Real-Time Water Quality Report

Grieg NL Nurseries Ltd Monitoring Well

Deployment Period:
June 16, 2021 to August 24, 2021

Newfoundland Labrador

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

Prepared by:

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General

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

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 hut

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. Tara Clinton is ECC's main contact regarding the instrumentation and functionality of the monitoring well operation. Tara is responsible for maintaining and calibrating the water quality instrument, as well as grooming, analyzing and reporting on water quality data recorded at the station.

Grab samples are collected at the beginning of each deployment period to compare against the initial in-situ logged data. Grab samples compliment the real-time data and provide an extra source of water quality data for comparisons when monitoring changes over time at the station (Table 1).

It should be noted that 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.

Concerns or Issues during the Deployment Period

Real time water monitoring well equipment was installed in the back-up production well in November 2020, which was to be used only when the main well went offline. However, after installation of the real-time instrument, it was determined that water will be drawn from the well regularly, requiring the water quality instrument to be removed each time pumping is occurring. The removal of the instrument and the pumping of the water will disrupt the data set.

This groundwater well shares its aquifer with the main pumping well for the hatchery and variations in the water parameters could be a result of pumping from either well.

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

Parameter of Comparison	In-Situ Instrument	Grab Sample Result
pH (pH units)	7.2	8.03
Specific Conductivity (µS/cm)	293.71	290

Grieg Monitoring Well

Water Temperature

Water temperature ranged from 7.21°C to 7.84°C during the deployment period (Figure 6). The average water temperature across the deployment is 7.28°C.

Grieg's monitoring station is a groundwater well. Generally, water temperatures remain fairly consistent throughout deployments in groundwater. This is evident during this deployment.

The large spike in water temperature on July 4th, was likely a result of pumping from the aquifer.

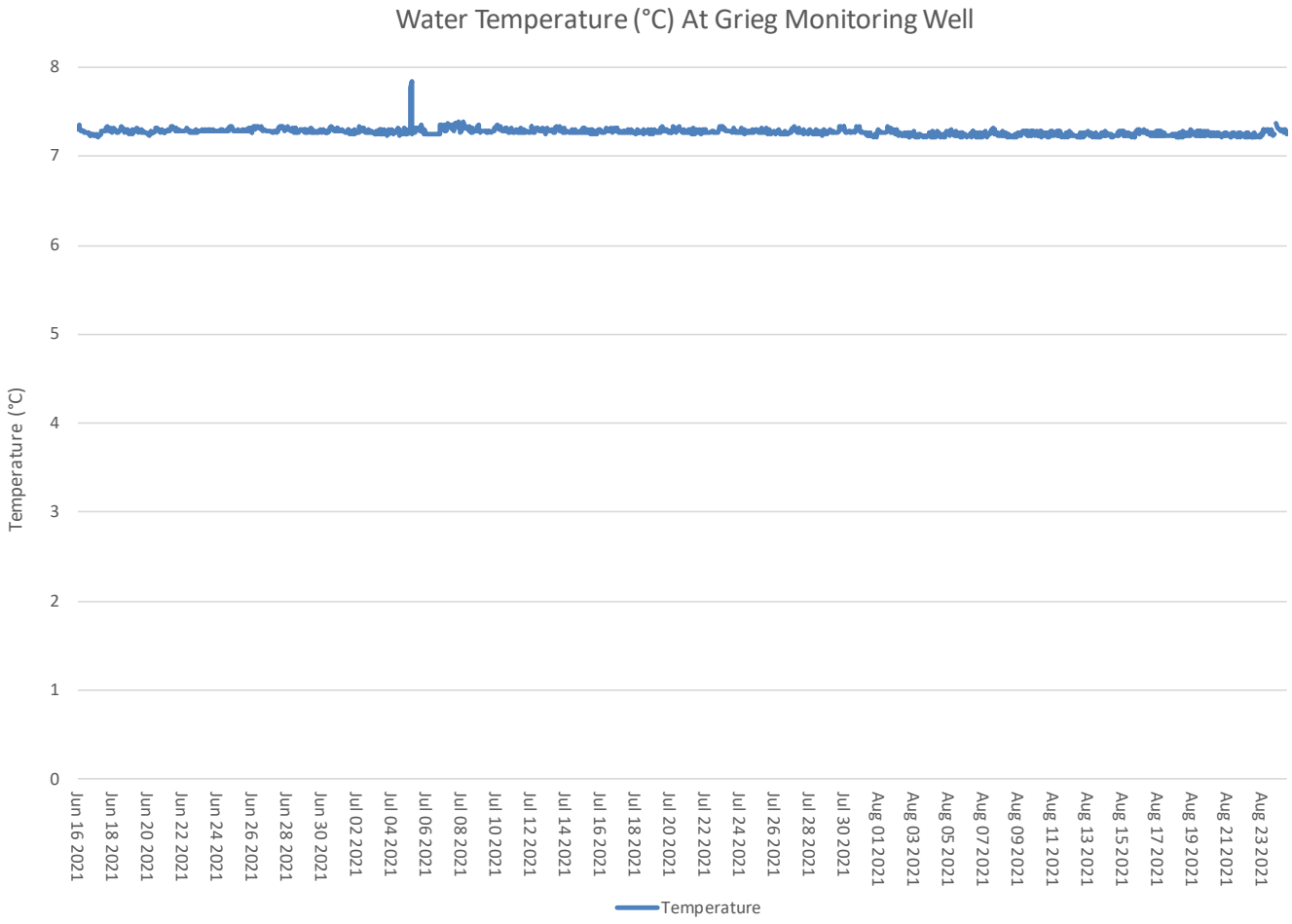

Figure 6: Water temperature (°C) values

pH

Throughout the deployment period, pH values ranged between 7.4 pH units and 7.6 pH units. The pH data remained consistent for the duration of the deployment, with a median of 7.5 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 (Figure 7). A period of fluctuation is evident July 4-6 at the same time changes were noted in temperature.

Comparison of the grab sample data for pH indicated that the pH in the grab sample of 8.03 pH units was slightly higher than what was recorded in-situ at 7.2 pH (Table 1). To obtain the grab sample, the well was pumped to remove the stagnant water in the casing before the sample was taken. The in-situ reading was recorded after the pumping of the well had stopped and the water column allowed to settle. From the data (Figure 7) it appears pH was slow to acclimate when deployed in the well as the values climbed up to 7.5 within the first few hours.

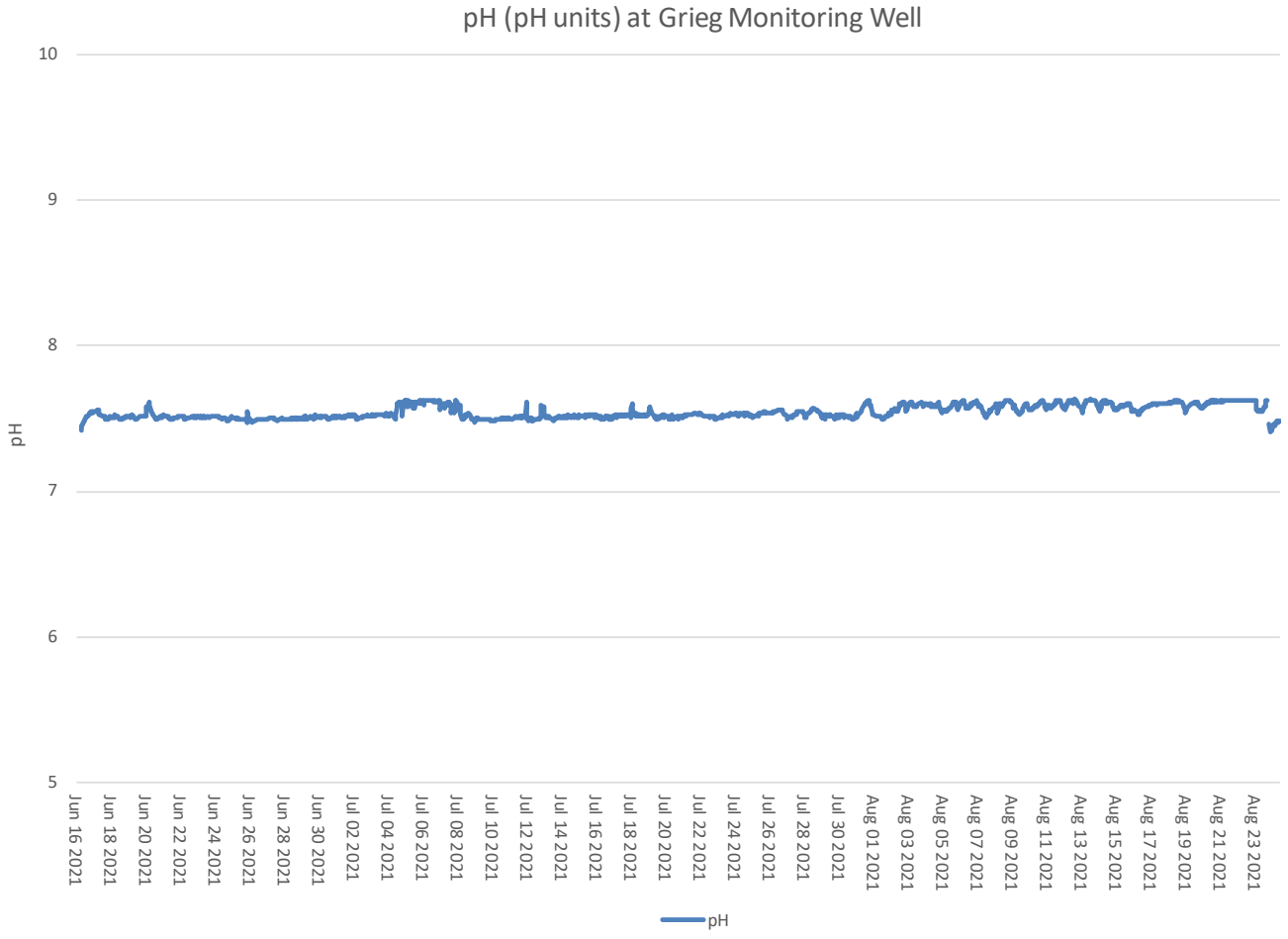

Figure 7: pH (pH units) values

Specific Conductivity & Total Dissolved Solids (TDS)

The specific conductivity probe measures the presence of diluted salts and inorganic materials in a water source. During the deployment, conductivity levels were within 275.8 µS/cm and 349.38 µS/cm (Figure 8). The higher spikes in conductivity July 4-6 coincide with changes in temperature and pH. This fluctuation may be due to pumping within the aquifer. Pumping can disrupt the diluted salts and inorganic materials that are present in the groundwater for a short period.

TDS 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 9). For the deployment period, TDS ranged within 0.18 g/L to 0.23 g/L.

Due to minimal or no influence from an outside source, the conductivity in the groundwater well is relatively stable. The spikes in specific conductivity are likely a result of pumping and associated disturbance of the aquifer.

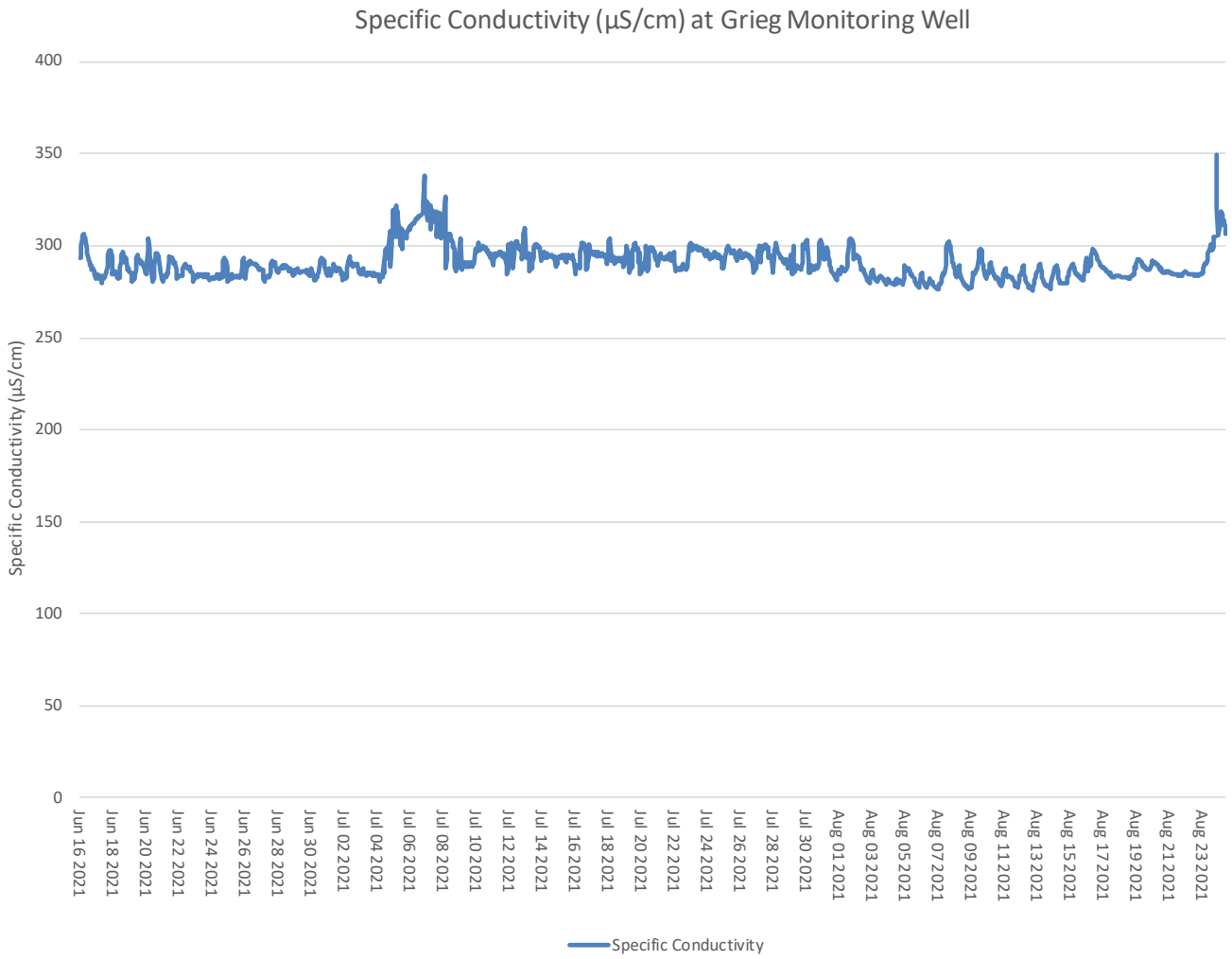

Figure 8: Specific conductivity (µS/cm) values

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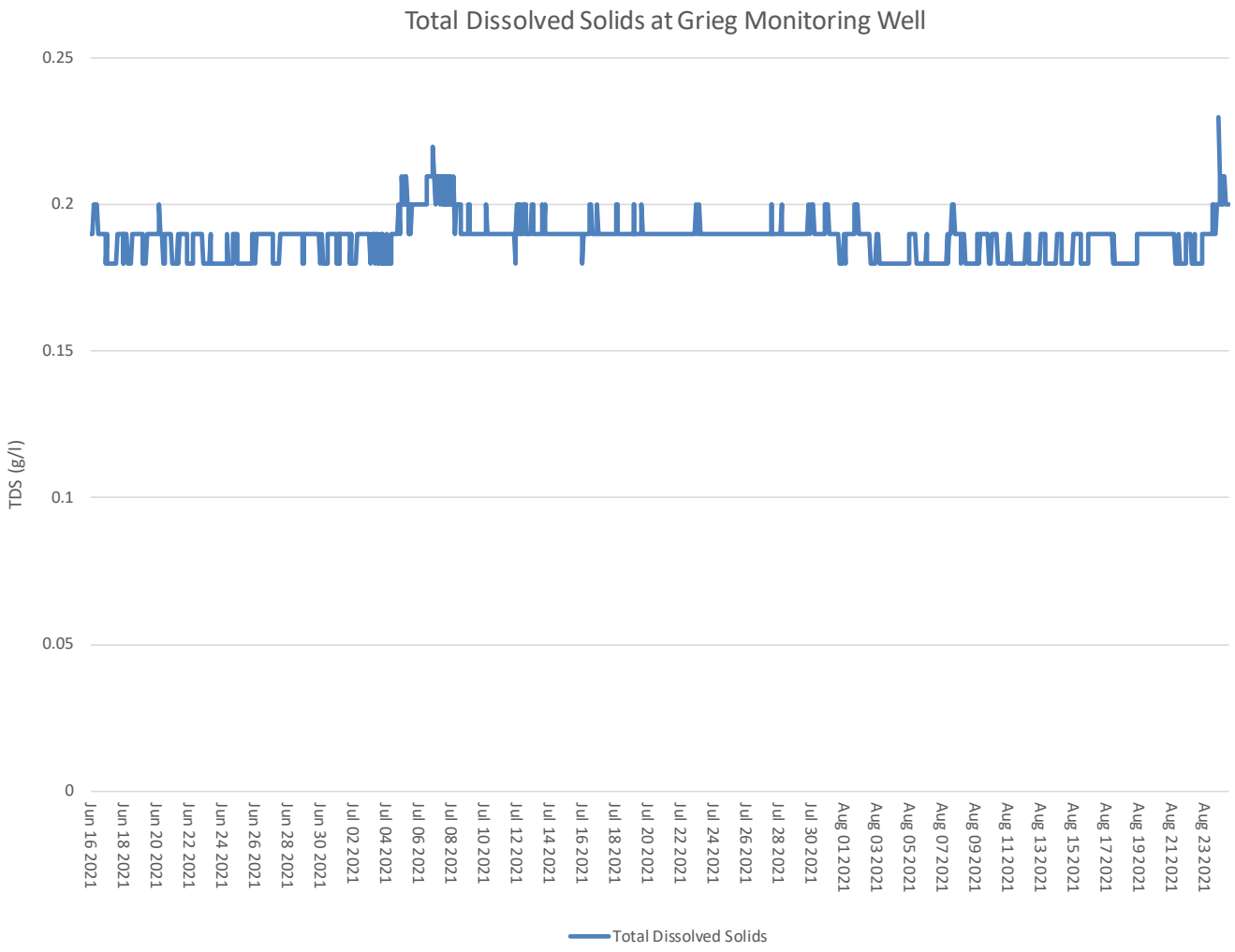

Figure 9: Total Dissolved Solids (TDS)

Oxidation-Reduction Potential (ORP)

ORP levels during the deployment ranged within -36.1 mV to 336.2 mV (Figure 10). The dataset had a median of 307.5 mV. It would be expected for the ORP to fluctuate in a groundwater well that is frequently disturbed with pumping.

Oxidation-Reduction Potential is used to determine the oxidizing-reduction potential of the groundwater. The 'redox potential' of the groundwater can indicate the presence of agents that may contaminate groundwater. ORP is individual and specific to each water body and gathering background data is essential in understanding what the changes in the data represent. Durign this deployment, ORP was very similar to the previous deployment, slowly climbing to a oxidative state over the first week of deployment.

Similar to temperature, pH and conductivity, a change in ORP is notable July 4-6. However, instead of increased fluctuations, there is less flux at that time. This may be due to pumping of the aquifer.

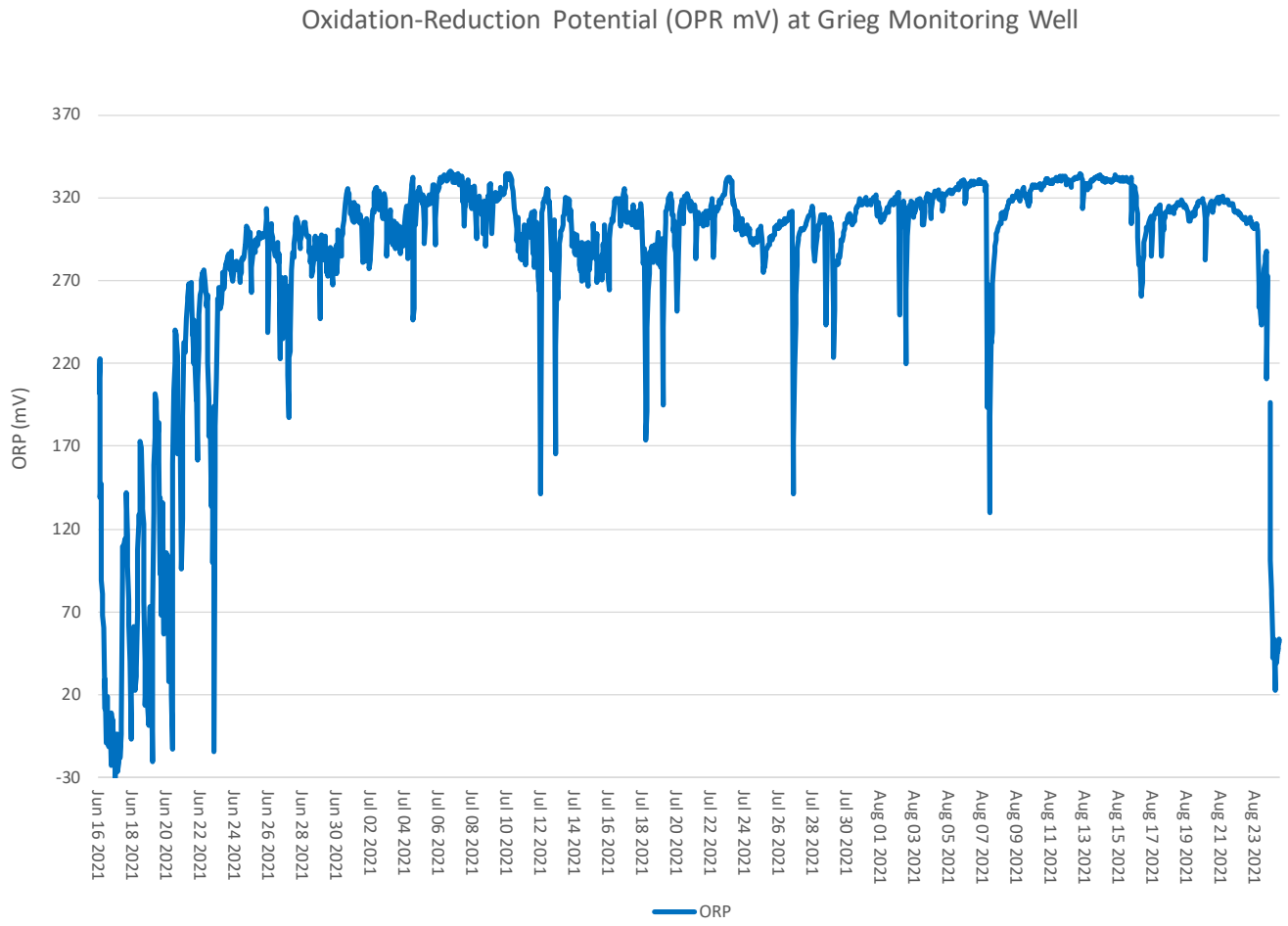

Figure 10: ORP values (mV)

Water Elevation

Water Elevation at the monitoring well, ranged within 18.24 m to 33.25 m. The data set had a median of 32.8 m.

Generally, water elevation within a groundwater well is consistent. However, this well and its aquifer are frequently disturbed by pumping. This causes fluctuations in water elevation at the monitoring well.

As shown below (Figure 11), water elevation dips periodically throughout the deployment and fluctuates rapidly during the same period the water quality parameters are disturbed (July 4-6).

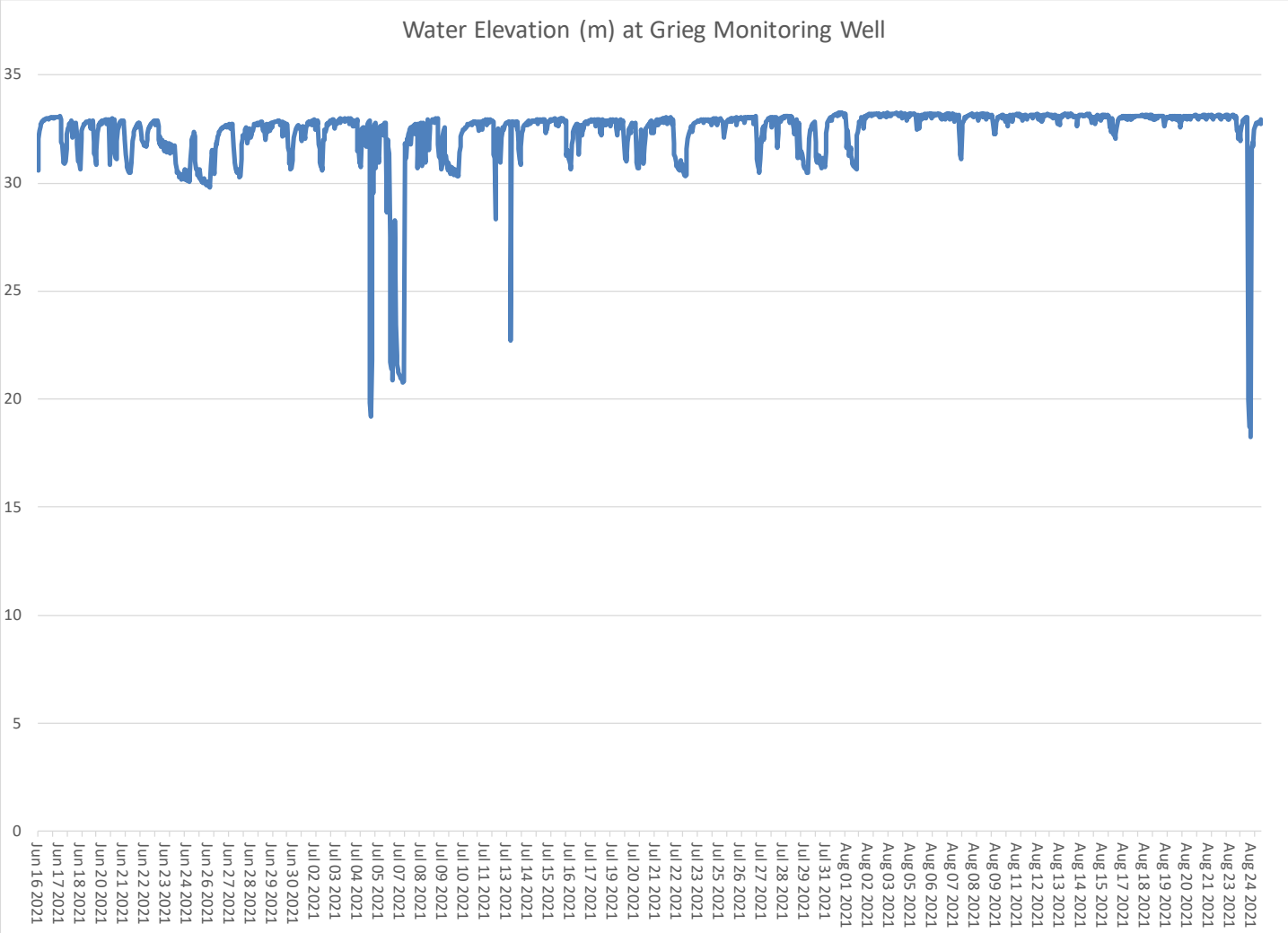

Figure 11: Water Elevation (m)

Appendix I

Water Quality Statistics of Grieg Groundwater Well

Deployment period June 16, 2021 to August 24, 2021

Parameter	Min	Max	Median	Mean
Water Temperature (°C)	7.214	7.84	7.28	7.28
pH (pH units)	7.4	7.6	7.5	7.5
Specific Conductivity (µS/cm)	275.81	349.38	288.52	290.4
Total Dissolved Solids (g/L)	0.18	0.23	0.19	0.19
ORP (mV)	-36.1	336.2	307.5	285.2
Water Elevation (m)	18.24	33.3	32.8	32.3