MEMORANDUM **Job 10684**

To: Darren de Klerk (Central Hawke's Bay District Council) & Hamish Lowe (Lowe Environmental Impact)

From: Eise Venter (Lowe Environmental Impact)

Date: 2nd of August 2021

Subject: P:B.14d – Initial Piezometer Water Quality & Field Data

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This memo provides feedback on the findings of slug tests performed and water sampling undertaken on 15 July 2021, at five recently installed monitoring piezometers at Porangahau.

BACKGROUND

Five new monitoring piezometers were installed during 7 – 9 June 2021, as part of the groundwater assessment phase of the Porangahau wastewater project. This included three piezometers on the property of Gordon Stoddart, located to the west of the Porangahau River. An additional two piezometers were installed to the east of the Porangahau River, including one on the Cutbush managed property, and one piezometer on the Country Club golf course.

Slug tests were undertaken to obtain an understanding of hydraulic conductivity across the site.

Groundwater sampling and testing was undertaken to obtain an initial understanding of the groundwater quality across the site.

OBJECTIVES

The objectives at the five new monitoring piezometers were as follows:

- Undertake slug testing;
- Measure groundwater levels;
- Purge until water is running clear; and
- Undertake sampling.

MONITORING LOCATIONS

The respective monitoring locations are described in Table 1 and illustrated in Figure 1.

Table 1: Porangahau Monitoring Locations

Bore ID	Location	Coordinates (WGS84, Decimal Degrees)
PP1d	Stoddart Property	-40.29615; 176.65044
PP2s	Stoddart Property	-40.29078; 176.65329
PP2d	Stoddart Property	-40.29077; 176.65329
PP3d	Cutbush Block	-40.29836; 176.65488
PP4s	Country Club Golf Course	-40.29997; 176.66020

Figure 1: Monitoring Locations

SLUG TESTING

All five new piezometers were slug tested to get an understanding of hydraulic conductivity (K) across the site. A portable slug was sunk into each 50 mm PVC piezometer and retrieved to measure water level recovery. The slugs used measured 1,480 x 38 mm as is illustrated in Figure 2. Automated water level loggers set to record at 1 second intervals were installed in each piezometer prior to slug testing.

Recovery data retrieved from the loggers will be processed and analysed to provide hydraulic conductivity in metres per day (m/d). Each piezometer was slug tested multiple times, with the data being able to be averaged to provide a hydraulic conductivity. The number of tests performed at each piezometer are presented in **Table 1**, with the construction of each detailed in Table 3. Reference can be made to the attached spreadsheet for the slug testing data obtained.

Figure 2: Slug Design

Table 1: Slug Tests Performed

Piezometer ID	No. of tests conducted
PP1d	3
PP2s	3
PP2d	3
PP3d	4
PP4s	4

Table 3: Piezometer Construction Summary

Bore ID	GW Level (15 Jul 2021)	Bore Depth	Blank PVC Pipe Section:	Slotted PVC Pipe Section:	Geosock Section:	Security
	mbgl	m	m	m	m	
PP1d	2.81	15.0	0 - 11	11 - 14	10 - 14	Flush mount toby box
PP2s	3.09	5.0	0 - 2	2 - 5	1 - 5	Flush mount toby box
PP2d	3.12	10.5	0 - 7	7 - 10	6 - 10	Flush mount toby box
PP3d	3.39	12.0	0 - 9	9 - 11	8 - 11	Flush mount toby box
PP4s	2.84	7.5	0 - 2.5	2.5 - 4.5	2 - 4.5	Flush mount toby box

GROUNDWATER LEVEL MONITORING

Groundwater levels were firstly recorded at all piezometers. Water levels were recorded in metres below ground level (mbgl) as measured from the top lip of the flush-mounted toby box, which is installed level with ground level. Groundwater levels recorded are detailed in Table 3.

GROUNDWATER SAMPLING METHODOLOGY

As per standard groundwater sampling methodology[1], the aim was to purge three times the volume of water from the each of the respective piezometers, and thereafter take a water sample representative of the surrounding aquifer.

Groundwater was extracted by means of a peristaltic pump. Three times the bore volume of water was purged from each of respective piezometers without obtaining completely clear water. Due to the relative fast recharge observed at all the piezometers, additional water was purged from each until the appearance was acceptable for laboratory analyses. The final water appearance before sampling ranged from hazy to slightly murky. Table 4 provides a summary of the field observations made during sampling.

[1] NEMS, 2019. Water Quality Part 1 - Sampling, Measuring, Processing and Archiving of Discrete Groundwater Quality Data

Table 4: Field Observations Summary

Sampling Location	Volume Required to Purge 3 x Standing Volume (L)	Approximate Volume Purged before Sampling	Water Sample Colour	Comments
PP1d	63	100	Murky	Fast recharge
PP2s	11	60	Murky	Fast recharge
PP2d	40	100	Murky	Fast recharge
PP3d	46	60	Hazy	Very fast recharge
PP4s	11	40	Hazy	Very fast recharge

WATER QUALITY RESULTS

The water quality results obtained consists of in-situ field measurements obtained by means of a calibrated multimeter (Table 5), as well as laboratory test results received (Table 6).

Table 3: Water Quality - Field Measurements (15/07/2021)

Piezometer	Temp	DO	DO	EC	pH	Redox
	°C	%	mg/L	SPC µS/cm	pH units	ORP mV
PP1d	15.3	10.4	1.00	1758	6.22	-1.4
PP2s	14.4	71.3	7.30	1067	7.77	215.8
PP2d	15.2	16.4	1.64	809	7.60	-1.2
PP3d	15.4	9.6	0.95	5987	7.16	1.7
PP4s	15.5	9.1	0.91	969	7.20	794.0

Table 4 – Water Quality: Laboratory Results (15/07/2021)

Piezometer	S_cBOD_5	SS	Cl	N Total	NH_3-N	NO_2-N	NO_3-N	P Total	DRP	E. coli
	g/m^3	g/m^3	g/m^3	g/m^3	g/m^3 NH^3-N	g/m^3 NO^2-N	g/m^3 NO^3-N	g/m^3	g/m^3 PO^4-P	MPN/ 100 mL
PP1d	3	71	318	1.40	1.080	0.257	<0.020	0.12	<0.005	<10
PP2s	1	46	158	17.00	0.028	0.123	17.800	0.21	0.011	<10
PP2d	3	51	85	5.00	0.082	0.135	4.680	0.08	<0.005	10
PP3d	1	38	1810	0.42	0.332	<0.050	<0.005	0.01	<0.005	<10
PP4s	2	40	134	0.18	0.071	0.076	<0.005	0.04	0.005	41

If you have any questions, please do not hesitate to get in contact.

Yours sincerely,

Lowe Environmental Impact

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