Ground Doctor Pty Ltd

ABN: 32 160 178 656

22 Tamworth Street
PO Box 6278
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5 September 2022

Mr Craig McDonald
Hy-tec Industries Pty Ltd
Austen Quarry
391 Jenolan Caves Road
Hartley NSW 2790
Craig.Mcdonald@adbri.com.au

Dear Craig,

RE: AUGUST 2022 WATER MONITORING RESULTS, AUSTEN QUARRY, HARTLEY, NSW

Ground Doctor was engaged by Hy-tec Industries Pty Ltd (Hy-tec) to collect groundwater level and quarry excavation water quality data biannually at the Austen Quarry, 391 Jenolan Caves Road, Hartley, NSW (the site). This report outlines the methodology and results of the monitoring round conducted on 23 August 2022.

1 Monitoring Objectives

The objective of the monitoring round was to collect water data to comply with monitoring programme outlined in the Water Management Plan (Groundwork Plus, 2017).

The Water Management Plan (Groundwork Plus, 2017) stipulates that Hy-tec will monitor water quality within the quarry excavation on a six-monthly basis for the life of the quarry. The Water Management Plan also stipulates that groundwater levels will be continuously monitored during the operational life of the quarry and outlines triggers for groundwater level changes at four existing monitoring bores.

2 Scope of Work

Ground Doctor conducted the following work.

- Gauged four existing groundwater monitoring wells to measure the depth to groundwater.
- Downloaded groundwater level data from data loggers within three bores in which groundwater was encountered (MB01S, MB01D and MB02).
- Downloaded atmospheric pressure data from a baro-logger installed within MB03.
- Measured water quality parameters within accumulated water at the base of the quarry excavation.
- Collected samples of water within the base of the quarry excavation for laboratory analysis.
- Prepared this report outlining methodology and results of the monitoring round.

3 Monitoring Bore Locations

The monitoring bore locations are shown on *Figure 1* of *Attachment A*. Monitoring bore coordinates and details are summarised in *Table 1*. *Table 1* also presents a summary of the monitoring bore construction details.

Table 1: Monitoring Bore Construction Details

Bore ID	Easting	Northing	Approx. Surface Elevation (AHD)	Depth to Bottom (btc)	Screened Intervals (bgl)	Stickup (agl)
MB01S	235245	6281077	700m	7.42m	3.7-6.7m	0.8m
MB01D	235259	6281098	700m	29.30m	20-23m 26-28.5m	0.8m
MB02	235915	6280398	710m	29.10m	10.5-13.5m 22.5-28.5m	0.6m
MB03	236419	6281786	690m	25.31m	18.5-24.5m	0.4m

Eastings and northings are MGA Zone 56.
btc = below top of casing
bgl = below ground level
agl = above ground level

4 Water Monitoring Methodology

Each monitoring bore was gauged using an electronic dip meter prior to any disturbance of the water column. Bores were gauged on the morning of 23 August 2022. The depth to water was measured from the top of casing at each bore. MB03 was installed into a dry hole and the hole was found to be dry at the time of gauging.

The water level logger was removed from each borehole following gauging. Data stored within the water level loggers were downloaded at the time of gauging on 23 August 2022. The water level loggers were reinstated in each monitoring bore after download.

A water sample was collected from standing water in the quarry excavation on 23 August 2022 2022. An unpreserved sample bottle was filled directly from ponded water in the quarry excavation. This bottle was then used to fill preserved sample bottles and samples requiring field filtering. Once sampling was complete field water quality parameters were measured. The water quality meter was placed in the pond and allowed to equilibrate for a period of approximately 10 minutes. The field water quality parameters were then recorded.

Water quality measurements were made using a YSI water quality meter. Ground Doctor calibrated the water meter prior to use.

Water samples were collected into laboratory supplied bottles, each marked with the appropriate identification. Sample bottles were appropriately preserved where necessary. The sample for dissolved metals analysis was filtered in the field using disposable 45µm filters. The sampler wore disposable nitrile gloves at all times during sampling to minimise potential for cross contamination. Samples were placed into an esky with ice immediately after collection.

Water samples were transported to Envirolab (Sydney) by an overnight courier service. The samples were sent on the afternoon of 23 August 2022 and were logged as being received by Envirolab on 24 August 2022.

Water samples collected from the base of the quarry excavation were analysed for major cations, major anions, nutrients, dissolved metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs) as specified in Table 37 of the Water Management Plan (Groundwork Plus, 2017).

5 Field Observations

Water quality data measured within water in the base of the quarry excavation is presented with all previous monitoring data in *Table 2*.

Table 2: Water Quality Parameters for Pit Water – All Monitoring Rounds

Date	Temp (ºC)	DO (ppm)	EC (uS/cm)	pH	Field ORP (mV)
Jan-18	21.9	4.30	820	7.00	8
Jun-18	7.6	6.97	357	7.01	119
Jan-19	25.2	5.30	794	8.20	91
Jul-19	7.9	9.50	536	8.33	129
Jan-20	19.4	3.17	1015	7.82	110
Aug-20	9.2	8.74	494	7.94	146
Jan 21	20.5	5.34	662	8.19	115
Jul 21	8.8	9.31	500	7.14	-71
Feb 22	23.1	3.15	617	8.27	-18
Aug 22	10.2	7.70	422	7.95	17

6 Analytical Results

A summary of analytical data is presented in *Table B1* of *Attachment B*. The summary table presents February 2022 results against preliminary triggers outlined in the Water Management Plan (Groundwork Plus, 2017) and analytical data from previous monitoring rounds spanning January 2018 to August 2022.

The certificate of analysis for water samples is presented as *Attachment C*.

Reported concentrations of all analytes were less than the preliminary triggers outlined in the Water Management Plan (Groundwork Plus, 2017). Where analytes were detected above the laboratory reporting limits, the analyte concentrations were within the range of previous results.

7 Water Level Logger Data

All water level loggers were set to record water level at 6 hour intervals commencing 12am on 12 January 2018. The water level data loggers were not vented. A baro-logger was deployed to record air pressure at the same recording interval to allow water level logger readings to be corrected to account for changes in air pressure.

Water level data loggers installed in MB01S, MB01D and MB02, and the barometric pressure logger installed at MB03, were downloaded on 23 Auguust 2022.

The raw data was corrected for changes in air pressure using the barometric pressure data. The manual water level measurement collected at the time the loggers were removed from each borehole were used to convert the water level logger data to a depth to water relative to the top of the PVC bore casing.

At the completion of the monitoring round the water level loggers were redeployed in their respective boreholes.

Corrected water level data is presented graphically as *Attachment D*. The presented data is for the period spanning January 2018 to August 2022.

Observed groundwater level changes did not exceed the adopted trigger, which is a drop in water levels more than 10m below baseline water levels. Water level trends in each monitoring bore over the monitoring interval (February 2022 to August 2022) were as follows.

7.1 MB01S

The water level in MB01S fluctuated several times during the monitoring interval but typically returned to the long term average level between 4m and 4.5m below ground level. Significant water level spikes were apparent in early March 2022 and early July 2022 which corresponded to significant rainfall events.

7.2 MB01D

In the period February 2022 to June 2022 the water level was close to 4.5m most of the time but was observed to spike in early March 2022 at the same time as the water level in MB01S. A second significant groundwater level spike occurred in early July 2022. This was followed by a period of general water level decline to approximately 5.5m below top of casing.

7.3 MB02

The water level within MB02 rose approximately 2.1m over the monitoring interval. The long term trend was a steady increase over the monitoring interval. Several small spikes were observed over the monitoring interval, most likely associated with recharge associated with significant rainfall events.

8 Estimated Groundwater Inflow to Pit

The WMP specifies that water inflow to the pit should be estimated on a quarterly basis by measuring changes to water levels within the pit during a period of fine weather and no water extraction. Hy-tec monitored water level changes in the base of the quarry excavation on two occasions in the period February 2022 to August 2022.

At the time of each monitoring event, water had not been removed from the pit for several days prior to monitoring. There had been no significant rainfall in the days leading up to the monitoring period and there was no obvious overland flow of water into the pit floor during the monitoring period.

A measuring benchmark was established at the waterline in the base of the pit. The height of standing water was noted to the nearest millimetre at the commencement of the monitoring period. The height of water at the benchmark was noted 24 hours later.

At the time of the monitoring events the pit floor was covered with water. The pit floor at the time of monitoring was estimated to be approximately 230m long with an average width of 30m, giving an estimated area of approximately 6900m^2.

Ground Doctor estimated evaporation from the pit using evaporation data from the nearest BOM gauging station that measures evaporation (Bathurst Agricultural Station). Ground Doctor used an evaporation rate of one third of the BOM reading at Bathurst. This was justified on the basis that the Quarry floor is surrounded by walls that are approximately 50m high, which protects ponded water from wind and reduces the amount of solar radiation reaching the bottom of the pit. In addition, the quarry is situated further east of Bathurst and evaporation typically decreases as you move closer to the east coast of Australia due to topographical effects and average humidity of the airmass.

The daily change in water level within the quarry excavation was used to estimate the annual groundwater inflow. *Table 3* summarises the observation made during the two monitoring events in the period February 2022 to August 2022.

Table 3: Summary of Pit Inflow Estimates February 2022 to August 2022

Monitoring Event	Change in Water Level	Description of Pit Conditions	Estimate of Groundwater Inflow
15-16 February 2022	No change in water level. 2.5mm Evaporation Loss	Pit floor approximately 6900m^2. Pit floor covered by water.	6.3ML/yr
23-24 May 2022	No change in water level. 0.3mm evaporation loss.	Pit floor approximately 6900m^2. Pit floor covered by water.	0.8ML/yr
		Average Inflow Estimate For February 2022 to August 2022	**3.5ML/yr**

The average estimate of groundwater inflow across the monitoring period was 3.5ML/yr. Hy-tec's licensed groundwater use is 20ML/yr.

9 Conclusions

Groundwater level monitoring, quarry excavation water quality monitoring and quarry excavation inflow monitoring was undertaken as specified by the Water Management Plan (Groundwork Plus, 2017). The data collected during the August 2022 monitoring round did not exceed any of the relevant triggers outlined in the Water Management Plan (Groundwork Plus, 2017).

Estimated inflow to the quarry excavation did not exceed Hy-tec's licensed use of groundwater (20ML/yr).

If you have any questions regarding the works outlined in this report please contact the undersigned on 0407 875 302.

Kind Regards

James Morrow
Environmental Engineer
Ground Doctor Pty Ltd
Certified Environmental Practitioner No.: 1194
Site Contamination Specialist No.: SC41087

Attachments:

Attachment A – Figure

Attachment B – Analytical Results Summary Table

Attachment C – Laboratory Certificate of Analysis

Attachment D – Groundwater Level Chart

10 References

- ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Trigger values for 95% protection of fresh water ecosystems.

- Groundwork Plus (2017), "*Austen Quarry Water Management Plan*", Report Number 1517_610_002_RPTO_Water Management Plan_V8, 10 October 2017.

- National Health and Medical Research Council (NHMRC) (2011) *Australian Drinking Water Guidelines.*

Attachment A

Figure

Ground Doctor Pty Ltd

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22 Tamworth Street
Dubbo NSW 2830

Project Name: August 2022 Groundwater Monitoring Round	Figure 1
Project Number: 2018-GD001	Groundwater Monitoring Bore Locations

Attachment **B**

Analytical Results Summary Table

Table B1

Analytical Data Summary - Pit Water - January 2018 to August 2022

Sampling Date		ANZECC	Aust. Drinking Water	10/01/2018	22/06/2018	03/01/19	03/07/19	07/01/20	27/08/20	05/01/21	28/07/21	03/02/22	23/08/22	Units
Sample Location		DGV 2018 (Fresh)	2011	PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT	PIT	
Major Cations (mg/L)	Calcium	-	-	71	49	64	62	92	58	54	54	48	56	mg/L
	Magnesium	-	-	45	26	44	51	60	43	43	43	35	39	mg/L
	Sodium	-	-	26	25	20	24	35	28	23	24	19	19	mg/L
	Potassium	-	-	4	3	4.7	4.6	6.2	4	4.5	5	5	5.1	mg/L
Major Anions (mg/L)	Sulphate	-	-	183	98	220	210	230	170	150	160	150	130	mg/L
	Chloride	-	-	9	10	13	18	25	9	9	8	7	7	mg/L
	Hydroxide as CaCO3	-	-	<1	<1	<5	<5	<5	<5	<5	<5	<5	<5	mg/L
	Carbonate as CaCO3	-	-	<1	<1	<5	<5	<5	<5	<5	<5	<5	<5	mg/L
	Bicarbonate as CaCO3	-	-	181	201	170	170	300	180	190	180	170	180	mg/L
Heavy Metals (Dissolved) (mg/L)	Aluminium	0.055	-	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	mg/L
	Arsenic	0.013	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Barium	-	2	0.032	0.029	0.071	0.029	0.046	0.039	0.048	0.040	0.047	0.035	mg/L
	Beryllium	-	0.06	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/L
	Boron	0.37	4	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/L
	Cadmium	0.0002	0.002	0.0088	0.0019	0.0001	<0.0001	0.0003	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/L
	Chromium	0.001	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Cobalt	-	-	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Copper	0.0014	2	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Iron	-	-	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.100	<0.01	mg/L
	Lead	0.0034	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Manganese	1.9	0.5	2.000	0.188	<0.005	<0.005	0.120	0.150	<0.005	0.008	0.007	<0.005	mg/L
	Mercury	0.6	0.001	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	mg/L
	Molybdenum	-	0.05	0.004	<0.001	0.011	0.009	0.015	0.005	0.004	0.004	0.003	0.003	mg/L
	Nickel	0.011	0.02	0.008	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Selenium	0.005	0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Silver	0.00005	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Strontium	-	-	0.298	0.231	0.330	0.260	0.440	0.260	0.230	0.270	0.230	0.240	mg/L
	Titanium	-	-	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Vanadium	-	-	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L
	Zinc	0.008	-	0.443	0.16	0.006	0.006	0.023	0.007	0.004	0.006	0.008	0.002	mg/L
Silicon (mg/L)	Silicon	-	-	15.2	19.4	5.1	3.8	8.6	3.6	3.2	2.7	3.2	3.9	mg/L
Nutrients (mg/L)	Nitrate*	10 (as N)	50 (as NO3)	4.45	0.48	1.4	0.3	0.14	2.2	2.4	2.8	3.1	2.6	mg/L
	Nitrite	-	-	0.010	<0.01	0.012	<0.005	<0.005	0.008	0.007	0.009	0.016	<0.005	mg/L
	Ammonia	0.9	-	0.4	0.05	<0.005	<0.005	0.087	<0.005	<0.005	<0.005	<0.005	0.078	mg/L
Hydrocarbons (ug/L)	TRH	-	-	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	ug/L
	Benzene	950	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/L
	Toluene	-	800	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1	ug/L
	Ethylbenzene	-	300	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1	ug/L
	Xylene	200	600	<2	<2	<3	<3	<3	<3	<3	<3	<3	<3	ug/L
	Naphthalene	16	-	<5	<5	<1	<1	<1	<1	<1	<1	<1	<1	ug/L
	Benzo(a)pyrene	-	0.01	<0.5	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	ug/L

Attachment **C**

Laboratory Certificate of Analysis

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Ground Doctor Pty Ltd
Attention	James Morrow

Sample Login Details

Your reference	Hytec Austen Quarry Groundwater Monitoring-Aug 22
Envirolab Reference	303906
Date Sample Received	24/08/2022
Date Instructions Received	24/08/2022
Date Results Expected to be Reported	31/08/2022

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	1 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	6
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHsin Water	All metals in water-dissolved	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	Metals in Waters -Dissolved	Ammonia as N in water	Nitrate as N in water	Nitrite as N in water	Total Dissolved Solids(grav)
Pit	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 303906

Client Details

Client	Ground Doctor Pty Ltd
Attention	James Morrow
Address	PO Box 6278, Dubbo, NSW, 2830

Sample Details

Your Reference	**Hytec Austen Quarry Groundwater Monitoring-Aug 22**
Number of Samples	1 Water
Date samples received	24/08/2022
Date completed instructions received	24/08/2022

Analysis Details

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

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

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

Report Details

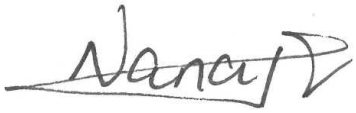
Date results requested by	31/08/2022
Date of Issue	31/08/2022

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Kyle Gavrily, Senior Chemist
Liam Timmins, Organic Instruments Team Leader
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date extracted	-	26/08/2022
Date analysed	-	27/08/2022
TRH C_6 - C_9	µg/L	<10
TRH C_6 - C_{10}	µg/L	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	102
Surrogate toluene-d8	%	95
Surrogate 4-BFB	%	98

svTRH (C10-C40) in Water		
Our Reference	UNITS	303906-1
Your Reference		Pit
Date Sampled		23/08/2022
Type of sample		Water
Date extracted	-	30/08/2022
Date analysed	-	31/08/2022
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
Total +ve TRH (C10-C36)	µg/L	<50
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Total +ve TRH (>C10-C40)	µg/L	<50
Surrogate o-Terphenyl	%	98

PAHs in Water		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date extracted	-	30/08/2022
Date analysed	-	30/08/2022
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	98

All metals in water-dissolved		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date prepared	-	25/08/2022
Date analysed	-	25/08/2022
Aluminium-Dissolved	µg/L	<10
Arsenic-Dissolved	µg/L	<1
Boron-Dissolved	µg/L	<20
Barium-Dissolved	µg/L	35
Beryllium-Dissolved	µg/L	<0.5
Cadmium-Dissolved	µg/L	<0.1
Chromium-Dissolved	µg/L	<1
Cobalt-Dissolved	µg/L	<1
Copper-Dissolved	µg/L	<1
Iron-Dissolved	µg/L	<10
Lead-Dissolved	µg/L	<1
Manganese-Dissolved	µg/L	<5
Mercury-Dissolved	µg/L	<0.05
Molybdenum-Dissolved	µg/L	3
Nickel-Dissolved	µg/L	<1
Selenium-Dissolved	µg/L	<1
Silver-Dissolved	µg/L	<1
Strontium-Dissolved	µg/L	240
Titanium-Dissolved	µg/L	<1
Vanadium-Dissolved	µg/L	<1
Zinc-Dissolved	µg/L	2

Ion Balance		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date prepared	-	25/08/2022
Date analysed	-	25/08/2022
Calcium - Dissolved	mg/L	56
Potassium - Dissolved	mg/L	5.1
Sodium - Dissolved	mg/L	19
Magnesium - Dissolved	mg/L	39
Hardness	mgCaCO 3 /L	300
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	180
Carbonate Alkalinity as $CaCO_3$	mg/L	<5
Total Alkalinity as $CaCO_3$	mg/L	180
Sulphate, SO4	mg/L	130
Chloride, Cl	mg/L	7
Ionic Balance	%	5.0

Metals in Waters - Dissolved		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date digested	-	26/08/2022
Date analysed	-	26/08/2022
Silicon*- Dissolved	mg/L	3.9

Miscellaneous Inorganics		
Our Reference		303906-1
Your Reference	UNITS	Pit
Date Sampled		23/08/2022
Type of sample		Water
Date prepared	-	25/08/2022
Date analysed	-	25/08/2022
Ammonia as N in water	mg/L	0.078
Nitrate as N in water	mg/L	2.6
Nitrite as N in water	mg/L	<0.005
Total Dissolved Solids (grav)	mg/L	350

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			26/08/2022	[NT]	[NT]	[NT]	[NT]	26/08/2022	[NT]
Date analysed	-			27/08/2022	[NT]	[NT]	[NT]	[NT]	27/08/2022	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	114	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	114	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	115	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	116	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	104	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-023	95	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-BFB	%		Org-023	97	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			30/08/2022	[NT]	[NT]	[NT]	[NT]	30/08/2022	[NT]
Date analysed	-			31/08/2022	[NT]	[NT]	[NT]	[NT]	31/08/2022	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	113	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	129	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	113	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	129	[NT]
Surrogate o-Terphenyl	%		Org-020	103	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			30/08/2022	[NT]	[NT]	[NT]	[NT]	30/08/2022	[NT]
Date analysed	-			30/08/2022	[NT]	[NT]	[NT]	[NT]	30/08/2022	[NT]
Naphthalene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	94	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: All metals in water-dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/08/2022	1	25/08/2022	25/08/2022		25/08/2022	[NT]
Date analysed	-			25/08/2022	1	25/08/2022	25/08/2022		25/08/2022	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	[NT]		104	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		104	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	1	<20	[NT]		110	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	1	35	[NT]		96	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	[NT]		111	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		102	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		99	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		100	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		105	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	1	<10	[NT]		102	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		99	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	<5	[NT]		103	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	98	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	3	[NT]		101	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		105	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		102	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		97	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	240	[NT]		100	[NT]
Titanium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		102	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		102	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	2	[NT]		105	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/08/2022	[NT]	[NT]	[NT]	[NT]	25/08/2022	[NT]
Date analysed	-			25/08/2022	[NT]	[NT]	[NT]	[NT]	25/08/2022	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	114	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	107	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	120	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	107	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]

QUALITY CONTROL: Metals in Waters - Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			26/08/2022	[NT]	[NT]	[NT]	[NT]	26/08/2022	[NT]
Date analysed	-			26/08/2022	[NT]	[NT]	[NT]	[NT]	26/08/2022	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	[NT]	[NT]	[NT]	[NT]	116	[NT]

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/08/2022	[NT]	[NT]	[NT]	[NT]	25/08/2022	[NT]
Date analysed	-			25/08/2022	[NT]	[NT]	[NT]	[NT]	25/08/2022	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	[NT]	[NT]	[NT]	[NT]	105	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	[NT]	[NT]	[NT]	[NT]	96	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	104	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

CHAIN OF CUSTODY - Client

Client: Ground Doctor Pty Ltd	**Client Project Name / Number / Site etc (ie report title):** Hytec Austen Quarry Groundwater Monitoring - Aug 22	
Contact person: James Morrow ph: 0407 875 302	**PO No.:**	**Phone:**
Project Mgr: James Morrow	**Envirolab Quote No. :**	**E-mail:**
Sampler: James Morrow	**Standard TAT**	**Contact:**
Address: Austen Quarry, 391 Jenolan Caves Road, Hartley, NSW	**Or choose:** standard / same day / 1 day / 2 day / 3 day	
Phone: -- **Mob:** 0407875302	*Note: Inform lab in advance if urgent turnaround is required - surcharge applies*	
Fax: --	**Lab comments:**	
Email:		

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Hy-tec Suite (see table below)	TRH, BTEX, PAHs													Provide as much information about the sample as you can
1	Pit	-	23-Aug-22	Water	x	x													

Relinquished by (company):	James Morrow	**Received by (company):**	Ausco Environ
Print Name:	James Morrow	**Print Name:**	
Date & Time:	23/8/22 1200	**Date & Time:**	24/8/22 1130
Signature:	JRM	**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 6 (if applicable)
Transported by: Hand delivered / courier

White - Lab copy / Blue - Client copy / Pink - Retain in Book

303906

HYTEC Groundwater Suite

Analyte Group	Analyte

Dissolved Solids	Total Dissolved Solids
Major Cations	Magnesium Calcium Sodium Potassium
Major Anions	Sulphate Chloride Hydroxide as $CaCO_3$ Carbonate as $CaCO_3$ Bicarbonate as $CaCO_3$
Heavy Metals (Dissolved)	Aluminium Arsenic Boron Barium Beryllium Cadmium Chromium Cobalt Copper Iron Lead Manganese Mercury Molybdenum Nickel Selenium Silicon Silver Strontium Titanium Vanadium Zinc
Nutrients	Ammonia Nitrate Nitrite

3039406

Attachment D

Groundwater Level Chart

Depth to Water vs Time

MB01S MB01D MB02

Depth to Water (m below top of PVC Casing)

0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 19.00 20.00 21.00 22.00 23.00 24.00 25.00

01/01/18 01/02/18 01/03/18 01/04/18 01/05/18 01/06/18 01/07/18 01/08/18 01/09/18 01/10/18 01/11/18 01/12/18 01/01/19 01/02/19 01/03/19 01/04/19 01/05/19 01/06/19 01/07/19 01/08/19 01/09/19 01/10/19 01/11/19 01/12/19 01/01/20 01/02/20 01/03/20 01/04/20 01/05/20 01/06/20 01/07/20 01/08/20 01/09/20 01/10/20 01/11/20 01/12/20 01/01/21 01/02/21 01/03/21 01/04/21 01/05/21 01/06/21 01/07/21 01/08/21 01/09/21 01/10/21 01/11/21 01/12/21 01/01/22 01/02/22 01/03/22 01/04/22 01/05/22 01/06/22 01/07/22 01/08/22 01/09/22