

Real Time Water Quality Deployment Report

Grieg NL Monitoring Well

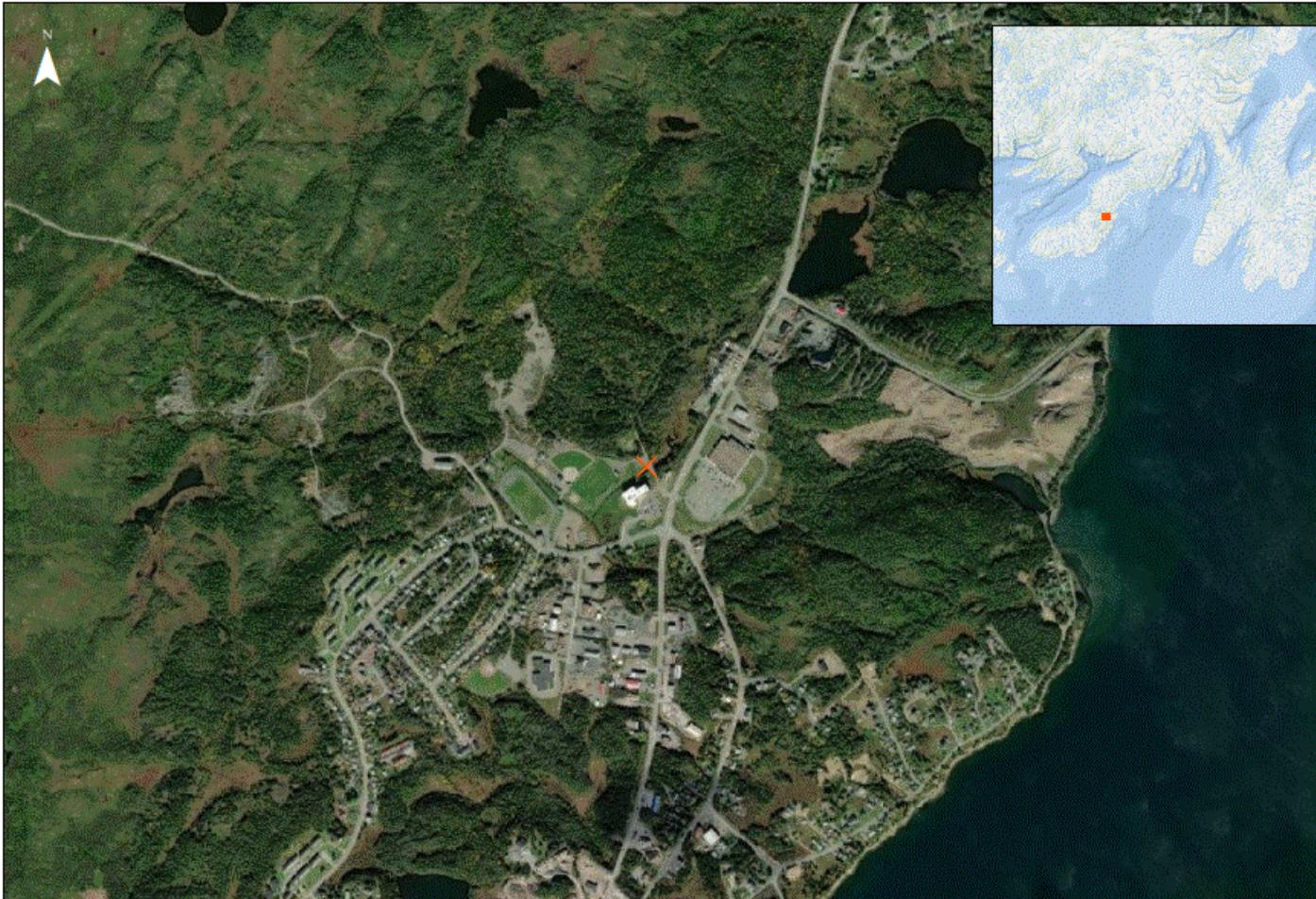
NLGWGA01

2024-04-03 to 2024-07-04



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

Grieg NL Monitoring Well



0 0.25 0.5 1 Kilometers

Grieg NL Monitoring Well
NLGWA01



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

Grieg Seafood has two wells: a primary production well responsible for supplying fresh water to the facility on demand, and a secondary well used for monitoring and backup purposes, housing the WRMD monitoring equipment. To ensure the effective operation of the pump installed in the backup well, the pump is initiated approximately once per week. This can result in variations and abrupt changes in the data collected by the water monitoring instrument.

Quality Assurance and Quality Control



As part of the Quality Assurance and Quality Control protocol (QA/QC), an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey. With the exception of water quantity data (elevation), all data used in the preparation of the graphs and subsequent discussion adhere to this stringent QA/QC protocol. Corrected data can be obtained upon request.

Parameter	Excellent	Good	Fair	Marginal	Poor
pH	$\leq \pm 0.2$ units	$\leq \pm 0.21 - 0.5$ units	$\leq \pm 0.51 - 0.8$ units	$\leq \pm 0.81 - 1$ units	$> \pm 1$ units
Specific conductance	$\leq \pm 3 \mu\text{S}/\text{cm}$ or $\leq \pm 3\%$, whichever is greater	$\leq \pm 3.1-10 \mu\text{S}/\text{cm}$ or $\leq \pm 3.1-10\%$, whichever is greater	$\leq \pm 10 - 15 \mu\text{S}/\text{cm}$ or $\leq \pm 10.1-15\%$, whichever is greater	$\leq \pm 15.1 - 20 \mu\text{S}/\text{cm}$ or $\leq \pm 15.1-20\%$, whichever is greater	$> \pm 20 \mu\text{S}/\text{cm}$ or $> \pm 20\%$, whichever is greater

At the beginning of the deployment period, grab samples are collected to compare against initial in-situ logged data. Values for pH and specific conductivity are compared between the instrument and the grab sample. Based on the degree of difference between parameters recorded by the Field Sonde and grab sample results at deployment, a qualitative statement is made on the data quality.

There are a few circumstances which may cause QA/QC rankings below excellent. Typically when the well is pumped to provide water for the grab sample, the pumping can disturb the water column including any diluted salts and inorganic materials that are present in the groundwater. Additionally, 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.

The temperature sensor on any sonde is the most important. All other parameters can be divided into subgroups of: temperature dependent, temperature compensated, and temperature independent. Due to the temperature sensor's location on the sonde, the entire sonde must be at a constant temperature before the temperature sensor will stabilize. The values may take some time to climb to the appropriate reading; if a reading is taken too soon it may not accurately portray the water body.

When comparing field data to grab sample data, pH ranked fair while specific conductivity ranked poor. This is likely due to the disturbance in the well from pumping prior to taking the sample.

Fair

pH Grab Sample Ranking

Poor

Spec. Conductivity Grab Sample Ranki...

PARAMETER	Field Value	Grab Sample	Difference
pH	7.48	7.99	-0.51
Specific Conductivity ($\mu\text{S}/\text{cm}$)	358.25	430.00	-71.75

Water Temperature

7.46

Average (°C)

7.45

Median (°C)

7.30

Minimum (°C)

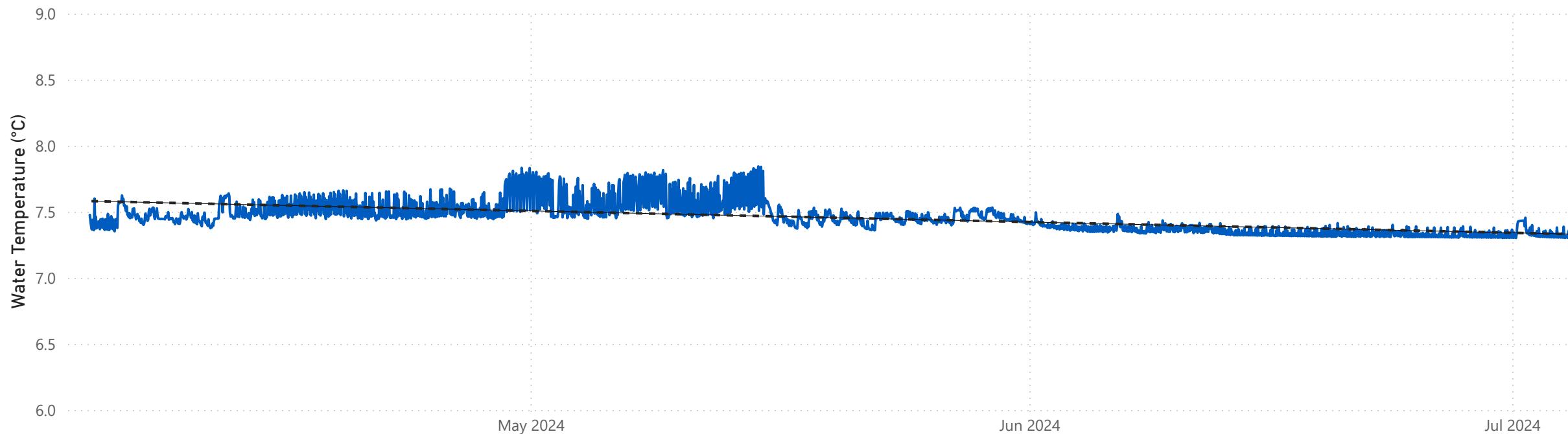
7.84

Maximum (°C)



Water temperature ranged from 7.30°C to 7.84°C during the deployment period. The average water temperature across the deployment is 7.46°C. Grieg's monitoring station is a groundwater well; generally, the water temperatures will remain consistent. This is evident during this deployment with the small range between minimum and maximum values. The water temperatures did not fluctuate significantly across the deployment. Increased fluctuations are observed until approximately mid-May due to the increased utilization of the monitoring well as the primary well underwent maintenance. Consequently, the monitoring well experienced more frequent usage and pumping activities.

Water Temperature (°C) at Grieg Monitoring Well



pH

7.80

Average of PH

7.77

Median of PH

7.45

Min of PH

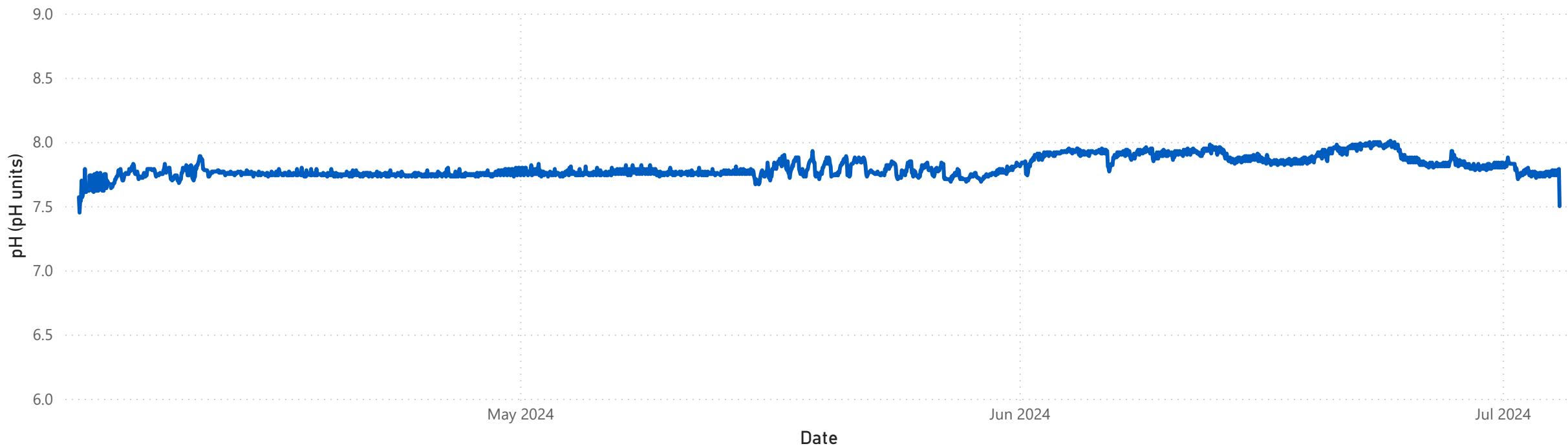
8.01

Max of PH



Throughout the deployment period, pH values ranged between 7.45 pH units and 8.01 pH units. The pH data remained consistent for the duration of the deployment, with a median of 7.80 pH units. Small changes in pH were likely the result of pumping within the aquifer. As the well refills and the level adjusts, there will be movement in the pH levels for a short period of time. Comparison of the grab sample data for pH indicated the grab sample of 7.99 pH, was slightly higher than what was recorded in-situ at 7.48 pH. It would be expected that these two pH results would vary slightly. The well was pumped throughout the morning before the sample was taken while the in-situ reading was recorded after the pumping of the well had stopped.

pH (pH units) at Grieg Monitoring Well



Oxidation-Reduction Potential (ORP)

270.61

Average ORP (mV)

314.90

Median ORP (mV)

31.90

Min ORP (mV)

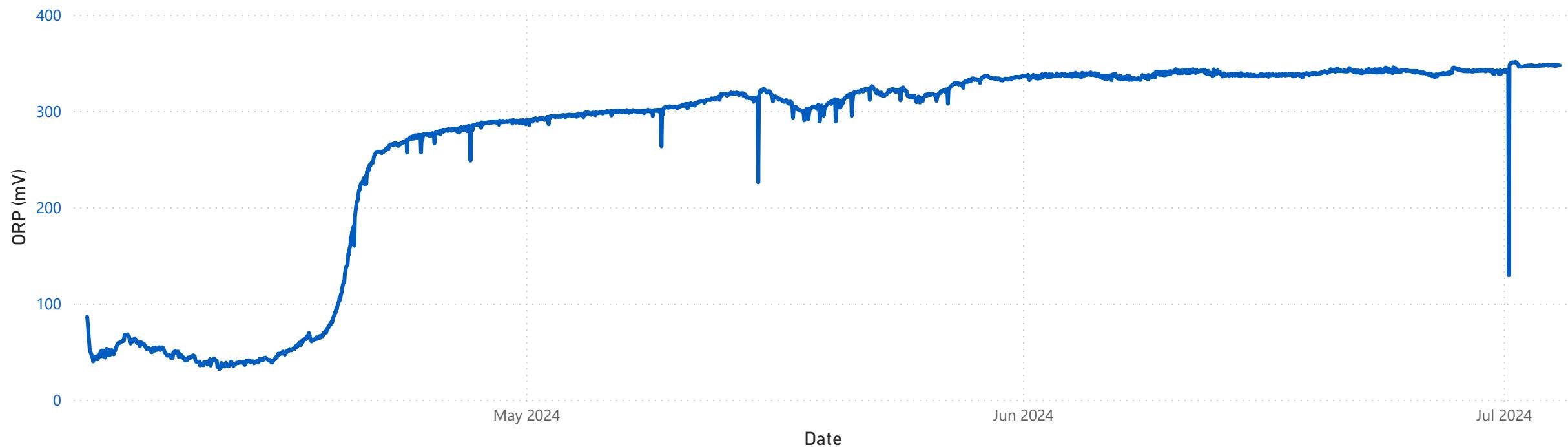
351.20

Max ORP (mV)



Throughout the deployment period, ORP values ranged between 31.90 mV and 351.20 mV with an average of 270.61 mV. ORP may require days to weeks to reach equilibrium with its surroundings, as illustrated in the figure below, where it initially rises at the start of deployment before stabilizing. The large dip on July 1st coincides with a drop in water elevation due to pumping of the well. ORP is individual and specific to each water body and gathering background data is essential in understanding what the changes in the data represent.

ORP (mV) at Grieg Monitoring Well



Specific Conductivity

326.51

Average $\mu\text{S}/\text{cm}$

344.80

Median $\mu\text{S}/\text{cm}$

252.68

Minimum $\mu\text{S}/\text{cm}$

520.33

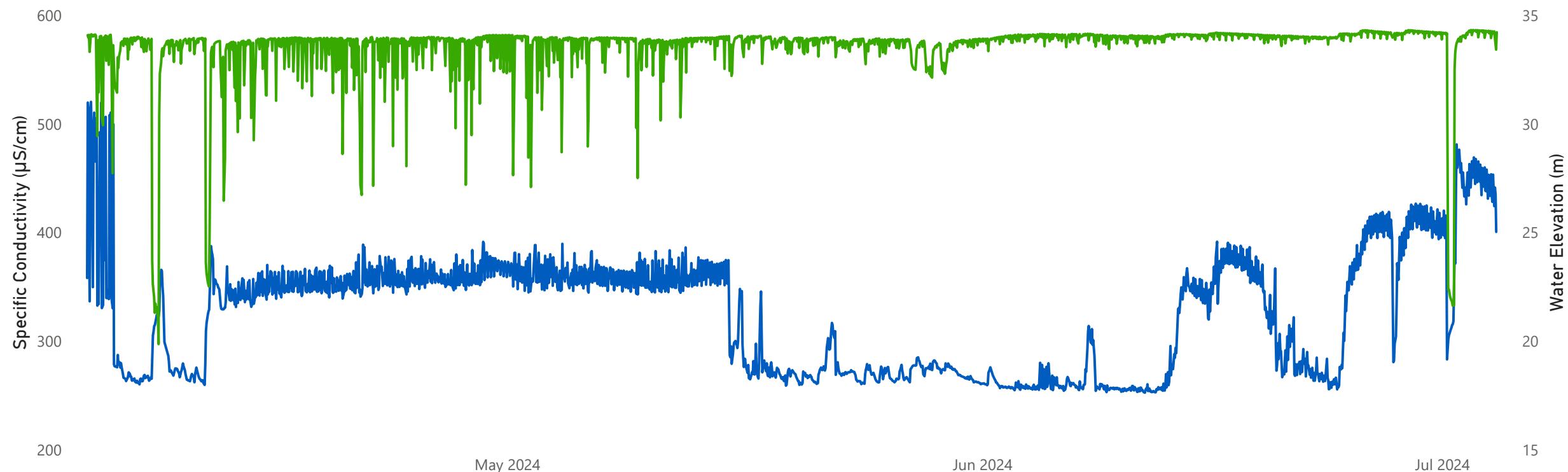
Maximum $\mu\text{S}/\text{cm}$



During the deployment, specific conductivity levels were within 252.68 $\mu\text{S}/\text{cm}$ and 520.33 $\mu\text{S}/\text{cm}$, with an average of 326.51 $\mu\text{S}/\text{cm}$. Comparison of the grab sample data for specific conductivity indicated the grab sample of 430.00 $\mu\text{S}/\text{cm}$, was slightly higher than what was recorded in-situ at 358.25 $\mu\text{S}/\text{cm}$. The higher spikes in conductivity are likely due to pumping within the aquifer, which can disrupt the diluted salts and inorganic materials that are present in the groundwater. When water elevation decreases (potentially due to pumping), it is followed by a sudden increase in specific conductivity. Conductivity was higher and more variable until mid-May, primarily due to increased use and pumping of the monitoring well while the primary well was undergoing maintenance. Several increases in conductivity were observed in late June, despite stable water levels. This may be attributed to changes in groundwater chemistry caused by seasonal fluctuations, external influences such as construction projects, or the accumulation of dissolved solids from prolonged pumping, leading to an increase in conductivity over time.

Water Elevation (m) and Specific Conductivity ($\mu\text{S}/\text{cm}$) at Grieg Monitoring Well

● Specific Conductivity ($\mu\text{S}/\text{cm}$) ● Water Elevation (m)



Total Dissolved Solids (TDS)

0.21

Average TDS (g/L)

0.22

Median TDS (g/L)

0.16

Min TDS (g/L)

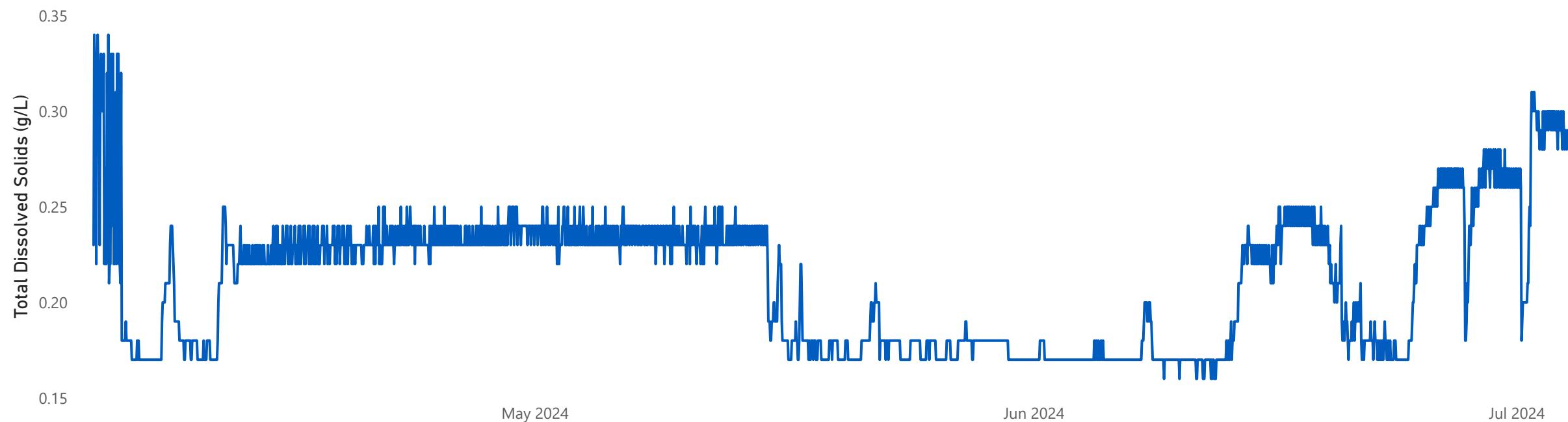
0.34

Max TDS (g/L)



For the deployment period, Total Dissolved Solids ranged within 0.16 g/L to 0.34 g/L, with an average of 0.21 g/L. 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 TDS is calculated in g/L.

Total Dissolved Solids (g/L) for Grieg Monitoring Well



Water Elevation (m)

33.57

Average (m)

33.92

Median (m)

19.87

Min (m)

34.32

Max (m)



For the deployment period, water elevation ranged within 19.87 m to 34.32 m, with an average of 33.57 m. Generally, water elevation within a groundwater well is consistent if the water is not drawn for use. The well is intermittently pumped, therefore there will be variations in water level as seen on the graph below. Increased fluctuations tend to occur until Mid-May due to the increased utilization and pumping of the monitoring well as the primary well underwent maintenance.

Water Elevation for Grieg Monitoring Well

