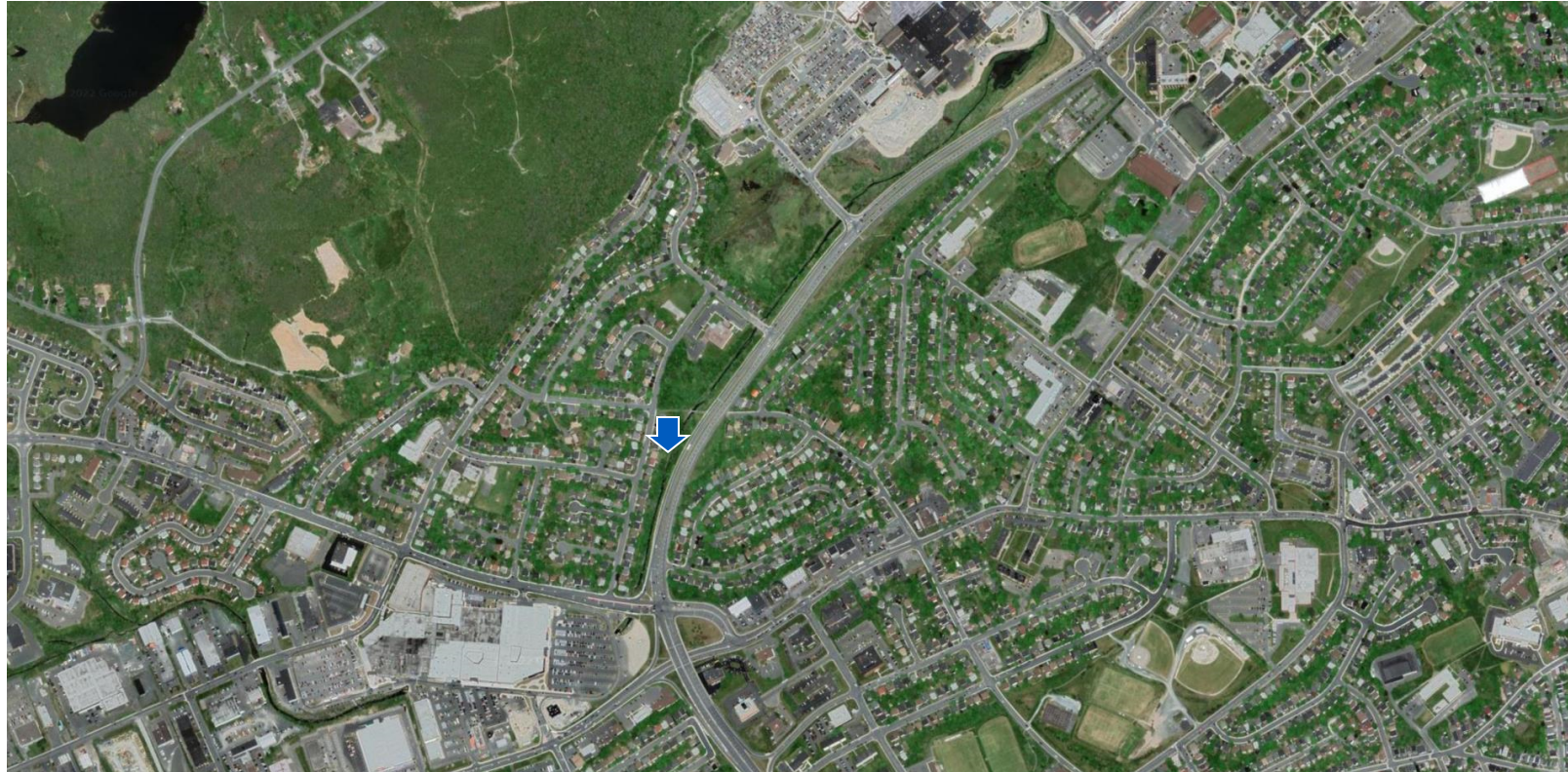


Real Time Water Quality Deployment Report Leary's Brook at Prince Phillip Drive

Tuesday, December 13, 2022 to Thursday, February 09, 2023



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

General

The Water Resources Management Division, in partnership with Environment and Climate Change Canada, maintains a real-time water quality and water quantity monitoring station at Leary's Brook, adjacent to Prince Phillip Drive in St. John's, Newfoundland.

The purpose of this real-time station is to monitor, process, and publish hydrometric (water quantity) and real-time water quality data. Leary's Brook is an urban stream which flows through industrial and commercial areas and is adjacent to a major roadway.

This report covers the period between sonde deployment on Tuesday, December 13, 2022 and removal on Thursday, February 09, 2023.

With the exception of water quantity data (stage) and precipitation data, all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent QA/QC protocol. Water Survey of Canada (WSC) is responsible for QA/QC of water quantity data. Corrected and finalized data may be retrieved from the WSC website. Precipitation data from the deployment period was retrieved from the [Pippy Park weather station](#).





Quality Assurance and Quality Control

To ensure the effectiveness and reliability of the real time water quality monitoring program, quality assurance, quality control, and quality assessment procedures have been implemented. 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

Instrument Performance Ranking Classification for Deployment and Removal

Parameter	Excellent	Good	Fair	Marginal	Poor
Dissolved oxygen	$\leq \pm 0.3$ mg/L	$\leq \pm 0.31 - 0.5$ mg/L	$\leq \pm 0.51 - 0.8$ mg/L	$\leq \pm 0.81 - 1$ mg/L	$> \pm 1$ mg/L
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	$\leq \pm 3$ μ S/cm or $\leq \pm 3\%$, whichever is greater	$\leq \pm 3.1 - 10$ μ S/cm or $\leq \pm 3.1 - 10\%$, whichever is greater	$\leq \pm 10 - 15$ μ S/cm or $\leq \pm 10.1 - 15\%$, whichever is greater	$\leq \pm 15.1 - 20$ μ S/cm or $\leq \pm 15.1 - 20\%$, whichever is greater	$> \pm 20$ μ S/cm or $> \pm 20\%$, whichever is greater
Turbidity	$\leq \pm 2$ turbidity units or $\leq \pm 5\%$, whichever is greater	$\leq \pm 2.1 - 5$ turbidity units or $\leq \pm 5.1 - 10\%$, whichever is greater	$\leq \pm 5.1 - 8$ turbidity units or $\leq \pm 10.1 - 15\%$, whichever is greater	$\leq \pm 8.1 - 10$ turbidity units or $\leq \pm 15.1 - 20\%$, whichever is greater	$> \pm 10$ turbidity units or $> \pm 20\%$, whichever is greater
Water temperature	$\leq \pm 0.2$ °C	$\leq \pm 0.21 - 0.5$ °C	$\leq \pm 0.51 - 0.8$ °C	$\leq \pm 0.81 - 1$ °C	$> \pm 1$ °C

The most important sensor on any sonde is the temperature sensor. 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 device 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. The deployment and removal instrument performance rankings for Leary's Brook for this period are summarized below.

Instrument Performance Rankings

Date	Action	Conductivity Rank	Dissolved Oxygen Rank	pH Rank	Temperature Rank	Turbidity Rank
Tuesday, December 13, 2022	Deployment	Excellent	Excellent	Excellent	Excellent	Excellent
Tuesday, December 13, 2022	Grab	Good		Good		Excellent
Thursday, February 09, 2023	Removal	Good	Excellent	Excellent	Fair	Excellent



Water Temperature

2.14

Average of Water Temperature(°C)

1.90

Median of Water Temperature(°C)

This report includes data collected from its deployment on Tuesday, December 13, 2022 until removal on Thursday, February 09, 2023. The maximum temperature, 8.96°C, occurred on Sunday, January 15, 2023, and the coldest temperature, -0.44°C, occurred on Saturday, February 04, 2023. The water temperature data displayed is typical of shallow streams and ponds. Water temperatures in shallow streams respond quickly to changes in air temperature. Water temperatures usually fall overnight and rise during the day.

-0.44

Min of Water Temperature(°C)

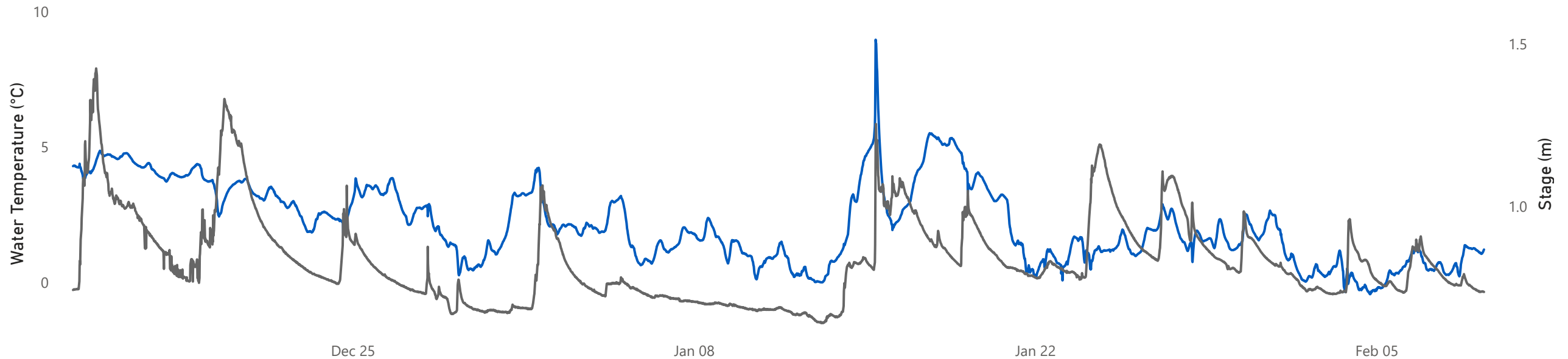
8.96

Max of Water Temperature(°C)

During this deployment period, water temperature shows an overall cooling trend. Water temperature can abruptly increase or decrease when stage increases depending on the air temperature at the time.

Water Temperature and Stage at Leary's Brook

● Water Temperature(°C) ● Sum of Stage (m)



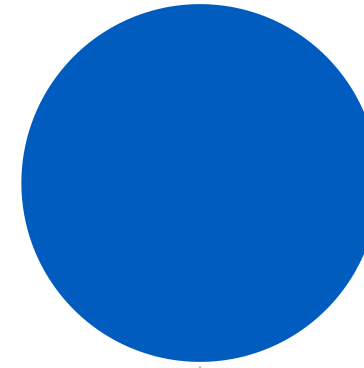
pH

This report includes data from its deployment on Tuesday, December 13, 2022 until removal on Thursday, February 09, 2023. The pH ranged from 6.51 pH units, on Wednesday, December 14, 2022, to 7.06 pH units on Sunday, January 15, 2023. The [CCME](#) (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. The long term concentration guideline for pH is 6.5 µg/L to 9.0 µg/L.

Generally there is a slight dip in pH in Leary's Brook (the water becomes more acidic) when stage increases. In general, precipitation entering Leary's Brook has a lower pH than local surface water causing a small reduction in the pH of the brook. Daily fluctuations can be caused by respiration and photosynthesis of aquatic plants and algae.

Overall, the pH levels remained consistent during deployment with a relatively narrow range of values.

● Within CCME Guideline



100%

6.76
Average of pH

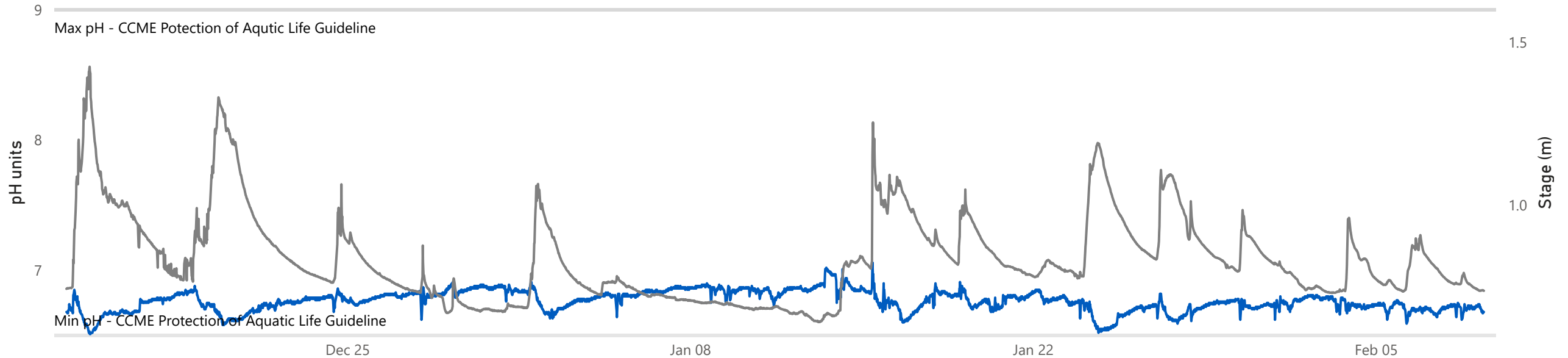
6.77
Median of pH

6.51
Min of pH

7.06
Max of pH

pH and Stage at Leary's Brook

● pH ● Stage (m)





Specific Conductivity

Conductivity relates to the ability of an electric charge to pass through a solution. Specific conductance is corrected to 25°C to allow comparison across variable temperatures. Conductivity levels ranged from 270 $\mu\text{S}/\text{cm}$ on Wednesday, December 14, 2022 to 8814 $\mu\text{S}/\text{cm}$ on Monday, February 06, 2023. The median and mean specific conductivities were 597 $\mu\text{S}/\text{cm}$ and 969.69 $\mu\text{S}/\text{cm}$ respectively. Precipitation and specific conductivity are related. Rain water has a lower specific conductivity than Leary's Brook. During the summer and fall, rainfall results in a temporary decrease in conductivity as the system is diluted; however, when road salts are present during the colder seasons, precipitation washes them into Leary's Brook, which increases the specific conductance of the system.

The specific conductivity levels observed are expected for this time of year despite being much higher than summer values or non-urban waterways. Overall the specific conductivity increased during this deployment period. Specific conductivity values will drop in the spring when road salts are no longer applied.

969.69

Average of Specific Conductivity ($\mu\text{S}/\text{cm}$)

597

Median of Specific Conductivity ($\mu\text{S}/\text{cm}$)

270

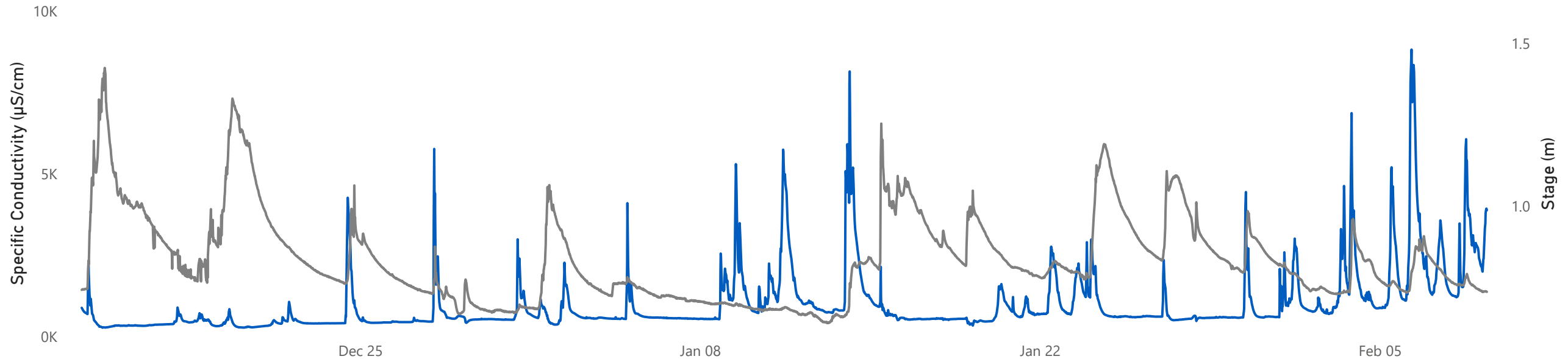
Min of Specific Conductivity ($\mu\text{S}/\text{cm}$)

8814

Max of Specific Conductivity ($\mu\text{S}/\text{cm}$)

Specific Conductivity and Stage at Leary's Brook

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



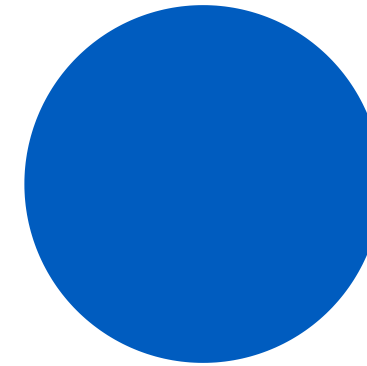
Dissolved Oxygen

The [CCME](#) (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. The minimum guideline for early life stages in cold water is 9.5 mg/L and the minimum guideline for other life stages is 6.5 mg/L.

The sonde measures dissolved oxygen (DO) (mg/L) and then calculates the percent saturation (% sat) using the dissolved oxygen and temperature sensors. The lowest DO value, 10.91 mg/L, occurred on Sunday, January 15, 2023. The maximum DO value, 13.79 mg/L, occurred on Friday, January 13, 2023.

Temperature influences the amount of dissolved oxygen that water can hold. As seen below, when temperatures drop, DO levels increase. Overall there is a slight increasing trend for DO during this deployment period. DO levels should drop in the spring when water temperatures begin to rise.

● Above CCME Guidelines



100%

12.94
Avg DO (mg/L)

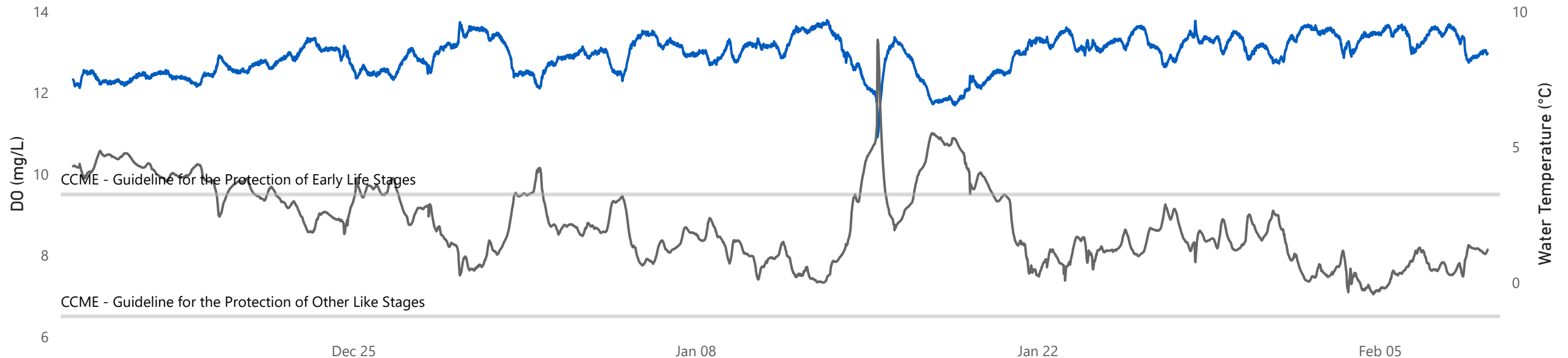
13.00
Median DO (mg/L)

10.91
Min DO (mg/L)

13.79
Max DO (mg/L)

Dissolved Oxygen and Water Temperature at Leary's Brook

● DO (mg/L) ● Water Temperature(°C)



Turbidity

3.80

Average of Turbidity (NTU)

0.00

Median of Turbidity (NTU)

Increases in turbidity (cloudiness) are often caused by increased runoff during precipitation events. Runoff carries silt and other debris into Leary's Brook. Upstream construction and the inadequate control of silt-laden runoff can also cause turbidity to increase.

This report includes data from, Tuesday, December 13, 2022 to Thursday, February 09, 2023; during this time, the turbidity ranged from 0.00 NTU to 274.80 NTU. As indicated below, turbidity generally increases during precipitation events; the strongest influencer on increasing turbidity is water flow. The Leary's Brook station is prone to debris and sediment becoming trapped in the sensor, which can impact the readings for a number of sensors.

0.00

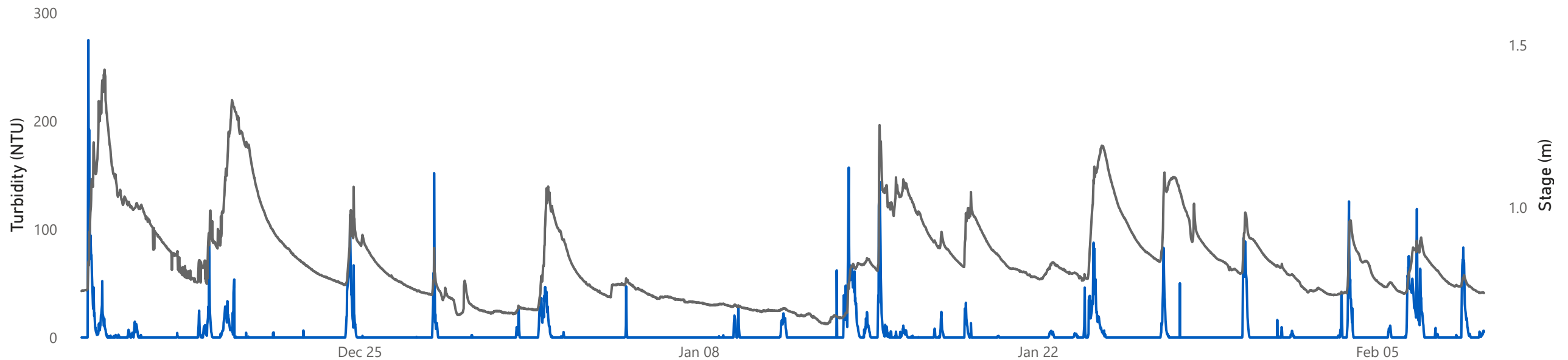
Min of Turbidity (NTU)

274.80

Max of Turbidity (NTU)

Turbidity and Stage at Leary's Brook

● Turbidity (NTU) ● Stage (m)





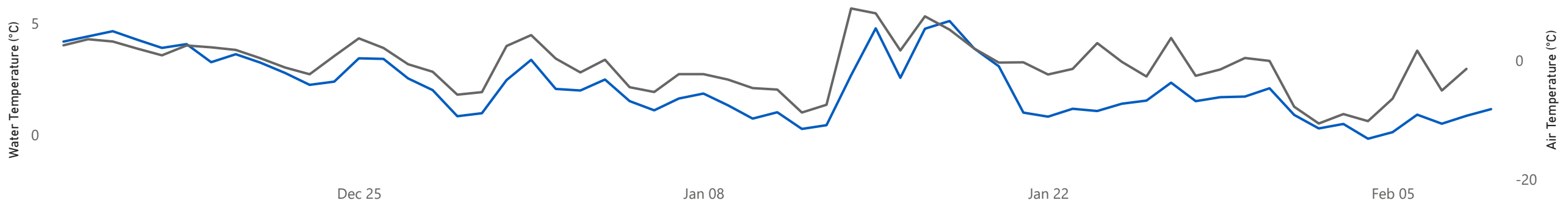
Climate and Stage

-0.85	-0.32	-10.61	8.78
Avg Air Temp	Median Air Temp	Min Air Temp	Max Air Temp
2.14	1.90	-0.44	8.96
Avg Water Temp	Median Water T...	Min Water Temp	Max Water Temp
6.77	0.64	0.00	59.70
Avg Precipitation	Median Precipit...	Min Precipitation	Max Precipitation
0.83	0.81	0.64	1.43
Average Stage	Median Stage	Min Stage	Max Stage

Climate data precipitation and air temperature are obtained from Pippy Park weather station.

Water Temperature at Leary's Brook and Air Temperature at Pippy Park Weather Station

● Water Temperature (°C) ● Air Temperature (°C)



Stage at Leary's Brook and Precipitation at Pippy Park Weather Station

● Precipitation (mm) ● Stage (m)

