Real-Time Water Quality Report

Canada Fluorspar (NL) Inc, Real-Time Water Quality Stations

Deployment Period
August 3, 2022 to August 29, 2022

Newfoundland Labrador

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

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General

The Water Resources Management Division (WRMD), in partnership with Water Survey of Canada (WSC) -Environment and Climate Change Canada (ECCC), maintain real-time water quality and water quantity monitoring stations on John Fitzpatrick Pond and Outflow of Unnamed Pond south of Long Pond, brooks that are within the site of Canada Fluorspar (NL) Inc, St. Lawrence, Newfoundland & Labrador.

Decommission of Outflow of Grebes Nest Pond

Due to a change in the water supply for Outflow to Grebes Nest Pond station. It was determined that this brook would not provide consistent water supply to remain a monitoring station. It was decided to decommission Outflow to Grebes Nest station. However in replacement, a new site was selected and the hut and all the water quality instrumentation was relocated to an area that has a consistent water supply and the capability to provide an overview of the water quality conditions (Figure 1 & 2). The new site was named John Fitzpatrick Pond.

John Fitzpatrick Pond

John Fitzpatrick station was established May 2022. The site was selected based on the location and a stable water supply. Despite small changes in water level during the summer, this station will provide beneficial water quality data for this industry partner (Figure 2).

The Real Time station is established on the North West bank of John Fitzpatrick Pond, close to the only outflow from the pond. This pond is surrounded by natural habitat on the North East side, and on the south west side bordered by the CFI mine (Figure 1). There are two small brooks that periodically flow into this pond. This station will monitor the water quality and the stage level of the pond.

Figure 1: Real-Time Water Quality and Quantity Station at John Fitzpatrick Pond

Figure 2: Real-Time Station at John Fitzpatrick Pond

Outflow of Unnamed Pond south of Long Pond

The Outflow of Unnamed Pond south of Long Pond is established downstream of the Tailings Management Facility (TMF). This station will provide near real-time water quality and quantity data to ensure emerging issues associated with the TMF are detected, to allow the appropriate mitigation measures to be implemented in a timely manner, thus reducing any adverse effect on the downstream systems.

The location of Outflow of Unnamed Pond south of Long Pond was selected due to accessibility to the brook and the sufficient pool available to place the water quality and quantity instruments (See Figure 3). The stream originates from a small unnamed pond and meanders through a marsh environment alongside the TMF. The stream is approximately 1.0 to 2.0 meters wide. Where the instrument is deployed, there is a depth of approximately 1.0 to 1.5 meters. The GPS coordinates for this site are as follows: **N46° 54' 14.1" W055° 26' 37.5"**. The station hut was placed on the right bank looking downstream approximately 8 meters from the stream (Figure 3).

Figure 3: Real-Time Water Quality and Quantity Station at Outflow of Unnamed Pond south of Long Pond.

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.

At deployment and removal, a QA/QC Sonde is temporarily deployed adjacent to the Field Sonde. Values for temperature, pH, conductivity, dissolved oxygen and turbidity are compared between the two instruments**.** Based on the degree of difference between the parameters on the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality (Table 1).

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 for the real-time water quality monitoring operation at Canada Fluorspar (NL) Inc, and 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.

WSC staff have an essential role in the data logging/communication aspect of the network and the maintenance of the water quantity monitoring equipment. WSC staff visit the site regularly to ensure the data logging and data transmitting equipment are working properly. WSC is responsible for handling stage and streamflow issues. The quantity data is raw data that is transmitted via satellite and published online along with the water quality data on the Real-Time Stations website. Quantity data has not been corrected or groomed when published online or used in the monthly reports for the stations. WSC is responsible for QA/QC of water quantity data. Corrected stage and streamflow data can be obtained upon request to WSC.

Table 1: Instrument Performance Ranking classifications for deployment and removal

	Rank				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (°C)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 35 µS/cm (%)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Dissolved Oxygen (mg/L) (% Sat)	<=+/-0.3	>+/-0.3 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Turbidity <40 NTU (NTU)	<=+/-2	>+/-2 to 5	>+/-5 to 8	>+/-8 to 10	>+/-10
Turbidity > 40 NTU (%)	<=+/-5	>+/-5 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20

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; if a reading is taken too soon it may not accurately portray the water body.

Table 2: Instrument performance rankings

Station	Date	Action	Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
John Fitzpatrick	Aug 3 2023	Deployment	Excellent	Good	Good	Excellent	Good
	Aug 29 2023	Removal	Fair	Excellent	Excellent	Good	Excellent
Unnamed Pond	Aug 3 2023	Deployment	Fair	Good	Excellent	Excellent	Excellent
	Aug 29 2023	Removal	Excellent	Excellent	Excellent	Excellent	Excellent

At the John Fitzpatrick station the instrument ranked 'Excellent' to 'Good' when compared to the QA instrument. At removal the water quality parameters ranked 'Excellent' to 'Good' for all, except the water temperature which ranked as 'Fair'. This could be a result of the temperature probe not reaching adequate stabilization before a reading was taken. It could also be a result of the differences in depth between the field sonde and the QA sonde, while all attempts are made to ensure the QA sonde is laying as close to the field sonde as possible, sometime conditions do not allow for this.

When compared to the QAQC instrument at Outflow of Unnamed Pond south of Long Pond, the field instrument data ranked 'Fair' for temperature, with all other parameters ranking 'Excellent' or 'Good' for during the deployment. All water parameters ranked 'Excellent' at removal.

Issues during the August 3rd, 2022 to August 29th, 2022 Deployment Period

At the end of this deployment period it was determined that the logfile that stores all the water quality data on the instrument was corrupt. Unfortunately despite the instrument being reviewed by the manufacture, the file was not able to be restored. Consequently, there is no water quality data available for John Fitzpatrick Pond for this deployment period.

During the deployment at Outflow of Unnamed Pond south of Long Pond the dissolved oxygen sensor failed, there is no dissolved oxygen data present in this report.

Please note that the stage data recorded for Outflow of Unnamed Pond south of Long Pond is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Outflow of Unnamed Pond south of Long Pond

Water Temperature

Water temperature ranged from 14.55°C to 28.49°C during the deployment period (Figure 4). Water temperature displayed the natural diurnal pattern representing the influence of air temperature on the brook, with the high temperatures during the daylight hours and the low temperatures representing the nighttime hours. Outside of the diurnal movement of the water temperature, the data does indicate small fluctuations corresponding to stage changes. As stage increases there is a slight decrease in the water temperature for a short period of time. These stage changes could be a result of precipitation.

Please note that the stage data in this document is raw data. The data has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

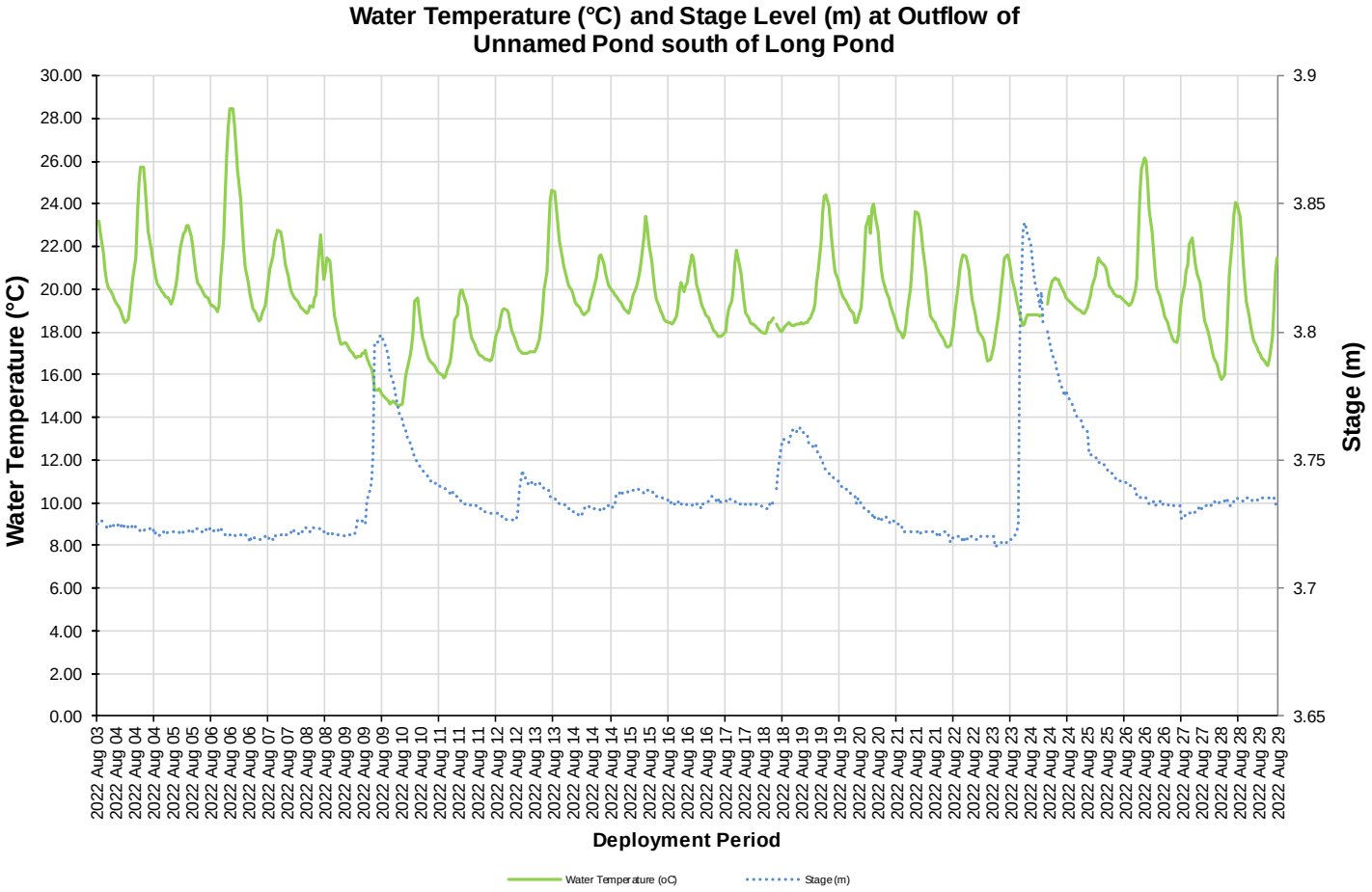

Figure 4: Water temperature (°C) values at Outflow of Unnamed Pond south of Long Pond

pH

Throughout this deployment period, pH values ranged within 6.84 pH units and 8.00 pH units (Figure 5), remaining within the Canadian Council of Ministers of the Environment (CCME) guidelines for aquatic life. The guidelines provide the overall range for the protection of aquatic life across all waterways in Canada. Every brook is different with its own specific natural background range.

Small decreases in pH during stage peaks are evident on Figure 5. The pH values returned to background levels shortly after each event, and overall the pH data was consistent across deployment. Natural processes such as rainfall and surrounding runoff will alter the pH of a brook for a period; however, it is the persistent long-term changes in pH that create the most damage to the natural aquatic environment.

Please note the daily averaged stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

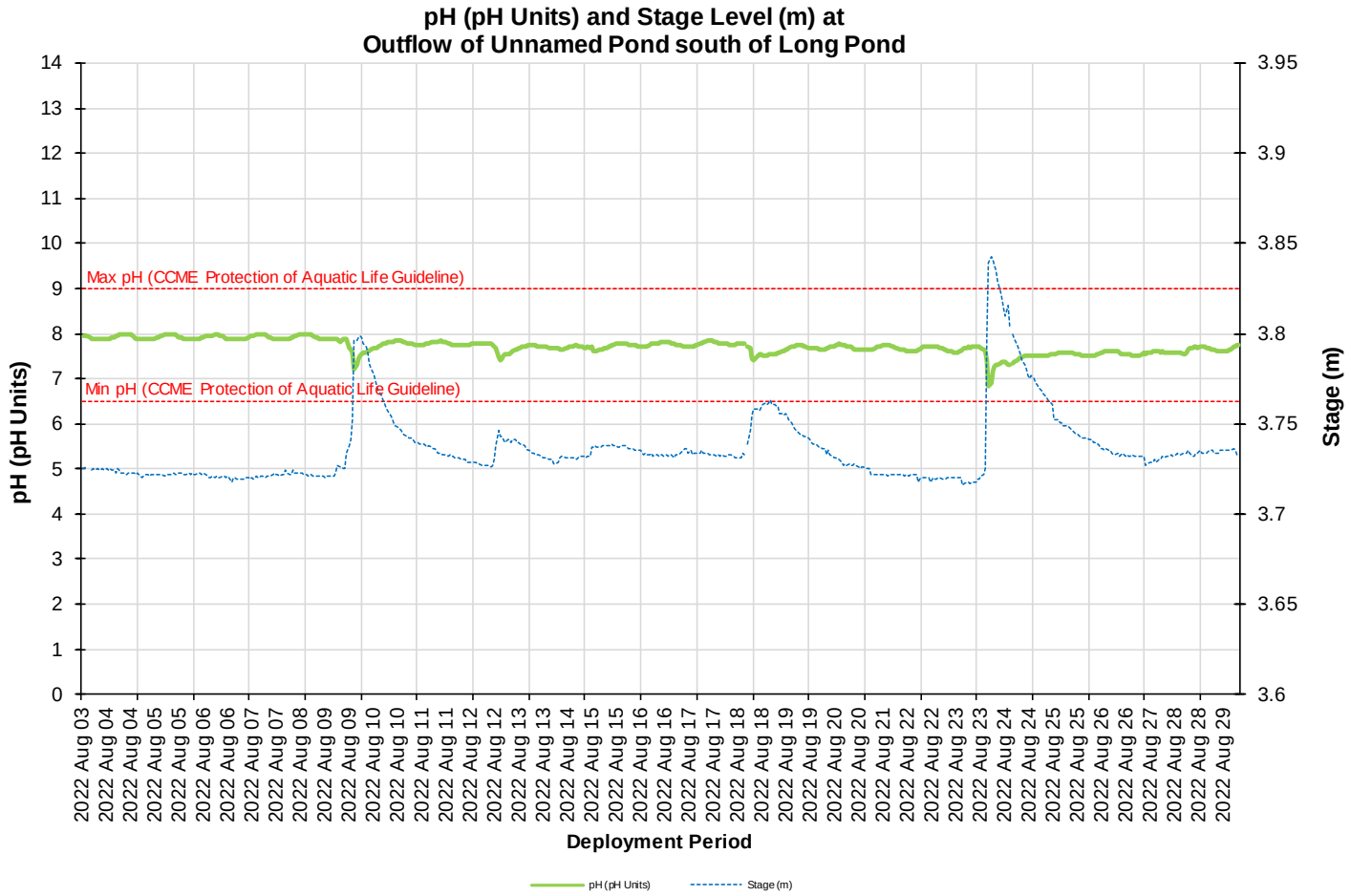

Figure 5: pH (pH units) at Outflow of Unnamed Pond south of Long Pond

Specific Conductivity

The conductivity levels ranged between 99.24 µS/cm and 358.74 µS/cm during deployment (Figure 6). The deployment period had a median of 269.09 µS/cm.

Changes in stage will influence the conductivity data (Figure 6). An increase in water level during an event will dilute the particulate matter present in a water column.

Please note the daily averaged stage data on the graph below, is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

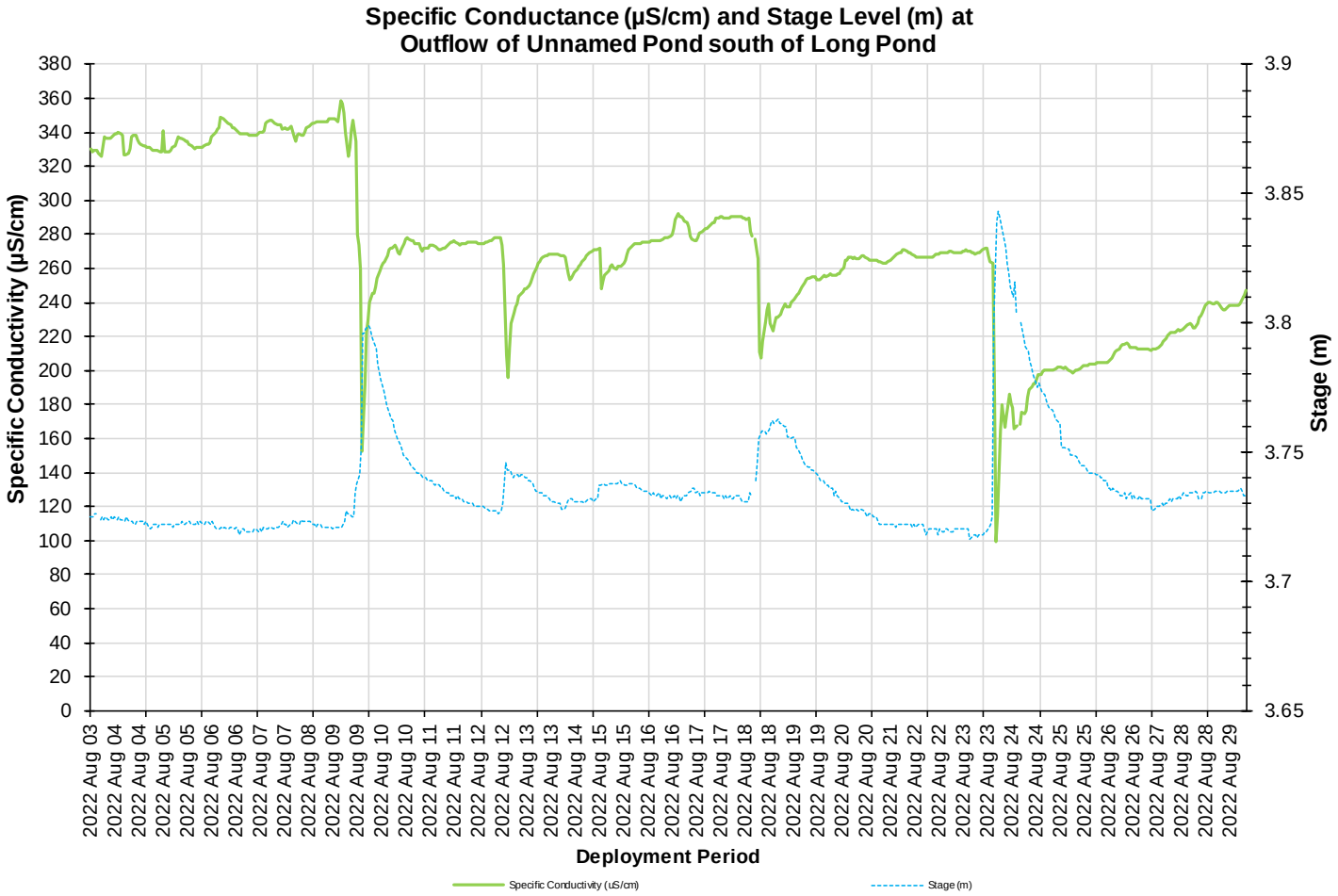

Figure 6: Specific conductivity (µS/cm) at Outflow of Unnamed Pond south of Long Pond

Turbidity

Turbidity levels during the deployment ranged within 2.2 NTU and 13 NTU (Figure 7). The deployment data had a median of 2.5 NTU, indicating a slight decrease in turbidity levels compared to previous deployment.

Turbidity remained below 13 NTU. Turbidity conditions continued to remain relatively low during this deployment which was likely a result of the work CFI have completed on reducing the runoff from the settling ponds upstream.

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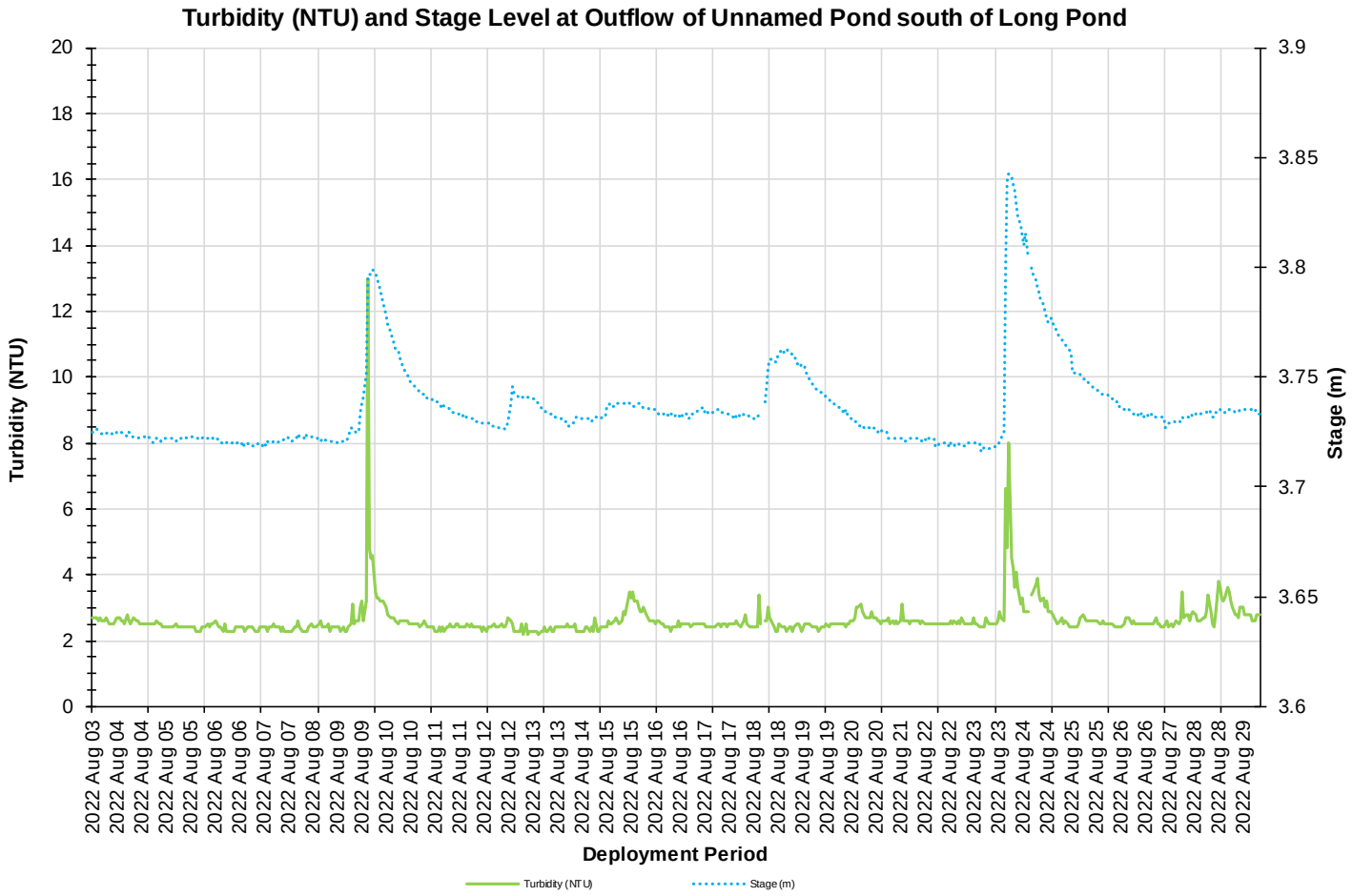

Figure 7: Turbidity (NTU) at Outflow of Unnamed Pond south of Long Pond

Daily Averaged Stage Level and Total Precipitation

Please note the stage data on the graph below is raw data. It has not been corrected for backwater effect. WSC is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request to WSC.

Stage is an estimation of water level at the station and can explain fluctuations occurring with other parameters (i.e. Specific Conductivity, DO, turbidity). Stage ranged between 3.71 m to 3.84m during the deployment. Stage increases during rainfall events (Figure 8) and during any surrounding snow or ice melt. However, direct snowfall will not cause stage to rise significantly.

Large peaks in stage correspond with the total precipitation events as noted on Figure 8. Total Precipitation data was obtained from Environment Canada's St. Lawrence weather station. The highest total precipitation was recorded on August 23rd 2022 at 36.1 mm.

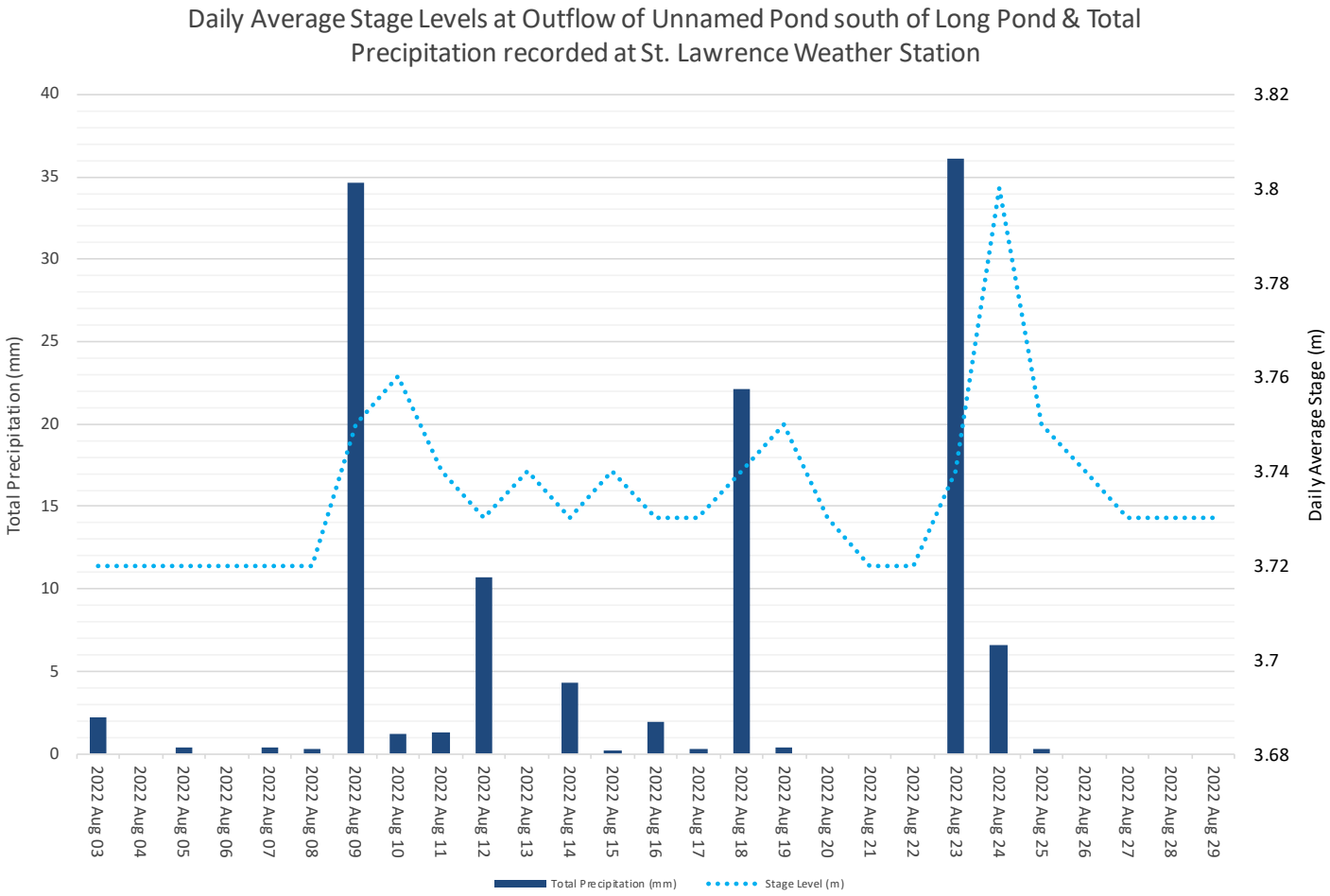

Figure 8: Daily averaged stage values and total precipitation.