACE	738189.214	5749302.417	173.976
BH17	NYBH02	BORE/WELL	738188.457	5749301.583	174.739
BH17	NYBH02	TOP OF CONCRETE	738188.432	5749301.654	174.138
BH17	NYBH02	NATURAL SURFACE	738188.235	5749302.040	174.034
BH18	DMBH01V	BORE/WELL	743191.667	5739706.886	165.897
BH18	DMBH01V	TOP OF CONCRETE	743191.707	5739707.043	165.397
BH18	DMBH01V	NATURAL SURFACE	743191.864	5739707.385	165.205
BH19	DMBH02V	BORE/WELL	743193.253	5739705.992	165.960
BH19	DMBH02V	TOP OF CONCRETE	743193.310	5739706.118	165.377
BH19	DMBH02V	NATURAL SURFACE	743193.448	5739706.353	165.283
BH20	PCBH01V	BORE/WELL	748893.389	5743876.048	162.089
BH21	PCBH02V	BORE/WELL	748893.358	5743876.111	162.091
BH20/21	PCBH01V/ PCBH02V	TOP OF CONCRETE	748893.554	5743876.194	161.527
BH20/21		NATURAL SURFACE	748893.814	5743876.354	161.477

[1]All co-ordinates reported in MGA94 Zone 54 except BH01 and BH02 reported in Zone 55.