Mobile Environmental Monitoring Platform (MEMP) Deployment Report
Hodge River - Town of Whitbourne
NLENMP0004

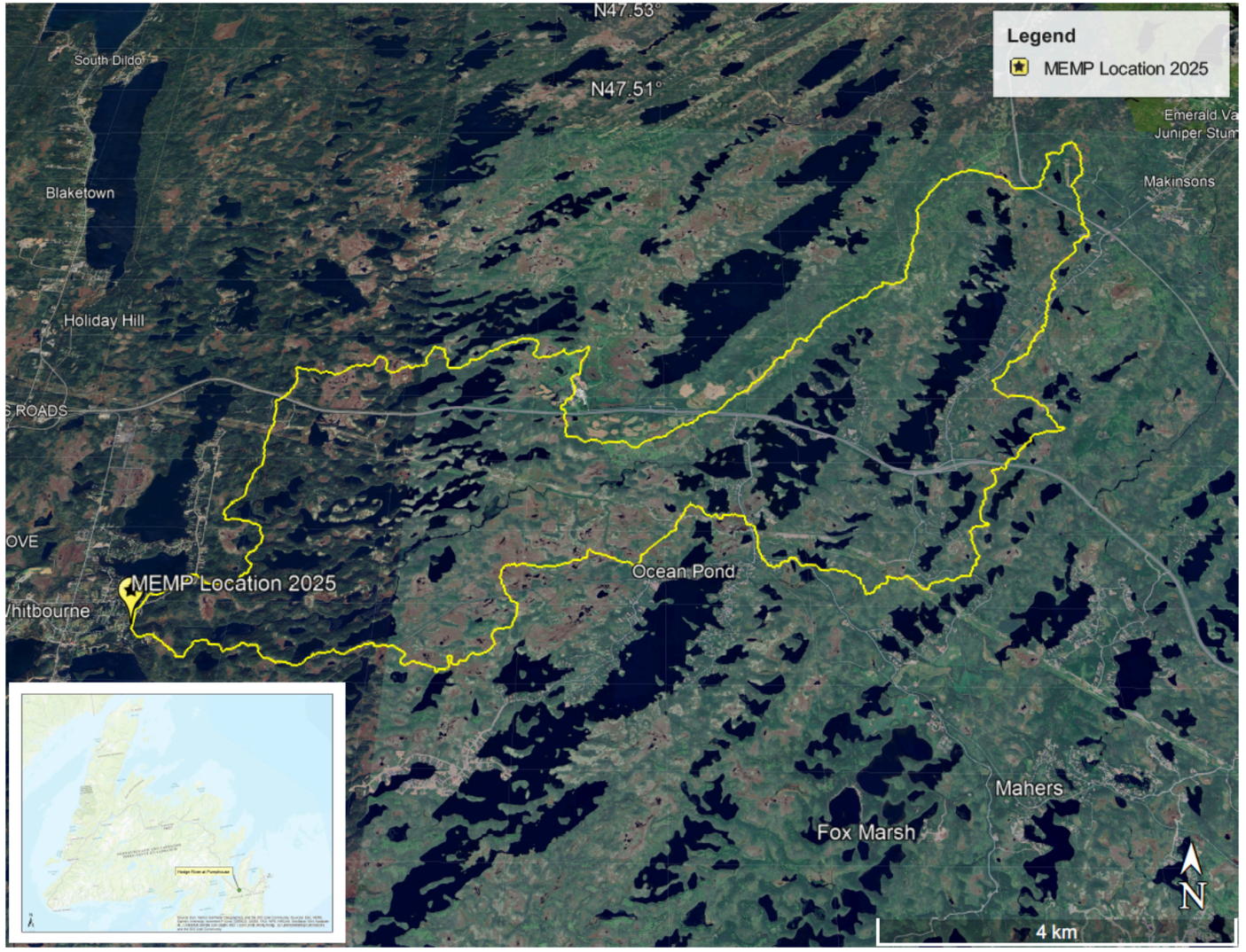
2025-04-30 to 2025-12-01

Newfoundland Labrador

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

Contents

Hodge River at Pumphouse, Whitbourne, NL



The Water Resources Management Division (WRMD) deployed a Mobile Environmental Monitoring Platform (MEMP) on the Hodge River in the Town of Whitbourne from April 30 to December 1, 2025.

The site was selected due to its location within a flood-prone area and its importance as part of the municipal drinking water supply.

The MEMP was equipped with integrated water quality, water quantity, and climate monitoring instrumentation, enabling the collection of continuous, multi-parameter data under a wide range of hydrologic and meteorological conditions.

Monitoring covered key seasonal periods, including spring freshet, summer low-flow conditions, and fall storm events. Data collected during the deployment support improved understanding of hydrological behaviour, assessment of potential impacts to drinking water quality, and enhanced watershed monitoring, contributing to informed decision-making for flood risk management and drinking water source protection.

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. The hydrometric data shown in this report is provisional and has not undergone quality control checks. Corrected hydrometric data can be obtained at https://wateroffice.ec.gc.ca/ or upon request to Water Survey Canada.

Parameter	Excellent	Good	Fair	Marginal	Poor
Dissolved oxygen	≤ ± 0.3 mg/L	≤ ± 0.31 -0.5 mg/L	≤ ± 0.51 - 0.8 mg/L	≤ ± 0.81 - 1 mg/L	> ± 1 mg/L
pH	≤ ± 0.2 units	≤ ± 0.21 - 0.5 units	≤ ± 0.51 - 0.8 units	≤ ± 0.81 - 1 units	> ± 1 units
Water Temperature	≤ ± 0.2°C	≤ ± 0.21 - 0.5°C	≤ ± 0.51 - 0.8°C	≤ ± 0.81 - 1°C	> ± 1°C
Specific Conductance	≤ ± 3 µS/cm or ≤ ± 3%, whichever is greater	≤ ± 3.1-10 µS/cm or ≤ ± 3.1-10%, whichever is greater	≤ ± 10 - 15 µS/cm or ≤ ± 10.1-15 %, whichever is greater	≤ ± 15.1 - 20 µS/cm or ≤ ± 15.1-20 %, whichever is greater	> ± 20 µS/cm or > ± 20 %, whichever is greater
Turbidity	≤ ± 2 turbidity units or ≤ ± 5%, whichever is greater	≤ ± 2.1-5 turbidity units or ≤ ± 5.1-10 %, whichever is greater	≤ ± 5.1-8 turbidity units or ≤ ± 10.1-15 %, whichever is greater	≤ ± 8.1-10 turbidity units or ≤ ± 15.1-20 %, whichever is greater	> ± 10 turbidity units or > ± 20 %, whichever is greater

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 parameters recorded by the Field Sonde and QA/QC Sonde at deployment and at removal, a qualitative statement is made on the data quality.

There are a few circumstances which may cause QA/QC rankings below excellent, including the placement of the QA/QC sonde in relation to the field sonde, the amount of time each sonde was given to stabilize before readings were recorded, and deteriorating performance of one of the sensors.

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.

QaQc Rankings

DATE	PARAMETERS	DEPLOYMENT RANK	REMOVAL RANK	GRAB SAMPLE RANK
Wednesday, April 30, 2025	Dissolved Oxygen (mg/l)	Excellent		
Wednesday, April 30, 2025	Turbidity (NTU)	Excellent		Excellent
Wednesday, April 30, 2025	pH	Excellent		Good
Wednesday, April 30, 2025	Specific Conductivity (µS/cm)	Excellent		Poor
Wednesday, April 30, 2025	Temperature ('C)	Good		
Friday, July 04, 2025	Dissolved Oxygen (mg/l)	Excellent	Excellent	
Friday, July 04, 2025	Turbidity (NTU)	Excellent	Excellent	Excellent
Friday, July 04, 2025	Specific Conductivity (µS/cm)	Excellent	Good	Good
Friday, July 04, 2025	Temperature ('C)	Good	Good	
Friday, July 04, 2025	pH	Good	Poor	Excellent
Wednesday, September 03, 2025	Dissolved Oxygen (mg/l)	Excellent	Excellent	
Wednesday, September 03, 2025	Turbidity (NTU)	Excellent	Excellent	
Wednesday, September 03, 2025	pH	Excellent	Excellent	Good
Wednesday, September 03, 2025	Temperature ('C)	Good	Good	
Wednesday, September 03, 2025	Specific Conductivity (µS/cm)	Good	Good	Excellent
Monday, December 01, 2025	pH		Excellent	Excellent
Monday, December 01, 2025	Turbidity (NTU)		Fair	Fair
Monday, December 01, 2025	Specific Conductivity (µS/cm)		Good	Good
Monday, December 01, 2025	Dissolved Oxygen (mg/l)		Poor	
Monday, December 01, 2025	Temperature ('C)		Poor	

Quality assurance and quality control (QA/QC) checks were conducted during the 2025 Mobile Environmental Monitoring Platform (MEMP) deployment on the Hodge River to evaluate the performance of field water quality instrumentation. QA/QC activities included comparisons between the field sonde and a QA/QC sonde at deployment, mid-season, and removal, as well as grab sample comparisons where applicable.

Deployment and mid-season QA/QC checks, completed on April 30, July 4, and September 3, 2025, indicated predominantly 'Good' to 'Excellent' agreement between the field and QA/QC sondes for most measured parameters, including temperature, pH, specific conductivity, dissolved oxygen (mg/L), and turbidity. These results confirm acceptable sensor performance throughout the majority of the deployment period and across a range of hydrologic and seasonal conditions.

Removal QA/QC checks, conducted during site visits and at the end of the deployment period, showed increased variability, with agreement rankings ranging from 'Good' to 'Poor' for some parameters. Reduced agreement at removal is consistent with sensor drift, biofouling, and changing field conditions over extended deployment periods and is commonly observed during end-of-season QA/QC assessments.

Grab sample comparisons demonstrated generally 'Good' to 'Excellent' agreement with sonde measurements for pH, specific conductivity, and turbidity. Overall, QA/QC results indicate that the 2025 water quality data collected at this site are of acceptable quality for assessing seasonal conditions and supporting watershed monitoring, flood risk assessment, and drinking water source protection objectives.

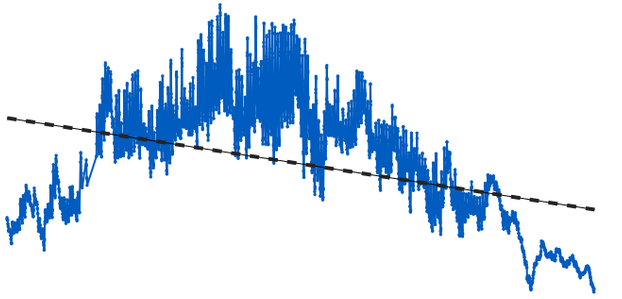
Water Temperature

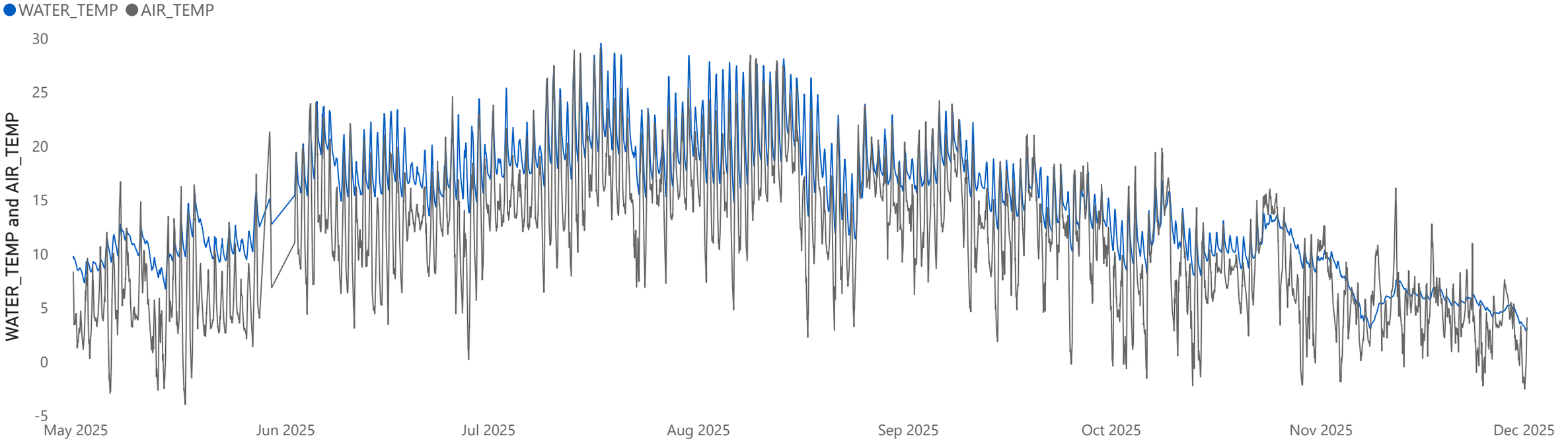
14.67	15.36	2.84	29.53
Average (°C)	Median (°C)	Minimum (°C)	Maximum (°C)

Water temperature is an important parameter for wildlife. Many organisms cannot regulate their own temperatures, and rely on surrounding air and water temperatures. Water temperature may be affected by inputs from industry or by modifying natural conditions like clearing trees and other vegetation, which eliminates the canopy protection they offer. Water temperature also affects other parameters monitored including dissolved oxygen and specific conductivity.

Water temperature data for this deployment was collected from 2025-04-30 until 2025-12-01. The minimum water temperature, 2.84°C, occurred on 2025-12-01. The maximum water temperature, 29.53°C, occurred on 2025-07-17. The average water temperature was 14.67 °C with peaks in mid-August corresponding to warmer air temperatures. Water temperature usually falls overnight and rises during the day, known as diurnal variation. Over the deployment period, a clear downward trend was observed, reflecting the seasonal transition from late summer into early fall as air temperatures declined.

Water Temperature Trendline





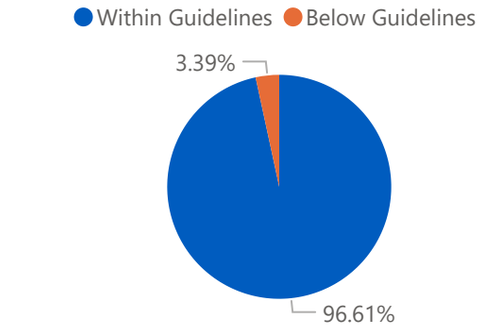
pH

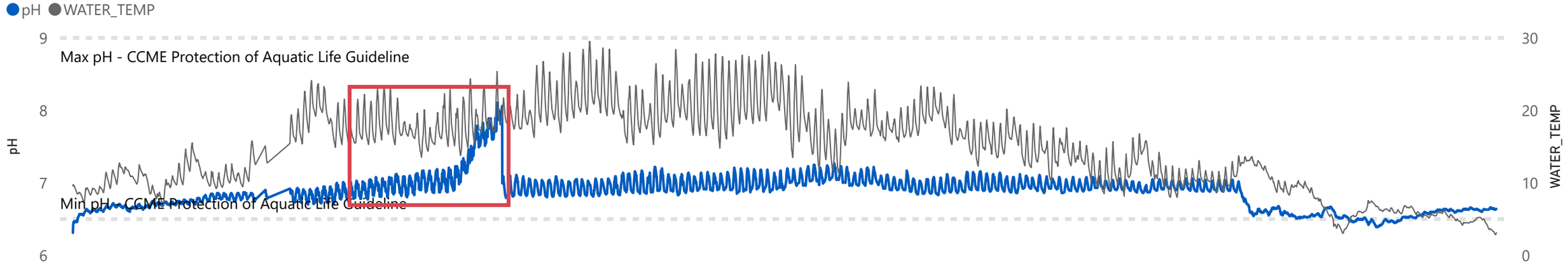
6.88	6.90	6.31	8.11
Average pH	Median pH	Minimum pH	Maximum pH

pH relates to the free hydrogen ions in water and it is a measure of acidity in water. A pH of 7 indicates a neutral pH, below 7 is considered acidic, and above 7 is considered basic. The Canadian Council of Ministers of the Environment (CCME) Freshwater Aquatic Life guideline provides a basis by which to judge the overall health of the brook. Their freshwater guidelines recommend a minimum pH of 6.5 and a maximum pH of 9.0; however, many rivers in Newfoundland and Labrador are naturally more acidic due to the local geology. Water parameter maps can be found on the Water Resources Management website.

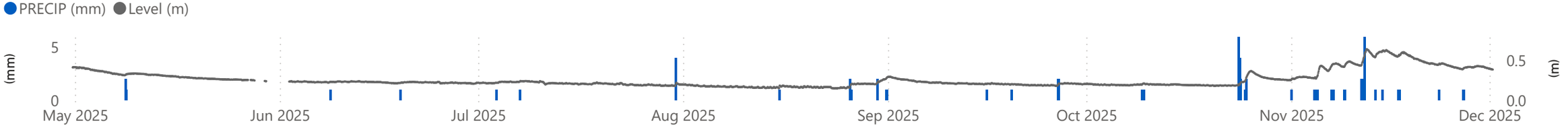
pH data for this deployment was collected from 2025-04-30 until 2025-12-01. The minimum pH, 6.31, occurred on 2025-04-30 . The maximum pH, 8.11, occurred on 2025-07-03. Daily fluctuations are common due to changes in temperature and photosynthesizing of aquatic plants. pH was stable throughout this deployment period. pH sensor drift was observed from mid-June to July 4, 2025, when the instrument was replaced with a freshly calibrated instrument. A sudden decrease in pH was observed from 2025-10-23 until the end of the deployment period due to significant precipitation events. Values during the deployment are within the CCME guidelines for the Protection of Aquatic Life (between 6.5 and 9 pH units) for 96.61% and fell below the guidelines (3.39%) due to the addition of cool, acidic rainfall.

CCME Freshwater Aquatic Life Guideline





Climate data from MEMP



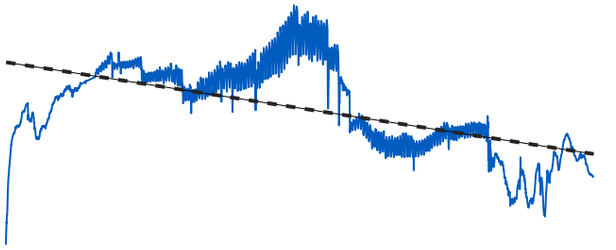
Specific Conductivity

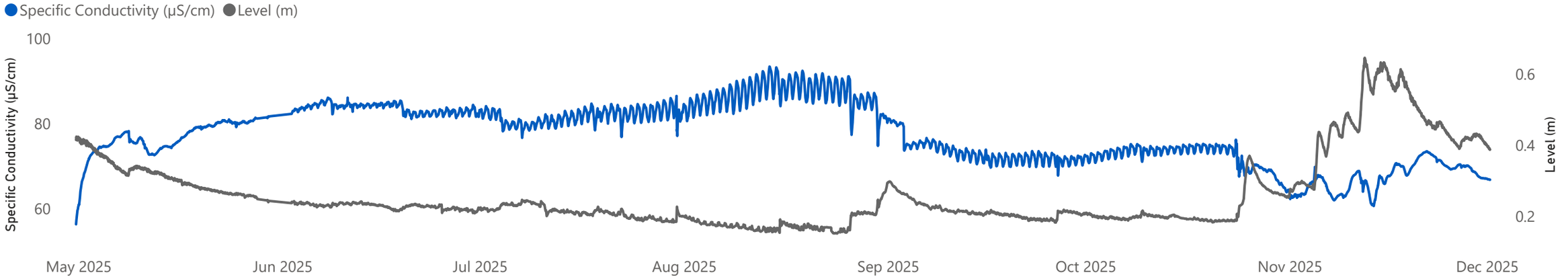
77.35	77.20	56.41	93.40
Average µS/cm	Median µS/cm	Minumum µS/cm	Maximum µS/cm

Conductivity relates to the ability of an electric charge to pass through a solution. Pure water has low conductance and water with dissolved ions has higher conductance. Specific conductance is corrected to 25°C to allow comparison across temperatures. Water parameter maps can be found on the Water Resources Management website.

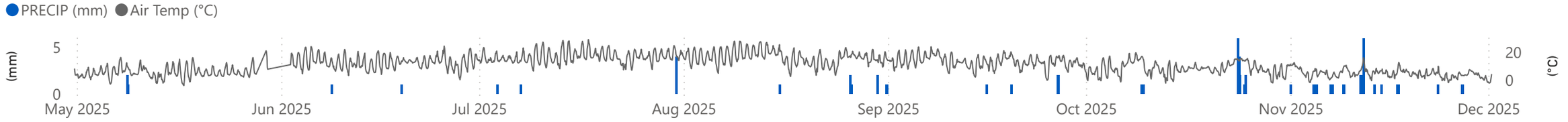
Specific conductivity in Hodge River showed a gradual increase from April 30 through mid-August 2025, rising from approximately 56 µS/cm at the start of the deployment to peak values near 93 µS/cm. After mid-August, conductivity began to decline overall, dropping through September and remaining lower and relatively steady through October. In November, conductivity became more variable as several rain events and increases in stage influenced the river, with conductivity generally decreasing during higher-flow periods due to dilution, then partially recovering as conditions stabilized. Overall, the data show a seasonal rise in conductivity during the drier spring and summer period, followed by lower and more variable values in the fall when precipitation and runoff had a stronger influence on river conditions.

Specific Conductivity Trendline





Climate data from MEMP



Dissolved Oxygen Concentration and Saturation

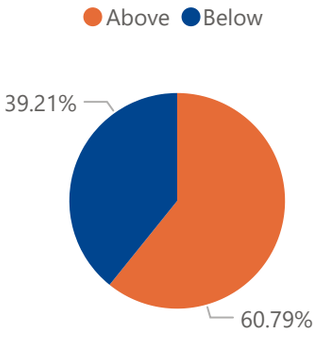
9.93	9.74	6.46	13.63
Average (mg/L)	Median (mg/L)	Minimum (mg/L)	Maximum (mg/L)

Dissolved oxygen (DO) in water is crucial for aquatic life. The CCME (Canadian Council of Ministers of the Environment) Freshwater Aquatic Life guidelines provide a basis by which to judge the overall health of waterways. 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. DO and water temperatures are correlated; colder waters can hold higher concentrations of DO than warm waters.

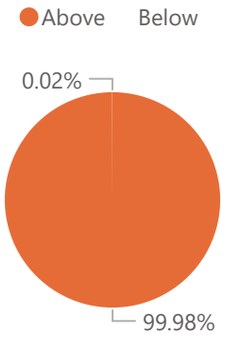
Dissolved oxygen (DO) concentrations from April 30 to December 1, 2025 exhibited a clear seasonal pattern closely linked to water temperature and hydrological conditions. DO levels were highest in the spring, generally ranging between 10–12 mg/L, before gradually declining through early summer and reaching their lowest values in mid- to late summer (approximately 6.5–9 mg/L) as water temperatures increased. During this period, pronounced daily fluctuations are observed, reflecting biological activity such as photosynthesis and respiration. From late August into the fall, DO concentrations began to recover as water temperatures decreased, with values steadily increasing through September and October. By November and into early December, DO reached some of the highest levels of the deployment (up to ~13.6 mg/L), corresponding with colder water temperatures and increased mixing.

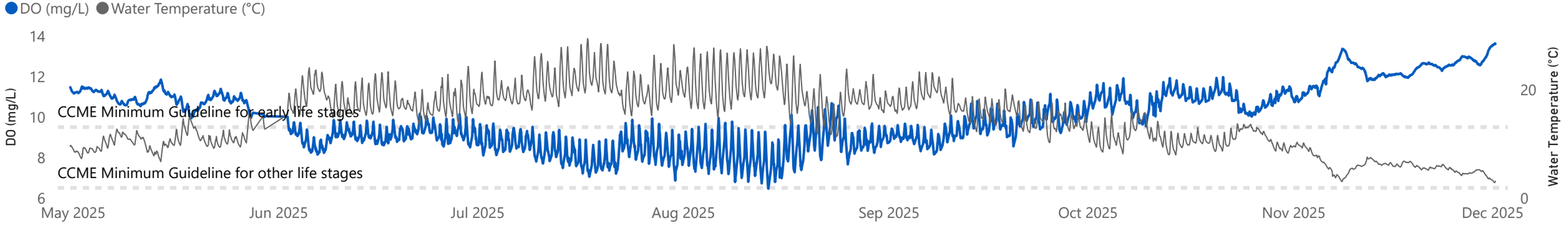
Values fell below the minimum threshold for early life stages in cold water (9.5 mg/L) during the warmer summer months (39.21%), while remained above the guideline for other life stages (6.5 mg/L). Overall, DO conditions improved significantly during the fall, with concentrations consistently exceeding both guideline thresholds as cooler temperatures supported higher oxygen availability.

CCME Early Life Stages Guideline

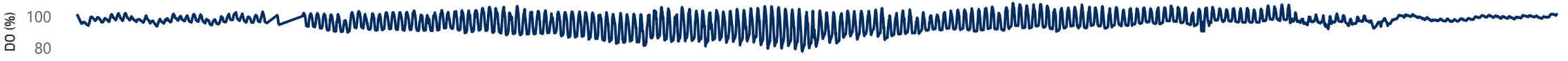


CCME Other Life Stages Guideline





Percent Saturation (%)

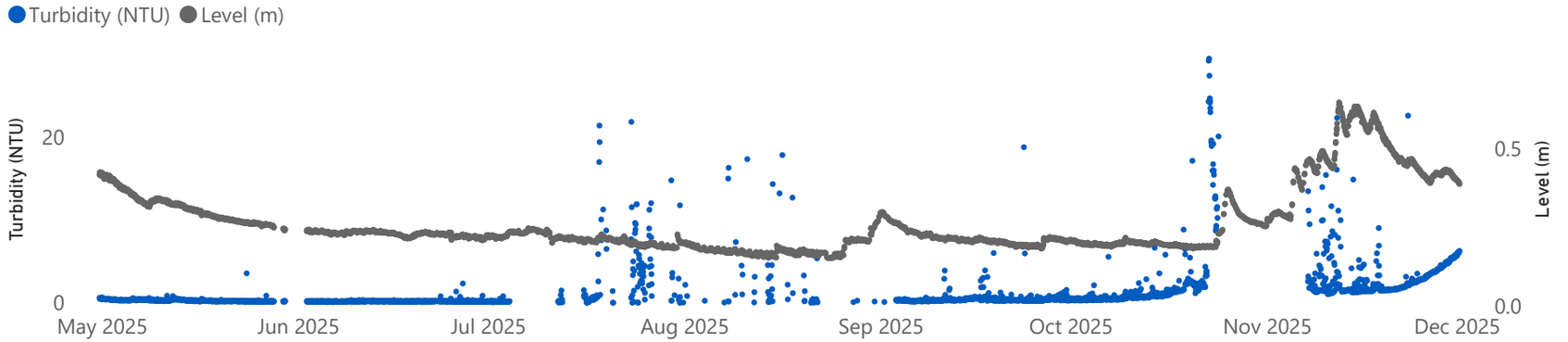


Turbidity

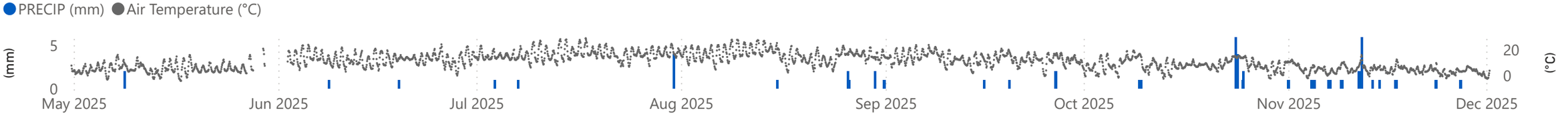
1.15	0.34	0.00	29.41
Average (NTU)	Median (NTU)	Minimum (NTU)	Maximum (NTU)

Water turbidity is characterized by the cloudiness or haziness caused by suspended particles and can significantly impact water quality. High turbidity reduces light penetration, hindering photosynthesis and affecting aquatic vegetation growth and habitat suitability. It can lead to temperature fluctuations, oxygen depletion from microbial decomposition of organic matter, and sedimentation, smothering benthic habitats and compromising biodiversity.

For statistical purposes, values greater than 30 NTU were removed. Turbidity at the site from April 30 to December 1, 2025 was generally low, with an average of 1.15 NTU and a median of 0.34 NTU, indicating that baseline conditions were typically clear throughout most of the monitoring period. The minimum recorded value was 0.00 NTU, while a maximum of 29.41 NTU occurred during a spike in early November. For much of the deployment, turbidity remained near zero, with intermittent increases observed primarily from mid-summer onward. These elevated values were partly associated with precipitation events and corresponding increases in water level. However, significant vegetation growth around the sensor became a dominant influence over time, contributing to persistently elevated readings by interfering with the optical sensor and trapping fine sediments. This buildup likely resulted in erroneous turbidity values during certain periods. Overall, while natural event-driven spikes were observed, vegetation growth had a notable impact on data quality and contributed to elevated turbidity measurements later in the deployment.



Climate data from MEMP

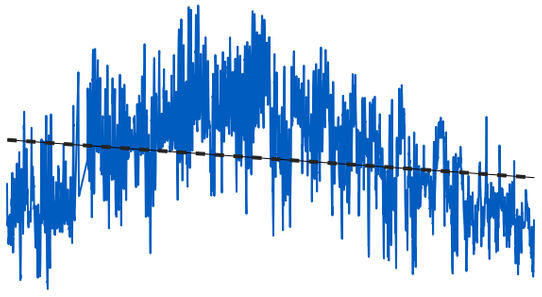


Meteorological and Hydrometric Data

*Climate data obtained from MEMP

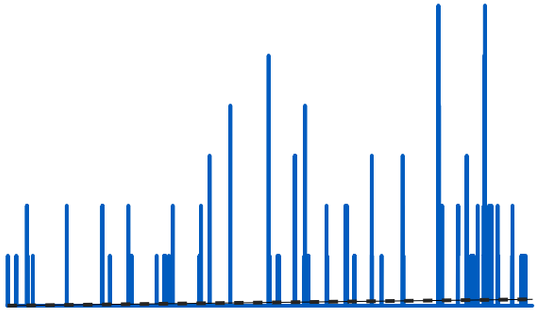
Newfoundland Labrador

Air Temperature Trendline



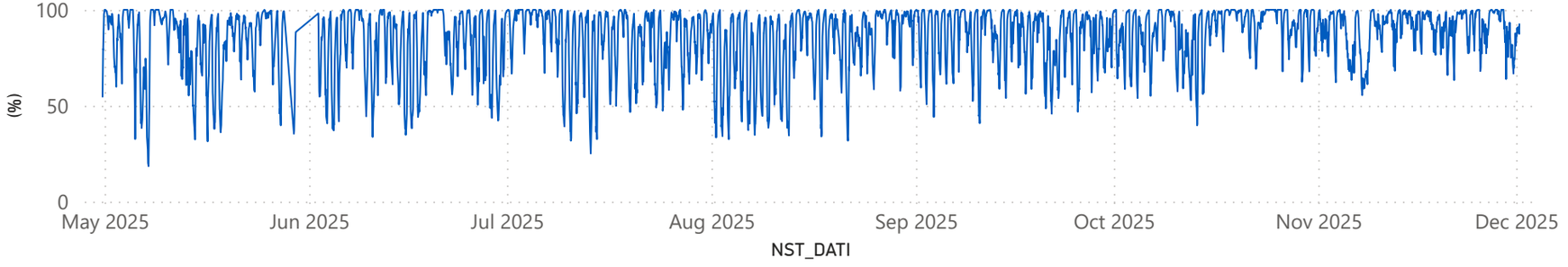
11.17	11.14
Average (°C)	Median (°C)
-3.99	29.08
Minimum (°C)	Maximum (°C)

Precipitation Trendline



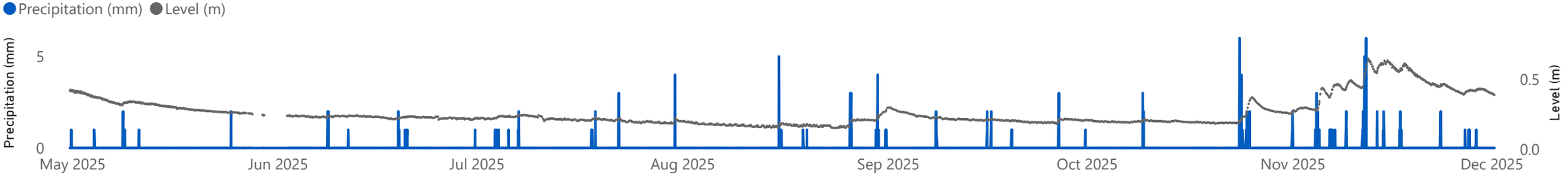
0.02	0
Average (mm/hr)	Median (mm/hr)
0	6
Minimum (mm/hr)	Maximum (mm/hr)

Relative Humidity (%)

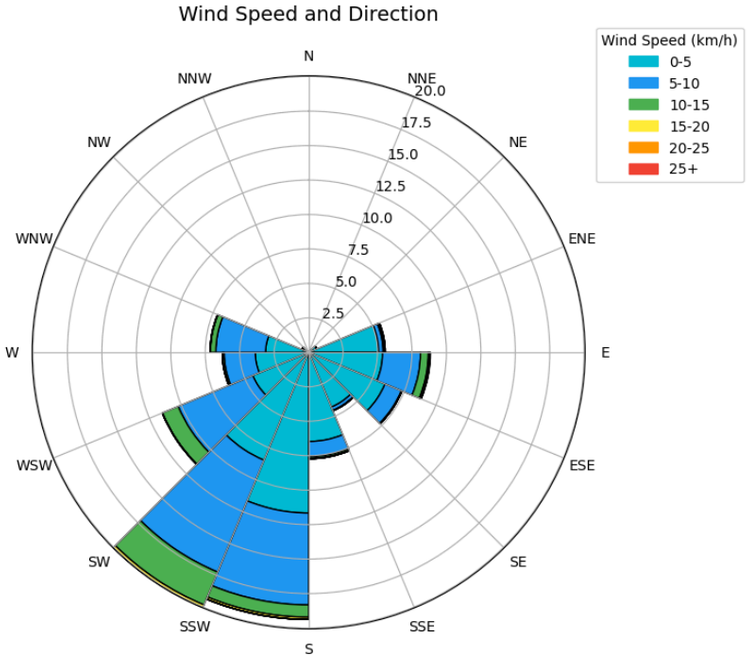


85.27	91.80
Average (%)	Median (%)
18.44	100.00
Minimum (%)	Maximum (%)

Precipitation (mm) and Level (m) by NST_DATI



Wind Speed & Direction

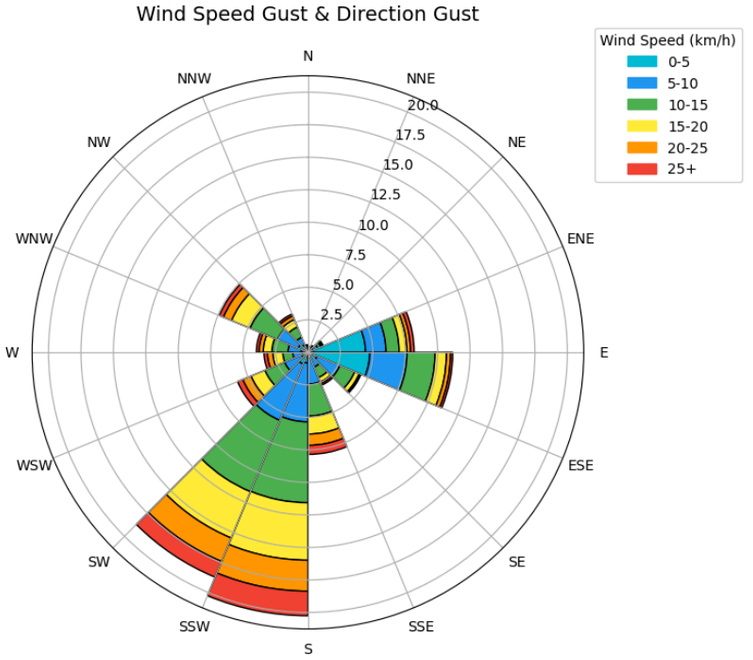


4.69
Average kmh

0.00
Minimum kmh

26.53
Maximum kmh

4.19
Median of WIND_...



12.38
Average Gust kmh

0.00
Minimum Gust kmh

55.53
Maximum Gust kmh

11.50
Median Gist kmh

Wind conditions at the Hodge River Pumphouse site in the Town of Whitbourne from April 30 to December 1, 2025 were characterized by a consistent prevailing wind direction from the south to south-southwest sectors. Wind speed and direction data indicate that most observations fell within the moderate range of approximately 5 to 15 km/h, with lower and higher wind speeds occurring less frequently. Contributions from other directional sectors, including westerly, easterly, and northerly winds, were present but minor in comparison.

The wind speed gust and direction gust data show a similar directional distribution, with peak gusts also predominantly originating from the south-southwest. Gust events were associated with higher wind speed categories than the average conditions, with multiple occurrences exceeding 20 km/h. Despite this increase in intensity, gusts remained largely aligned with the dominant southerly flow pattern.

Overall, the agreement between average wind conditions and gust data indicates a stable and well-defined prevailing wind regime at the site during the monitoring period, with periodic higher-intensity gust events occurring within the same dominant directions.

Hydrometric Study

In addition to the continuous water level data collected at the station, a total of five streamflow measurements were obtained at varying water levels using a FlowTracker These measurements were primarily collected to compile water quantity data for an upcoming flood study.

For the collected data to be suitable for a flood study, a vertical control survey was also completed at the site. This survey was done to relate locally referenced stage measurements to a standard vertical datum (e.g., CGVD2013). The survey was completed on two occasions to ensure accurate and consistent results. Both surveys were undertaken using Real -Time Kinematic (RTK) survey equipment. RTK observations were then processed using Precise Post Processing (PPP). All collected data, including RTK observations, were compiled and given to the consultants undertaking the flood study.

In addition to flood study applications, streamflow data was also collected to support WRMD staff's ongoing efforts to evaluate approaches for developing rating curves at gauged rivers. The measurements were used to create a preliminary rating curve in Excel and were also applied within British Colombia's HydRA rating curve tool. This was done to essentially compare methods and determine a path forward for our gauged rivers regarding rating curves and flow measurements.

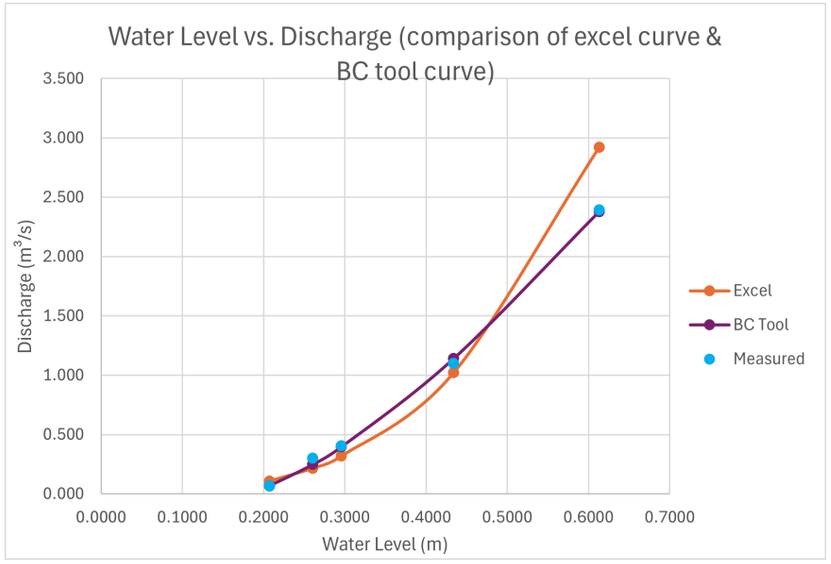
Figure 1. RTK survey point location. Conducted August 27, 2025, & November 28, 2025

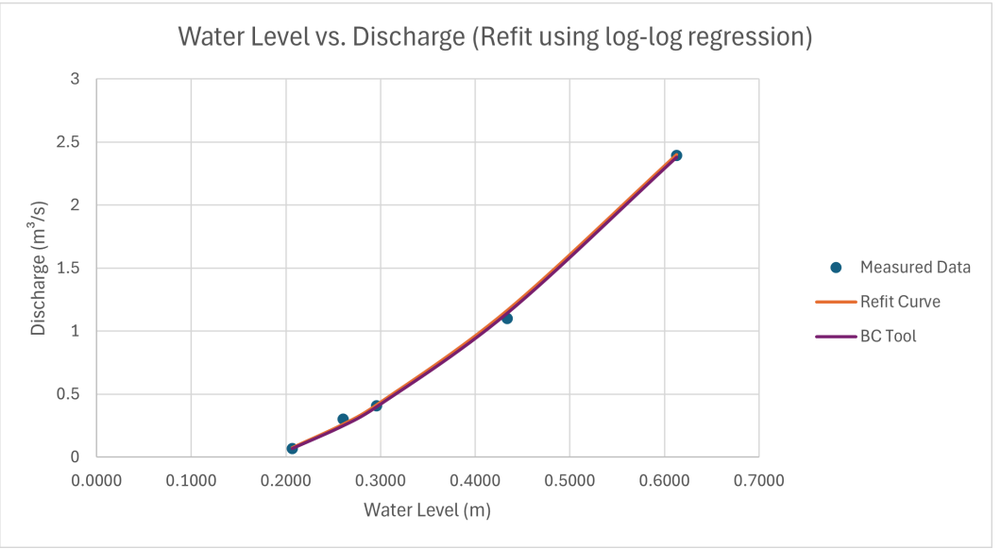
Figure 2. Survey locations (4) & water points collected at each location were averaged.

RTK Water Level Survey Interpretation

A high-precision GNSS survey was completed at the Hodge River near the Town pumphouse in August and November 2025 to establish accurate water-surface elevations relative to a permanent ground reference. Measurements show that the average river water level at the monitoring location increased from approximately 56.02 m (CGVD2013) in August to 56.15 m in November, representing a rise of about 0.13 m (13 cm) over this period. The survey methodology used repeated measurements and independent positioning techniques to ensure reliability, with an estimated uncertainty of ±2–3 cm for relative water-level change. This observed increase therefore exceeds measurement uncertainty and represents a real and measurable rise in river level. The results provide the Town with a defensible benchmark for tracking future water-level changes and assessing potential implications for infrastructure, erosion, and flood risk near the pumphouse area.

Rating Curve Evaluation





Streamflow data was also collected to support WRMD staff's ongoing efforts to evaluate approaches for developing rating curves at gauged rivers. The measurements were used to create a preliminary rating curve in Excel and were also applied within British Colombia's HydRA rating curve tool. This was done to essentially compare methods and determine a path forward for our monitored rivers regarding rating curves and flow measurements.

Measured water-level and discharge data collected between August and November 2025 were used to evaluate and refine the stage–discharge (rating) relationship for the Hodge River. Observed flows ranged from approximately 0.07 m^3/s at low water levels (~0.21 m) to 2.39 m^3/s at higher stages (~0.61 m). Comparison of measured discharges with the existing rating curve showed good agreement at low to moderate flows, but increasing divergence at higher water levels, where the original curve tended to either over- or under-estimate discharge depending on stage. A refitted power-law rating equation based on the measured data provides improved consistency across the observed range and more accurately represents flow conditions during elevated water levels. These results indicate that the updated rating relationship offers a more reliable tool for estimating river discharge from water-level observations, supporting improved flood assessment, flow monitoring, and infrastructure planning for the Town of Whitbourne.

Conclusions

A Mobile Environmental Monitoring Platform (MEMP) was deployed on the Hodge River in the Town of Whitbourne on 2025-04-30 to 2025-12-01. The system collected continuous water quality, meteorological, and hydrometric data.

• **Water Temperature** ranged from 2.84 °C to 29.53 °C, with an average of 14.67 °C. Temperatures followed expected seasonal and diurnal patterns, with peak values occurring during summer months and a steady decline into fall, closely tracking air temperature trends.

• **pH** values ranged from 6.31 to 8.11, with an average of 6.88. Conditions remained generally stable throughout the deployment and were within CCME Guidelines for the Protection of Aquatic Life for the majority of the monitoring period. Short-term decreases observed in the fall were associated with precipitation events and the influence of cooler, more acidic runoff.

• **Specific Conductivity** ranged from 56.41 to 93.40 µS/cm, with an average of 77.35 µS/cm. Conductivity increased gradually through spring and summer under lower flow conditions and decreased into the fall as precipitation and runoff resulted in dilution.

• **Dissolved Oxygen** ranged from 6.46 to 13.63 mg/L, with an average of 9.93 mg/L. DO concentrations exhibited a strong seasonal relationship with temperature, with lower values observed during warmer summer conditions and recovery through the fall as temperatures declined. Values remained above the CCME guideline for other life stages (6.5 mg/L) throughout the deployment but fell below the early life stage guideline (9.5 mg/L) during warmer periods.

• **Turbidity** ranged from 0.00 to 29.41 NTU, with an average of 1.15 NTU. Baseline conditions were generally low, indicating good water clarity. Elevated turbidity events were associated with precipitation and increased stage; however, some sustained elevated values were likely influenced by sediment and vegetation accumulation within the sonde casing, affecting sensor performance.

• **Meteorological and Hydrometric Conditions** show that temperature variation and precipitation events, with resulting increases in water level had a direct influence on water quality parameters, particularly turbidity, conductivity, and pH.

• **Hydrometric and Rating Curve Analysis** demonstrated that measured flows aligned well with existing rating relationships at low to moderate flows, with improved accuracy achieved through updated curve fitting at higher stages. Survey results confirmed a measurable increase in water level between summer and fall, supporting ongoing flood risk assessment efforts.

Overall, the MEMP deployment provided a comprehensive dataset capturing seasonal variability and hydrologic responses within the Hodge River system. The collected data support improved understanding of watershed dynamics, drinking water source protection, and flood risk management within the Town of Whitbourne.

Appendix 1
Grab Sample Results