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HYDROILEX GEOLOGICAL CONSULTANTS

Groundwater Geosciences

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Summary of Results of a 40-hour drawdown and Recovery Test – Proposed Iceton Subdivision, Yass NSW (Hydroilex Report HG21.9.2CA_final).

INTRODUCTION

This report summarises the results of a 40-hour constant rate drawdown and recovery test conducted at Lot 13 DP786575, located at Iceton Place, Yass, NSW. The bore was pumped at a constant rate of 1.5 L/s. *Figure 1* shows the location of the subject bore.

The test was conducted over the period 19-21.9.21 using a submersible borehole pump powered by a mobile generator. Drawdown data was recorded both manually, and by a data-logger installed in the bore, recording drawdown levels at 10-minute frequencies. Discharge volumes were measured using a calibrated 200-litre container. The pump was installed at 102m depth.

The subject bore was constructed in June 2021 as a fully-cased 200mm bore with 150mm PVC casing, completed to a depth of 125m. Surface grout and gravel-pack were installed behind the casing, as documented in the *Form A Report.* Test results, bore construction and hydrogeological are summarised in ***Table 1***.

The results confirm that the bore far exceeds the project requirement of 8-10ML per annum, where testing has revealed a capacity of 43-57ML subject to discharge rate.

TEST RESULTS

Results are summarised in *Table 1. Figures App.1_1&2* provide plots of the data.

The pertinent results of the test and associated hydrogeological factors are:

1. The bore is free-flowing at a rate of approximately 0.2 L/s with appositive head of approximately 0.8m;
2. Testing over an extended 40-hour period was conducted at a constant rate of 1.5 L/s;
3. The ‘available drawdown’ in the bore is 104m;
4. Drawdown during the test was 53.90m;
5. Realised drawdown represents only 52% of the ‘available drawdown’;
6. At the test rate the bore has the capacity to produce 64,800 litres in 12 hrs;
7. The ‘safe’ capacity of the bore is approximately 2.0 L/s, where 86,400 litres would be produced in 12 hrs;
8. At the test rate, the bore may be pumped continuously for up to 7 days to fill tanks and domestic storages for the proposed development;
9. The positive head and extremely rapid recovery rate reflect a positive head and likely connection to an extensive aquifer system; the geological target in which the bore is located is an extensive fracture linear N-S zone along the axis of the adjacent watercourse;
10. The bore has the ideal advantage of a high head and deep aquifer system which facilitates optimum pumping conditions;
11. Water samples have been lodged for analysis to determine potability and major ion chemistry;
12. It is recommended that the bore is equipped to discharge at 2 L/s, with a pump setting of 80m depth;

Linear- Time Drawdown and Recovery Plot (*Figure App.1_1*)

The following is noted in *Figure App.1_1:*

1. A moderate rate of drawdown in the first 400 minutes, followed by a reduced rate for the duration of the test;

2. Extremely fast rate of recovery;
3. Final drawdown level (and drawdown) of 53.90m;
4. Relative depths of utilised and un-used available drawdown;
5. Maximum drawdown level at the depth of the main aquifer at 104m;

Drawdown Plot (*Figure App.1_2*)

The following is noted in *Figure App.1_2:*

1. A linear drawdown gradient, with a minor boundary effect after 1000 minutes pumping;
2. Calculated aquifer Transmissivity 15.4m3/day/m;
3. From the curve, it is predicted that after 7 days continuous pumping, the drawdown would be approximately 70m (not shown on curve);

Table 1. Summary of Bore Construction and Test Results *(refer to Form A_Appendix 2)*

DETAILS & SPECS	PB1 Data & Test summary
CONSTRUCTION DATA	
WaterNSW Lic. No.	40BL192833
Hole Depth (m)	125
Location mga 56	67660E 6139375N
Land Title	13/686575
Approx. Elevation	To determine
Constructed date	June 2021
Aquifers	55m 0.2L/s 104m 1L/s 118m 0.6 L/S
Geology	Interbedded Silurian calc.-carboniferous sediments
Screen	55-60,104-110, 118-125
Gravelpack	9-125m
Grout	0-9m
Available Drawdown (drawdown level)	104m (104m top of main aquifer)
TEST DATA	
SWL at GL (m) -current	~0.6m agl (flowing ~0.2 L/s
T1 Test date (pumping)	19-21.9.21
Drawdown (m)	53.90m
Recovery character	Extremely rapid recharge
Drawdown character	Linear, weak boundary after 1000 minutes
Recovery character	Linear, very rapid
% Available D'down used	52%
Transmissivity	Early data – 15.4 m^3/day/m
Potential Duty	90%
Likely bore capacity	43 ML at 1.5 L/s; 57 ML at 2.0 L/s

CHEMISTRY

Water samples were submitted to ALS laboratory for a standard potability test. The results are provided in *Appendix 2*.

Table 2. Summary of Groundwater Chemistry

Physical /analyte	Units	ALS Report ES2135123-001	ADWG Guidelines-health
pH	pH units	7.85	6.5-8.5
EC	uS/cm	1190	none
TDS	mg/L	840	none
Hardness	mg/L	91	none
Sodium Na^+	mg/L	252	none
Potassium K^+	mg/L	2	none
Calcium Ca^{2+}	mg/L	20	none
Magnesium Mg^{2+}	mg/L	10	none
Chloride Cl^-	mg/L	114	none
Sulphate SO_4^{2-}	mg/L	17	500
Bicarbonate HCO_3^-	mg/L	476	none
Carbonate CO_3^{2-}	mg/L	0	none
Nitrate NO_3^-	mg/L	0.23	50
Fluoride F^-	mg/L	5.3	1.5 - **high**
Iron (Total)	mg/L	'v.low'	
Manganese (Total)	mg/L	0.005	0.5
Boron	mg/L	0.22	4
Barium	mg/L	0.276	0.7
Nickel	mg/L	0.016	0.02
Silver	mg/L	<0.001	0.1
Arsenic	mg/L	<0.001	0.01
Cadmium	mg/L	<0.0001	0.05
Chromium	mg/L	<0.001	0.05
Copper	mg/L	<0.001	2
Molybdenum	mg/L	<0.001	0.05
Lead	mg/L	<0.001	0.01
Mercury	mg/L	<0.0001	0.001
Antimony	mg/L	<0.001	0.003
Selenium	mg/L	<0.01	0.01
Cyanide	mg/L	<0.004	0.08

The following is noted in the analytal report:

1. Fluoride concentration is significantly elevated (Fluoride >4mg/L can cause skeletal fluorosis);
2. Trace metal concentrations are 'low';
3. The water is clear, palatable and moderately soft;
4. As a gardening water, it may be intolerant to sensitive plants, where spraying on leaves should be avoided; otherwise for general watering of lawns and trees, the water should be excellent;

Based on the chemical composition of the water, it is classified as *bicarbonate-sodium water.* The certified report is provided in *Appendix 3.*

SUMMARY

The following summarises the results of testing and water analyses:

1. The results confirm that the bore far exceeds the project requirement of 8-10ML per annum, where testing has revealed a capacity of 43-57ML subject to discharge rate;
2. Water analyses confirm that the water is not potable, and that it should be used exclusively as a secondary water supply;
3. Formal licensing and registration with *WaterNSW* is recommended;

Figures

Figure 1 Aerial Plan showing location of proposed water supply bore

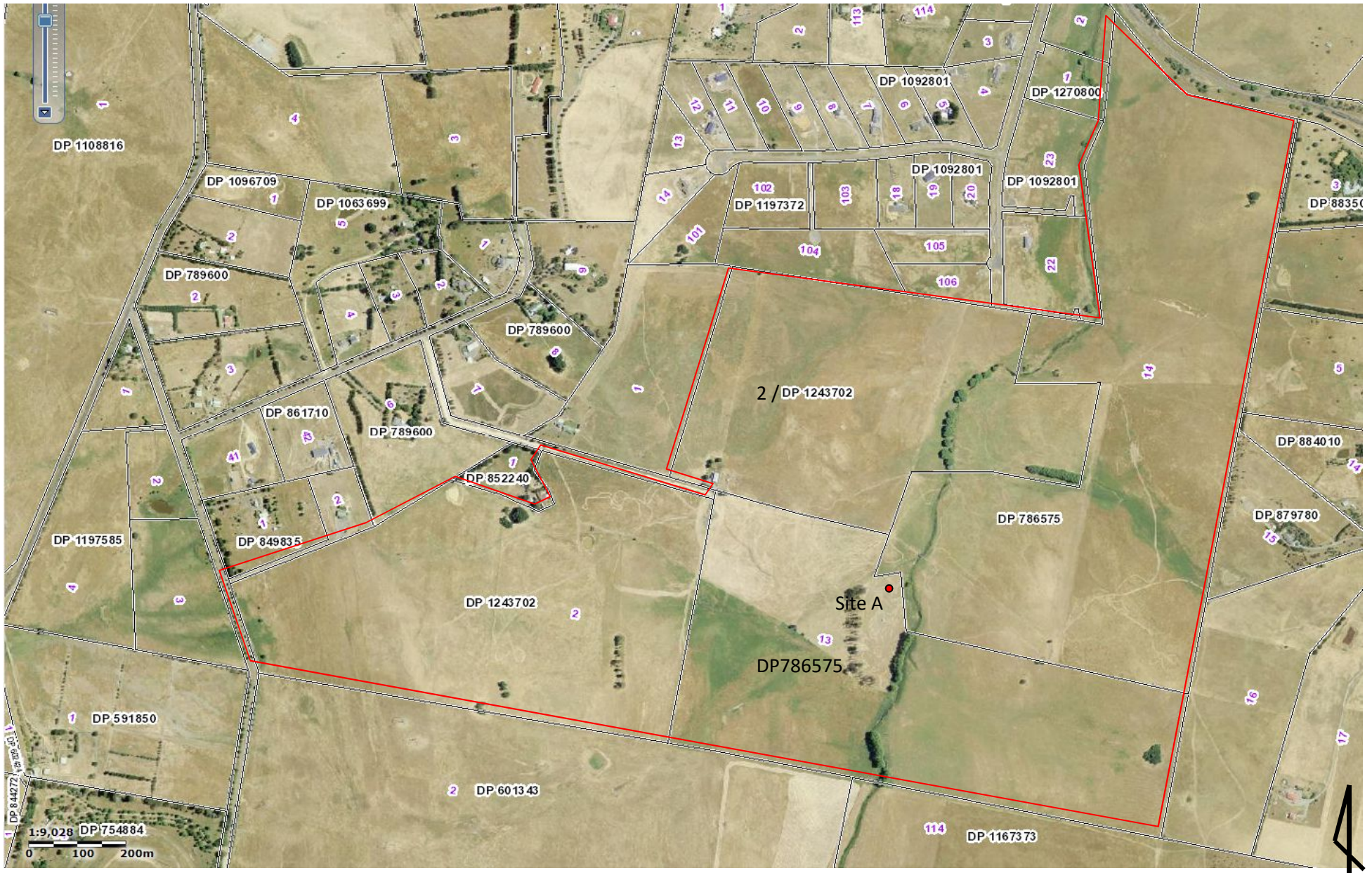
Appendices

Appendix 1 Test plots
Appendix 2 Form A Report
Appendix 3 Analytical Report

John Lee

Geoscientist

25.10.2021

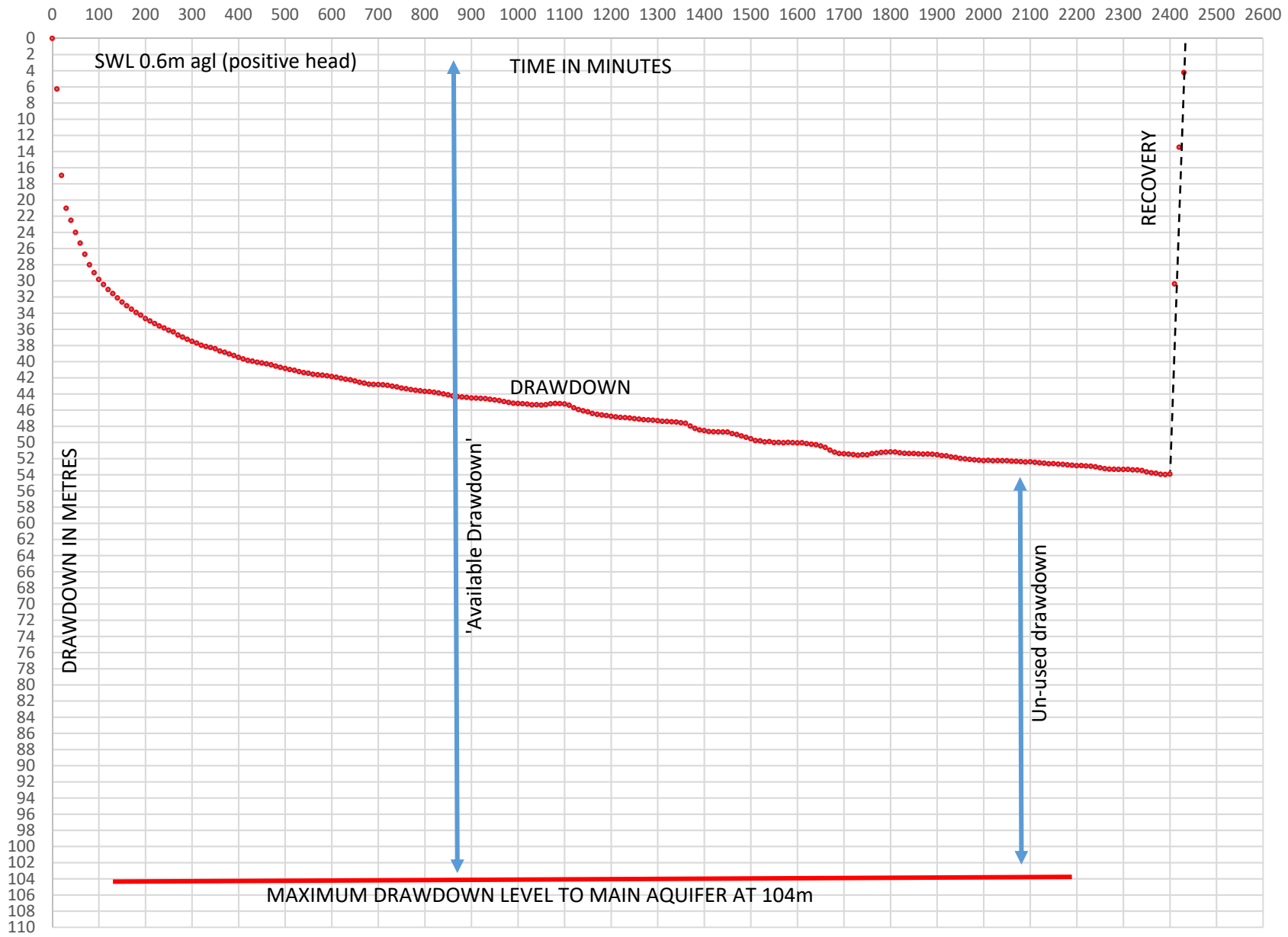


Proposed Production Bore - Tested

Hydroilex Pty Ltd www.hydroilex.com.au	UTM: - Oct-21 Drawn: RJL Approved: RJL	Proposed Iceton Place Development - Iceton Investments Pty Ltd - 7 Iceton Place, Yass NSW **Aerial Plan showing Proposed Water Supply Bore**	**Figure: 1**

APPENDIX 1

Iceton Subdivision_Yass_Linear-time Drawdown & Recovery - Pumping at 1.5 L/s for 40 hours



Figure_App.1_1

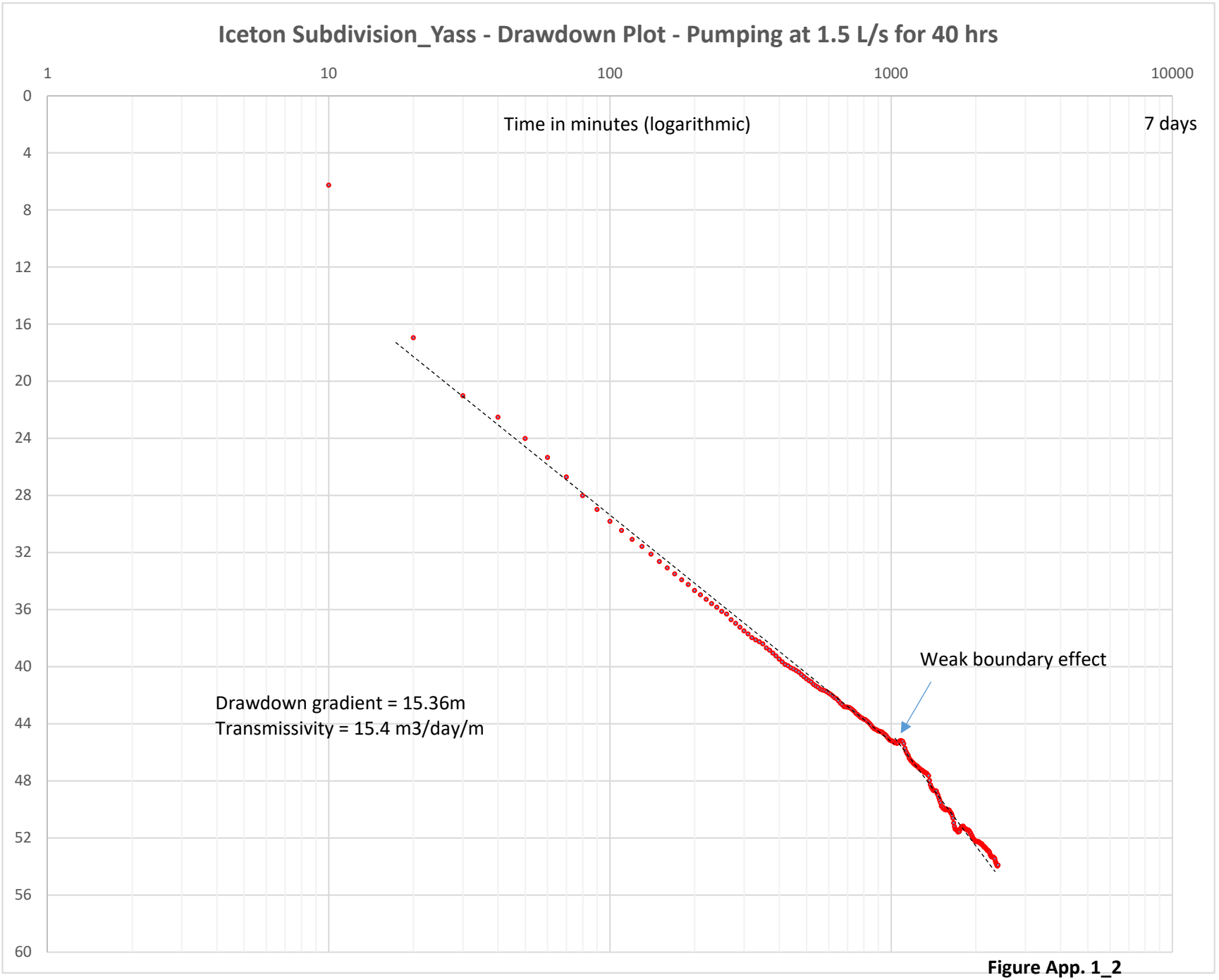


Figure App. 1_2

APPENDIX 2

Department of Primary Industries Water

Form A Particulars of completed work

Page 1

Driller's Licence No:	1C3019	1
Class of Licence:	6	
Driller's Name:	William Overall	
Assistant Driller:		
Contractor:		
New bore	✓	Replacement bore
Deepened		Enlarged
Reconditioned		Other (specify)
Final Depth	125 m	

Work Licence No:	40BL192833	2
Name of Licensee:	iceton investments	
Intended Use:		
Completion Date:		

DRILLING DETAILS 3

From (m)	To (m)	Hole Diameter (mm)	Drilling Method See Code 3
0	125	203	9

WATER BEARING ZONES 4

From (m)	To (m)	Thickness (m)	S W L (m)	Estimated Yield (L/s) Individual Aquifer	Estimated Yield (L/s) Cumulative	Test method See Code 4		D D L at end of test (m)	Duration Hrs	Duration min	Salinity (Conductivity or TDS) Cond (µS/cm)	Salinity (Conductivity or TDS) TDS (mg/L)
55	56	1		0.2	0.2	1	H			30		
104	105	1		1	1.2	1	H			30		
118	119	1		0.6	1.8	1	H		1	30		

CASING / LINER DETAILS 5

Material Code 5	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Method Fixing Code 5
9	219	4.8	0	20	5
5	150		0	60	4
6	150		60	125	4

Casing support method — See Code 5: 4

Type of casing bottom — See Code 5: 1

Centralisers installed (Yes/No): (indicate on sketch)

Sump installed (Yes/No): From m To m

Pressure cemented (Yes/No): From m To m

Casing Protector cemented in place

WATER ENTRY DESIGN 6

General Material Code 5	General OD (mm)	General Wall Thickness (mm)	General From (m)	General To (m)	General Opening type See Code 6	General Fixing See Code 5	Screen Aperture (mm)	Slot Details Length (mm)	Slot Details Width (mm)	Slot Details Alignment See Code 6
6	150		70	76	3	4	2.5			H
6	150		105	120	3	4	2.5			H

GRAVEL PACK 7

Type	Grade	Grain size (mm) From	Grain size (mm) To	Depth (m) From	Depth (m) To	Quantity Litres	Quantity m³
Rounded ✓	Graded ✓	2	4	25	125		
Crushed	Ungraded						

Bentonite/Grout seal (Yes/No): ✓

Method of placement of Gravel Pack — See Code 7: 1

For Departmental use only: G W

Please submit forms to water.gds@dpi.nsw.gov.au or to the local NSW Office of Water agency

Department of Primary Industries
Water

Form A Particulars of completed work

Work Licence No:

BORE DEVELOPMENT — 8

Chemical used for breaking down drilling mud (Yes/No)		Name:											
Method	Bailing/Surging		Jetting		Airlifting		Backwashing		Pumping		Other:		
Duration		hrs		hrs	2-5	hrs		hrs		hrs		hrs	

DISINFECTION ON COMPLETION — 9

Chemical(s) used	Quantity applied (Litres)	Method of application
Chlorine		

PUMPING TESTS ON COMPLETION — 10

Test type		Date	Pump intake depth (m)	Initial Water Level (SWL) (m)	Pumping rate (L/s)	Water Level at end of pumping (DDL) (m)	Duration of Test (hrs)	Recovery: Water level (m)	Recovery: Time taken (hrs)	Recovery: Time taken (mins)
Multi stage (stepped drawdown)	Stage 1									
	Stage 2									
	Stage 3									
	Stage 4									
Single stage (constant rate)		19-21.9.21	110	+0.5	1.5	53.9	48	2		20

Height of measuring point above ground level ____ m Test Method ____ See Code 4 ____

WORK PARTLY BACKFILLED OR ABANDONED — 11

Original depth of work: ____ m Is work partly backfilled: (Yes/No) ____

Is work abandoned: (Yes/No) ____ Method of abandonment: Backfilled ☐ Plugged ☐ Capped ☐

Has any casing been left in the work (Yes/No) ____ From ____ m To ____ m

Sealing / fill type (See Code 11)	From depth (m)	To depth (m)	Sealing / fill type (See Code 11)	From depth (m)	To depth (m)

12

Site chosen by: Hydrogeologist ☐ Geologist ☐ Driller ☐ Diviner ☐ Client ☐ Other ____

13

Lot No ____ DP No ____

Work Location Co ordinates Easting ____ Northing ____ Zone 54

GPS: (Yes/No) ____ >> AMG/AGD ☐ or MGA/GDA ☐ (See explanation)

Longitude ____ Latitude ____

Please mark the work site with "X" on the CLID provided map.

Indicate also the distances in metres from two (2) adjacent boundaries, and attach the map to this Form A package.

Signatures:

Driller: _____ **Licensee:** _____

Date: _____ **Date:** _____

Please submit forms to water.gds@dpi.nsw.gov.au or to the local NSW Office of Water agency

Department of Primary Industries Water

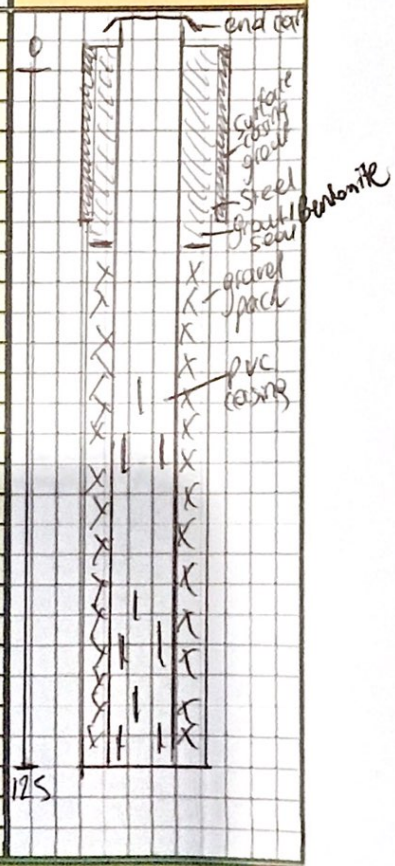
Form A Particulars of completed work

Work Licence No:

DRILLER'S ROCK/STRATA DESCRIPTION (LITHOLOGY)

Depth From (m)	Depth To (m)	Description (See Code 15)
0	3	Clay
3	50	calcerous shales - quartz & limestone inserts
50	105	Basalt
105	114	Basalt - limestone inserts
114	125	Basalt

15 WORK CONSTRUCTION SKETCH



WORK NOT CONSTRUCTED BY DRILLING RIG 16

Method of excavation: Hand dug ☐ Back hoe ☐ Dragline ☐ Dozer ☐ Other ☐

Depth (m)	Length (m)	Width (m)	Diameter (m)	Lining material	Dimentions of liner (m)	From Depth (m)	To Depth (m)

Please attach copies of the following if available 17

Geologist log (Yes/No) ☐ Laboratory analysis of water Sample (Yes/No) ☐ Pumping test(s) (Yes/No) ☐

Geophysical log (Yes/No) ☐ Sieve analysis of aquifer material (Yes/No) ☐ Installed Pump details (Yes/No) ☐

APPENDIX 3

0 0.00 True

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2135123**	Page	: 1 of 4
Client	: **HYDROILEX**	Laboratory	: Environmental Division Sydney
Contact	: John Lee	Contact	: Customer Services ES
Address	: 5-7 William Street Molong 2866	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9540 1029	Telephone	: +61-2-8784 8555
Project	: ICETON SUBDIVISION, YASS	Date Samples Received	: 29-Sep-2021 13:15
Order number	: hex_9_1	Date Analysis Commenced	: 29-Sep-2021
C-O-C number	: ----	Issue Date	: 06-Oct-2021 11:47
Sampler	: John Lee		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

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.

- Radiological analysis will be undertaken by ALS WRG Canberra, NATA accreditation no. 992, site no. 1531. The estimated TAT for this analysis is 15 working days.
- Only approved EPA methods for the analysis of water pollutants in New South Wales are used: pH by classical APHA 4500 H+B and in-house EA005; EC by classical APHA 2510 and in-house EA010.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Hex-Keton	----	----	----	----
				Sampling date / time	22-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2135123-001	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.85**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**1190**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**840**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**476**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**476**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**17**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**114**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**20**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**10**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**252**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**2**	----	----	----	----
EG020T: Total Metals by ICP-MS									
Silver	7440-22-4	0.001	mg/L		<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.22**	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.276**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.005**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.016**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Hex-Keton	----	----	----	----
				Sampling date / time	22-Sep-2021 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2135123-001	--------	--------	--------	--------
					Result	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS - Continued									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK025G: Free cyanide by Discrete Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**5.3**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.23**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.23**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**13.1**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**12.8**	----	----	----	----
ø Ionic Balance	----	0.01	%		**0.95**	----	----	----	----