Real-Time Water Quality Report

Grieg NL Nurseries Ltd Monitoring Well

Deployment:
December 3, 2024 to March 13, 2025

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment & Climate Change
Water Resources Management Division

Prepared by:

Tara Clinton
Environmental Scientist
Water Resources Management Division
Department of Environment & Climate Change
4th Floor, Confederation Building, West Block
St. John's NL A1B 4J6
Ph. No.: (709) 729 - 5925
taraclinton@gov.nl.ca

Grieg Monitoring Well

The Water Resources Management Division (WRMD) in partnership with Grieg NL Nurseries Ltd, maintain a real-time water quality groundwater monitoring station. The station is located near the Marystown YMCA and Track and Field Complex.

Grieg Seafood has two wells: a main production well that provides new water to the facility as needed; and a monitoring/backup well that houses the WRMD monitoring equipment. Both wells are functioning in good condition. In the event of a catastrophic failure of the main well, the monitoring well can serve as a backup.

To ensure the pump installed in the monitoring/backup well is functioning, the pump is operated periodically. Due to this groundwater well sharing its aquifer with the main pumping well, variations in the water parameters could be a result of pumping from either well. The water monitoring equipment, a YSI EXO1, is not removed during the pump test and as a result, there may be disruptions to the water quality data for a short period of time. Data can also be disrupted during routine calibration and maintenance of equipment by WRMD.

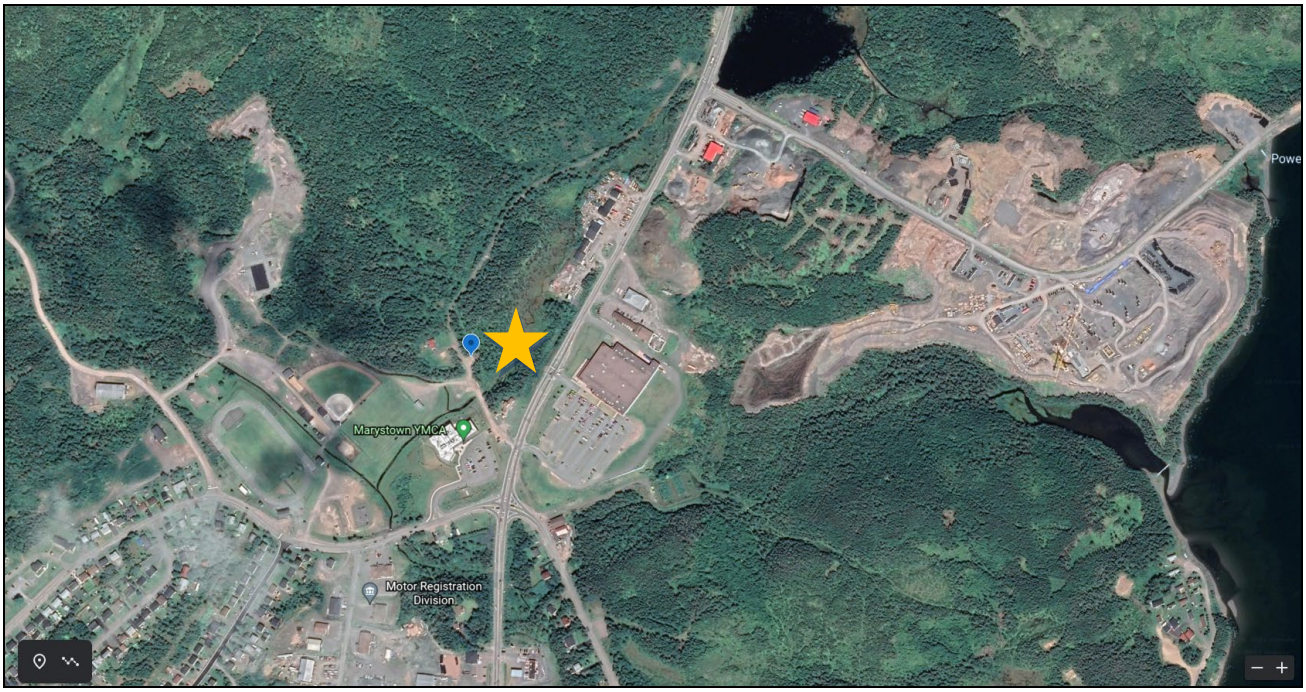

Figure 1: Location of Real-Time Groundwater Well

Figure 2: Hut Structure for groundwater well

Figure 3. View standing in front of well looking toward main road in Marystown, NL

Figure 4: Well Casing in the hu

Figure 5: View looking into well

Quality Assurance and Quality Control

WRMD staff (Environment & Climate Change (ECC)) are responsible for maintenance of the real-time water quality monitoring equipment, as well as recording and managing the water quality data. Grab samples are collected at the beginning of each deployment period to compare against the initial in-situ logged data. The samples are collected from an internal tap located in the station hut. Grab samples complement the real-time data and provide an extra source of water quality data for comparisons when tracking changes over time at the station (Table 1). Combining both types of data can offer a more comprehensive understanding of the water quality.

Initial in-situ instrument measurements are recorded shortly after the freshly calibrated instrument is deployed. The limited time for the sonde to reach equilibrium with its surroundings can occasionally lead to variations in values between grab sample results and instrument measurements.

Table 1: Comparison of the In-Situ instrument vs. Grab Sample Results at deployment of new instrument

Date	Parameter	Grab Sample Result	In-Situ Result
Deployment: Dec 3, 2024	**pH (pH units)**	7.99	7.42
	Specific Conductivity (µS/cm)	340	307.33
Removal: March 12, 2025	**pH (pH units)**	8.02	7.81
	Specific Conductivity (µS/cm)	330	413.4

Water Temperature

Between December 3, 2024 and March 12, 2025 the water temperature fluctuated within the range of 7.31°C to 7.62°C, as illustrated in Figure 6. The average water temperature across the deployment was at 7.3°C.

The water temperatures remain consistent throughout the deployment. Due to the depth of the instrument in the well, there is very little influence from air temperatures on the water, therefore there is minimal variance between the minimum and maximum values.

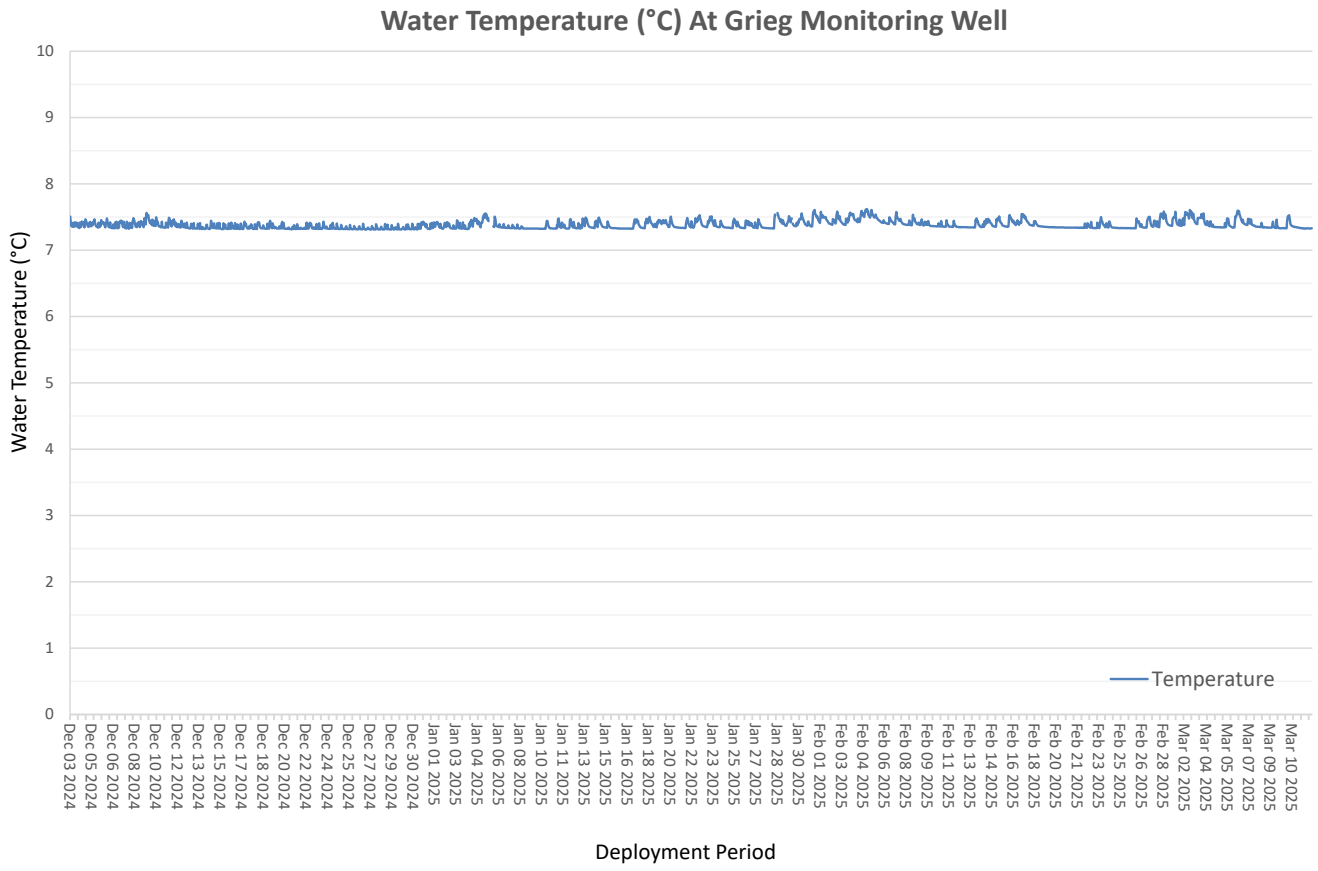

Figure 6: Water temperature (°C) values

pH

Between December 3, 2024 to March 12, 2025, pH values exhibited a range from 7.7 pH units to 8.00 pH units. Throughout the deployment, pH remained reasonably consistent, with an average of 7.9 pH units.

A pH sensor measures the acidity or alkalinity of a water body and is a measure of the concentration of hydrogen ions (H^+) in a solution. Minor pH fluctuations were likely a consequence of aquifer pumping activities. The well's refilling process and subsequent level adjustments led to temporary variations in pH levels, as depicted in Figure 7.

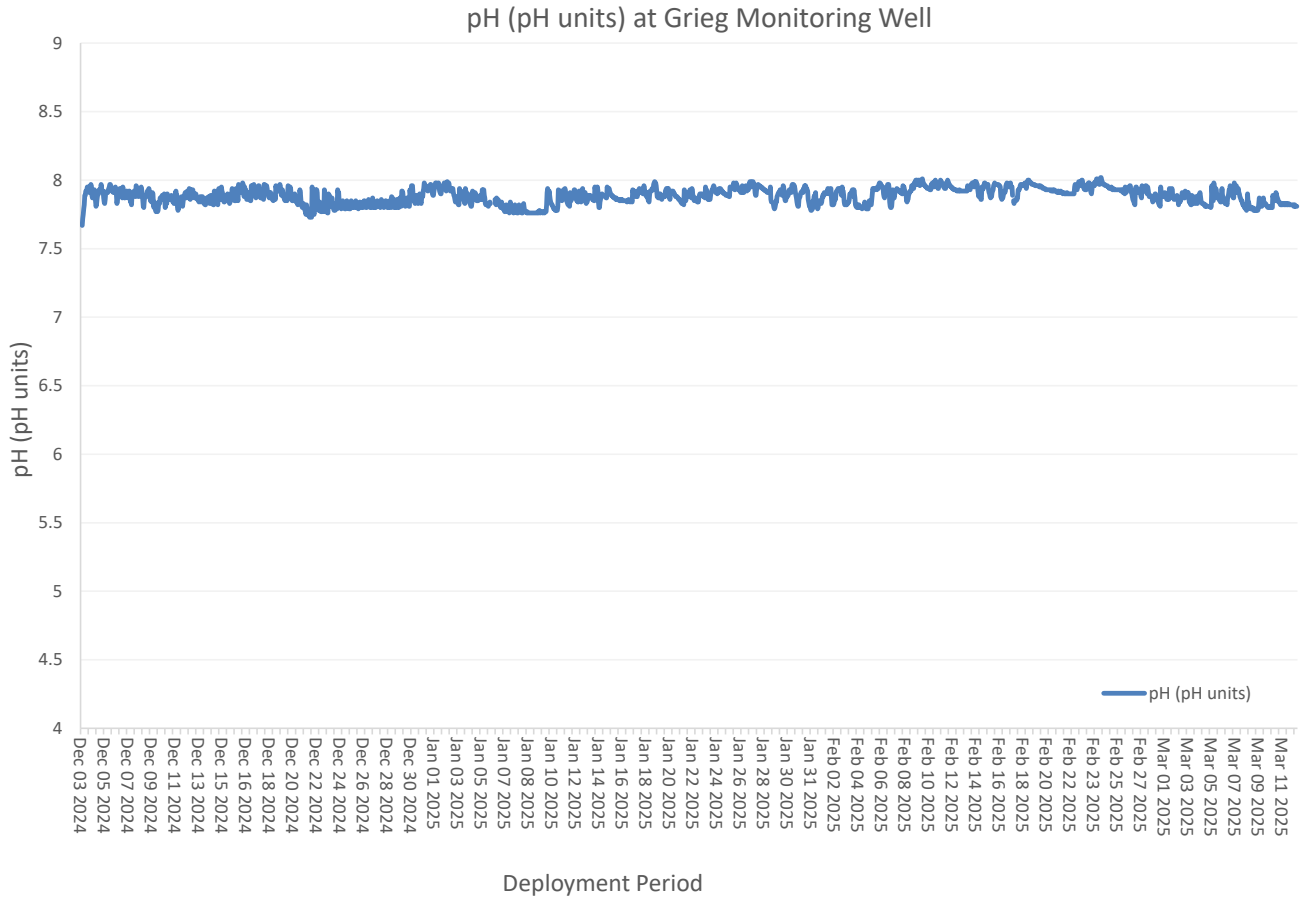

Figure 7: pH (pH units) values

Specific Conductivity & Total Dissolved Solids (TDS)

Throughout the deployment, conductivity levels were within 248.88 µS/cm and 421.61 µS/cm (Figure 8), with an average of 311.2 µS/cm. The specific conductivity probe measures the presence of diluted salts and inorganic materials in a water source. In instances where there is minimal or no external influence, the conductivity in the groundwater well remains relatively stable, experiencing minimal fluctuations (Figure 8). Elevated spikes in conductivity are likely attributed to pumping activities and disturbances within the aquifer which can disrupt the water column (Figure 9).

Total Dissolved Solids data is derived from the specific conductivity data. The water quality instrument is programmed to calculate an estimated TDS value from a conductivity value. TDS data will mirror the movement of the specific conductivity data, however the TDS is calculated in g/L (Figure 10). For the deployment, TDS ranged within 0.16 g/L to 0.27 g/L.

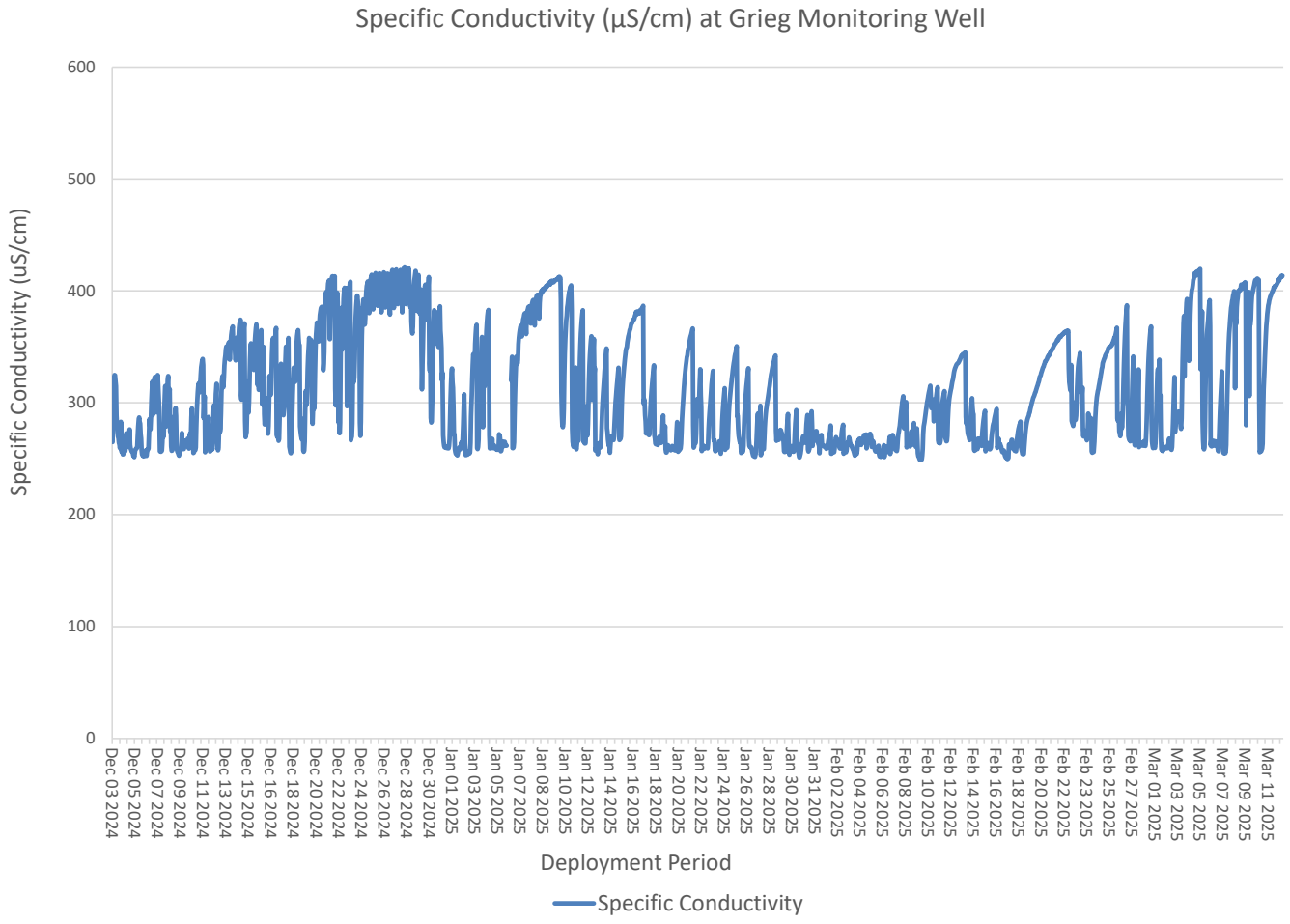

Figure 8: Specific conductivity (µS/cm) values

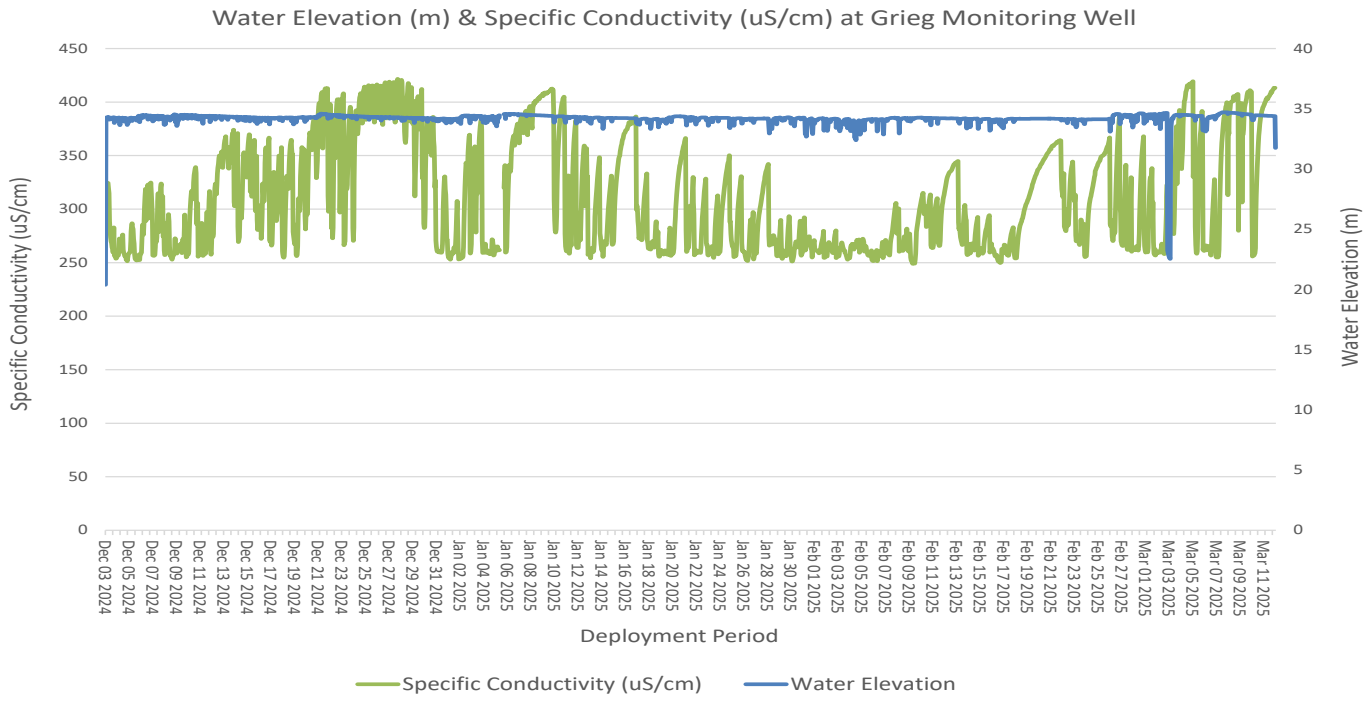

Figure 9: Specific Conductivity & Water Elevation

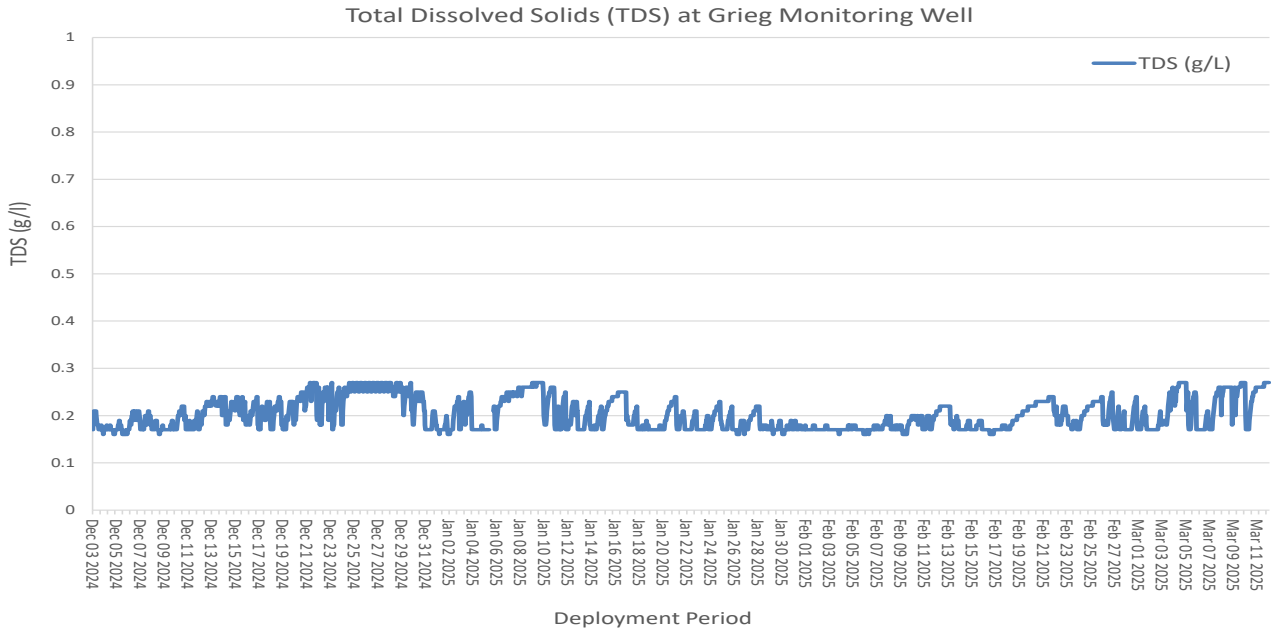

Figure 10: Total Dissolved Solids (TDS)

Oxidation-Reduction Potential (ORP)

ORP levels during the deployment ranged within 82.1 mV to 378.2 mV, with an average of 271.2 mV. As expected, due to periodic pumping of the well, fluctuations in ORP levels were observed, but values generally remained within typical ranges over the course of the deployment. The variations in ORP values throughout the deployment are visually evident in Figure 11, showcasing dips and increases. It's worth noting that ORP can take days to weeks to equilibrate in groundwater, which may explain the lower values observed at the beginning of the deployment period.

ORP, measuring the oxidizing-reduction potential of groundwater, plays a crucial role in identifying the mobility and persistence of contaminants that could impact water quality. The values can be influenced by local conditions, the presence of specific contaminants, and the geochemical characteristics of the aquifer. Natural aquifer materials may release specific chemicals, leading to concentration changes over time. pH and ORP are inversely related, therefore pH can also play a role in influencing ORP (Figure 12). ORP values are unique to each water body and collecting background data is essential for understanding the significance of changes in the data and their potential implications.

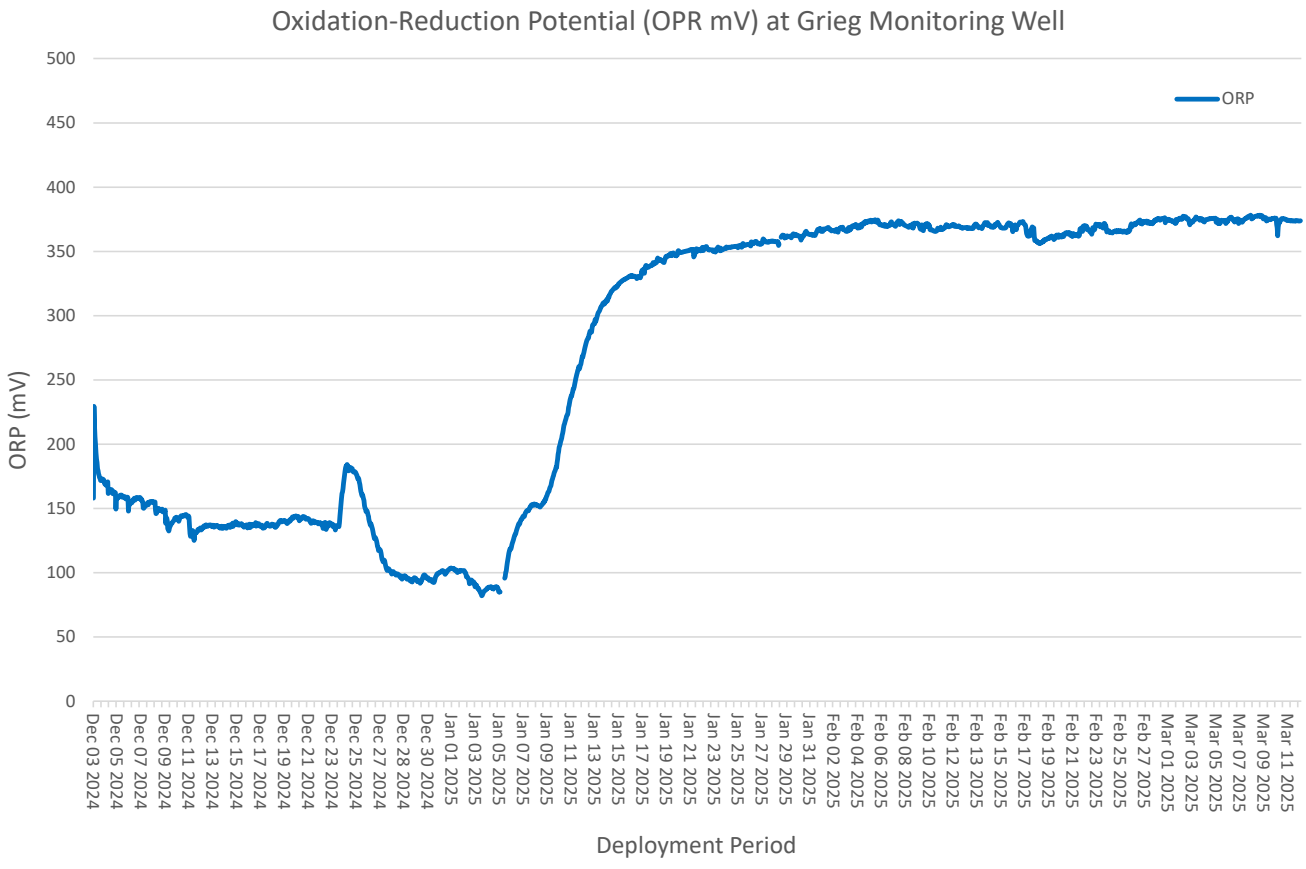

Figure 11: ORP values (mV)

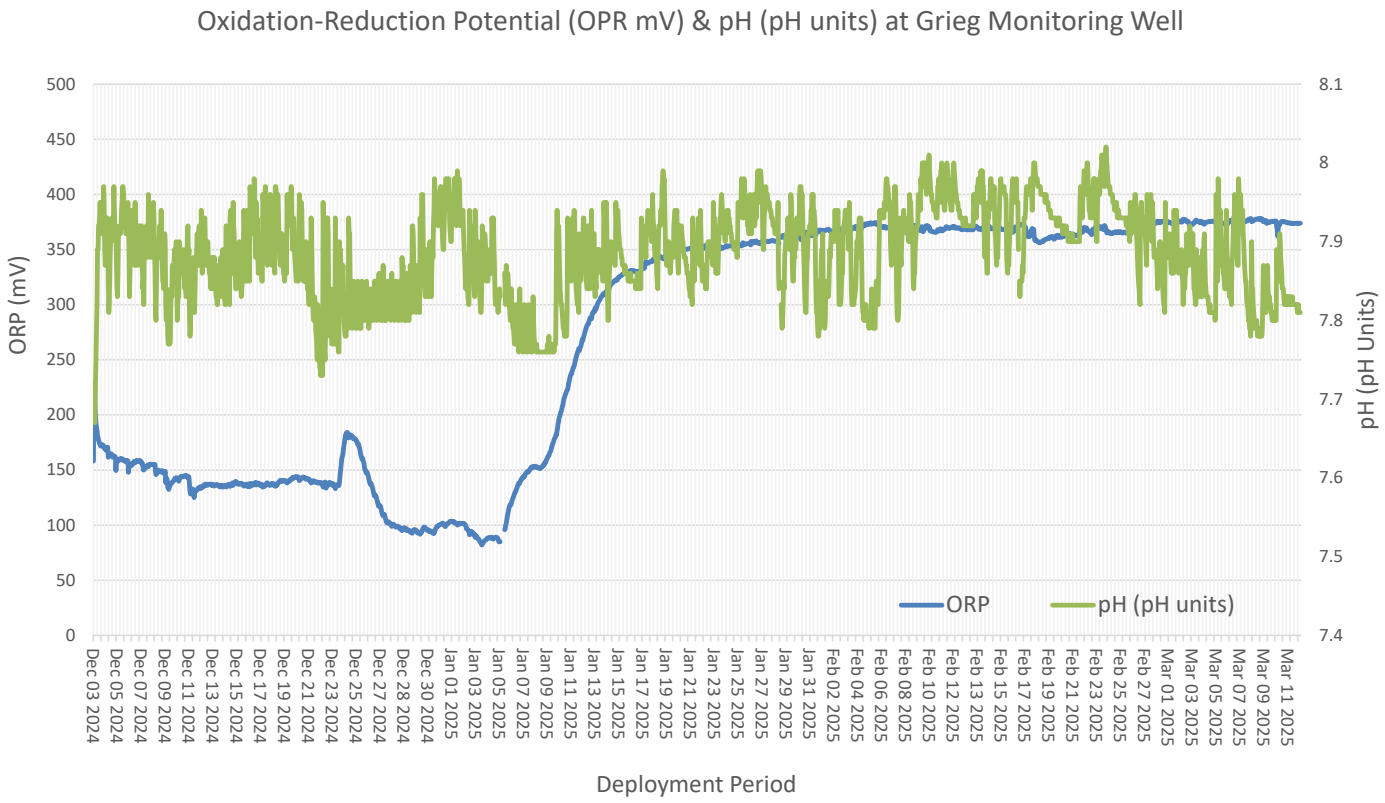

Figure 12: ORP (mV) graphed with pH (pH units) at Grieg Monitoring Well

Water Elevation

Water Elevation monitors the height of the water surface in the well measured to an assumed datum. Water Elevation at the monitoring well, ranged within 20.4 m to 34.7 m throughout the deployment, with an average of 34.2 m. Generally, the water elevation within this groundwater well remains constant. This well and its aquifer are intermittently accessed through pumping. There will be fluctuations in water elevation during deployment (Figure 13). Despite the larger dips in water elevation, the range of the elevation was reasonably consistent across the deployment.

Fluctuations in the water elevation do influence the other water parameters covered in this report. Figure 14 displays this relationship.

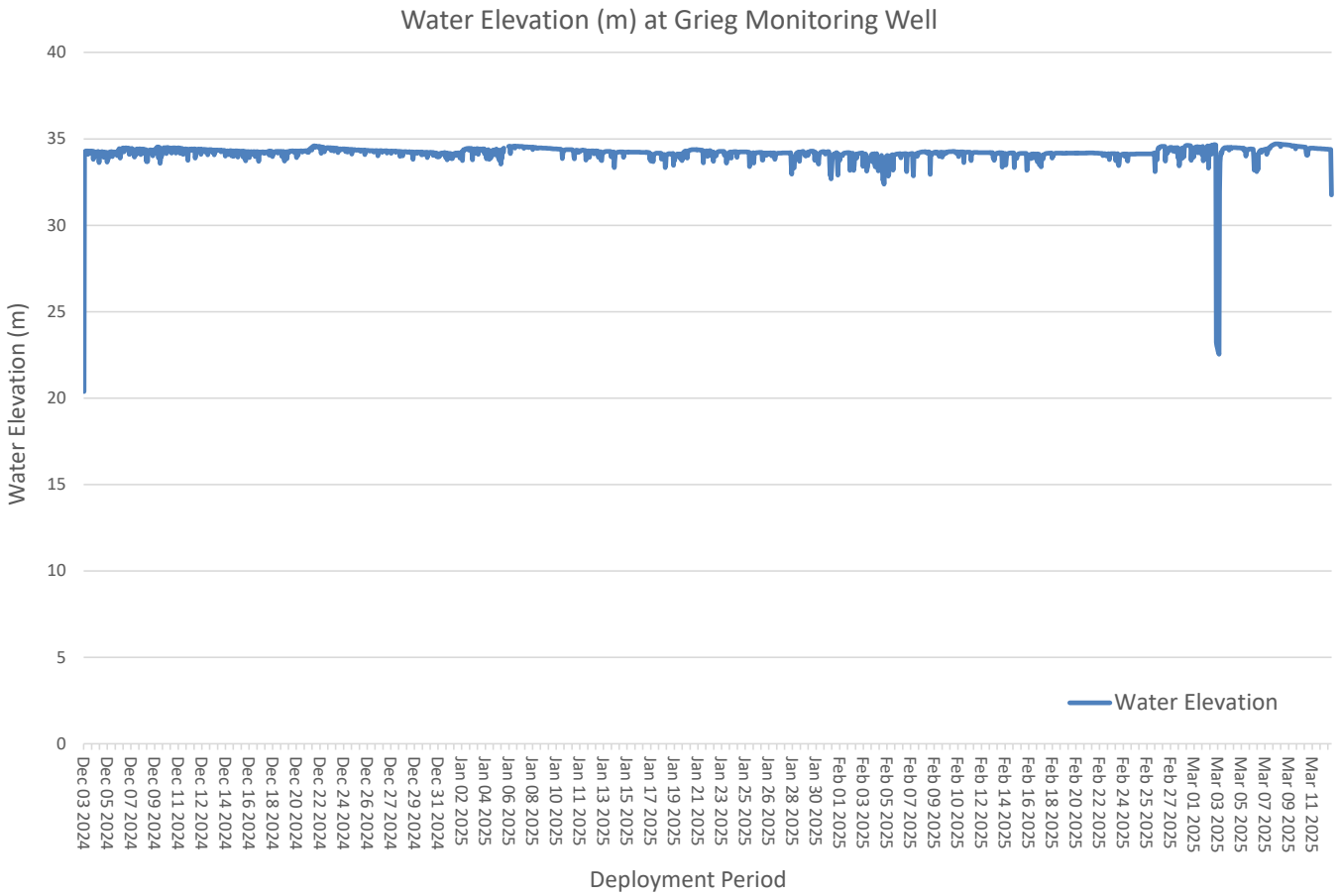

Figure 13: Water Elevation (m)

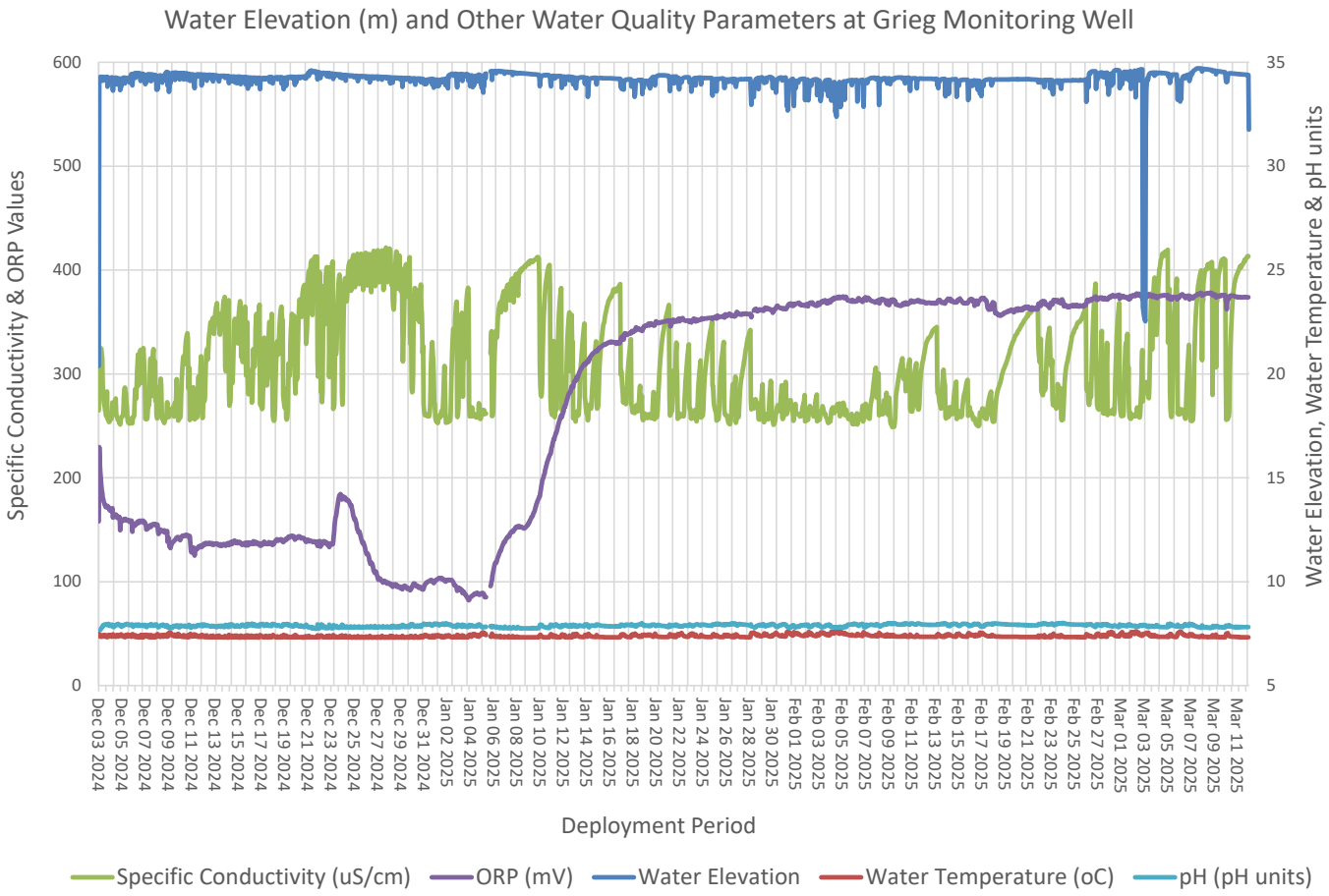

Figure 14: Water Elevation (m) and other water quality parameters.

Appendix I

Water Quality Statistics for Grieg Groundwater Well

Table 1:Water Quality Statistics for Grieg Groundwater Well: December 3, 2024 to March 12, 2025

Water Quality Parameters	Minimum	Maximum	Median	Mean
Water Temperature (°C)	7.31	7.62	7.36	7.38
pH (pH Units)	7.67	8.02	7.89	7.88
Specific Conductivity (µS/cm)	248.88	421.61	294.9	311.2
Total Dissolved Solids (g/L)	0.16	0.27	0.19	0.2
ORP (mV)	82.1	378.2	350.9	271.1
Water Elevation (m)	20.38	34.7	34.2	34.2

Appendix II

Grab Sample Results

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
AOYL67 GRIEG MONITORING WELL Sampling Date 2025/03/12 14:00 Matrix DR Sample # 2025-1900-00-SI-SP Registration # SA-0000								
RESULTS OF ANALYSES OF DRINKING WATER								
Calculated Parameters								
Hardness (CaCO3)	-	130	1.0	mg/L	N/A	2025/03/20		9891829
Nitrate (N)	-	0.24	0.050	mg/L	N/A	2025/03/21		9891832
Total dissolved solids (calc., EC)	-	190	1.0	mg/L	N/A	2025/03/21		9891906
Inorganics								
Conductivity	-	330	1.0	uS/cm	N/A	2025/03/20	M2C	9894303
Chloride (Cl-)	-	32	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Dup.Chloride (Cl-)	-	32	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Bromide (Br-)	-	ND	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Dup.Bromide (Br-)	-	ND	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Sulphate (SO4)	-	4.1	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Dup.Sulphate (SO4)	-	4.2	1.0	mg/L	N/A	2025/03/20	VP2	9893669
Total Alkalinity (Total as CaCO3)	-	110	2.0	mg/L	N/A	2025/03/20	M2C	9894304
Colour	-	ND	5.0	TCU	N/A	2025/03/21	MCN	9895125
Dissolved Fluoride (F-)	-	0.12	0.10	mg/L	N/A	2025/03/20	M2C	9894305
Total Kjeldahl Nitrogen (TKN)	-	0.17	0.10	mg/L	2025/03/18	2025/03/19	KJP	9893184
Nitrate + Nitrite (N)	-	0.24	0.050	mg/L	N/A	2025/03/21	MCN	9895124
Nitrite (N)	-	ND	0.010	mg/L	N/A	2025/03/21	MCN	9894819
Nitrogen (Ammonia Nitrogen)	-	ND	0.050	mg/L	N/A	2025/03/21	MCN	9895344
Dissolved Organic Carbon (C)	-	ND	0.50	mg/L	N/A	2025/03/20	SSI	9894275
Total Organic Carbon (C)	-	ND	0.50	mg/L	N/A	2025/03/18	SSI	9892851
pH	-	8.02		pH	N/A	2025/03/20	M2C	9894299
Total Phosphorus	-	ND	0.004	mg/L	2025/03/18	2025/03/20	VKH	9893185
Total Suspended Solids	-	1.0	1.0	mg/L	2025/03/19	2025/03/19	RD4	9893330
Turbidity	-	2.8	0.10	NTU	N/A	2025/03/20	M2C	9894787
MERCURY BY COLD VAPOUR AA (DRINKING WATER)								
Metals								
Total Mercury (Hg)	-	ND	0.000013	mg/L	2025/03/21	2025/03/21	JEP	9894722
ELEMENTS BY ICP/MS (DRINKING WATER)								
Metals								
Total Aluminum (Al)	-	0.041	0.0050	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Antimony (Sb)	-	ND	0.0010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Arsenic (As)	-	ND	0.0010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Barium (Ba)	-	0.086	0.0010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Boron (B)	-	ND	0.050	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Cadmium (Cd)	-	ND	0.000010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Calcium (Ca)	-	33	0.10	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Chromium (Cr)	-	ND	0.0010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Copper (Cu)	-	0.00056	0.00050	mg/L	2025/03/19	2025/03/20	MOA	9893341

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com

Bureau Veritas Job #: C528145
Report Date: 2025/03/24

NL Department of Environment, Climate Change and Municipalities
Your P.O. #: 224006869-3
Sampler Initials: TC

Sample Details/Parameters	A	Result	RDL	UNITS	Extracted	Analyzed	By	Batch
AOYL67 GRIEG MONITORING WELL Sampling Date 2025/03/12 14:00 Matrix DR Sample # 2025-1900-00-SI-SP Registration # SA-0000								
ELEMENTS BY ICP/MS (DRINKING WATER)								
Metals								
Total Iron (Fe)	-	0.13	0.050	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Lead (Pb)	-	ND	0.00050	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Magnesium (Mg)	-	11	0.10	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Manganese (Mn)	-	0.0081	0.0020	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Nickel (Ni)	-	ND	0.0020	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Phosphorus (P)	-	ND	0.10	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Potassium (K)	-	0.36	0.10	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Selenium (Se)	-	ND	0.00050	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Sodium (Na)	-	19	0.10	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Strontium (Sr)	-	0.32	0.0020	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Uranium (U)	-	0.00015	0.00010	mg/L	2025/03/19	2025/03/20	MOA	9893341
Total Zinc (Zn)	-	0.016	0.0050	mg/L	2025/03/19	2025/03/20	MOA	9893341

Bureau Veritas 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel: 902-420-0203 Toll-free: 800-565-7227 Fax: 902-420-8612 www.bvna.com