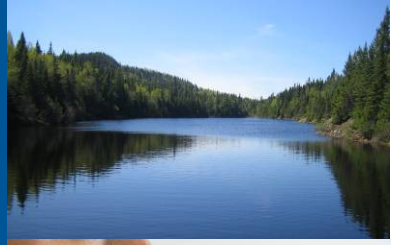
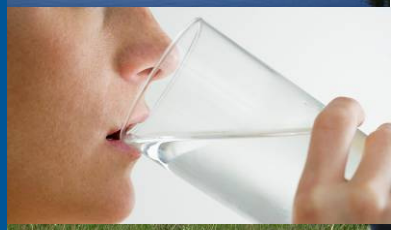






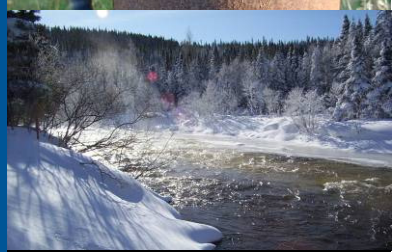

Real Time Water Quality Report
Minipi River

Deployment Period 2010-06-24 to 2010-07-24

2010-07-29

Newfoundland Labrador

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

General

- Water Resources Management Division (WRMD) staff monitors the real-time web page on a daily basis.

Maintenance and Calibration of Instrumentation

- After being cleaned and freshly calibrated the **DataSonde®** for Minipi River were installed on June 24, 2010, and remained deployed continuously until July 24, 2010, a 30 day period. On June 24, 2010, the instrument was checked *in situ* against a freshly calibrated **MiniSonde®** to verify that it was functioning properly, and had no significant drift.

Quality Assurance / Quality Control (QA/QC) Measures

- As part of the QA/QC protocol, 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. See **Table 1**.

	Rank				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (oC)	<=+/-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

Table 1: Ranking limits for Parameters

- Upon deployment, a QA/QC **MiniSonde®** is temporarily deployed along side the Field **DataSonde®**. Values for temperature and dissolved oxygen are compared between the two instruments. A grab sample is taken to compare with the Field **DataSonde®** for specific conductivity, pH and turbidity parameters. Based on the difference between parameters recorded by the Field **DataSonde®**, QAQC **MiniSonde®** and grab sample a qualitative statement is made on the data quality upon deployment.
- At the end of a deployment period, readings are taken in the water body from the Field **DataSonde®** before and after a thorough cleaning in order to assess the degree of biofouling. During calibration in the laboratory, an assessment of calibration drift is made and the two error values are combined to give Total Error (T_e). If T_e exceeds a predetermined data correction criterion, a correction based on T_e is applied to the dataset using linear interpolation. Based on the value for T_e, a qualitative statement is also made on the data quality upon removal.
- The rankings at the beginning and end of the deployment period are shown in **Table 2** for Minipi River.

- During deployment all parameters are ranked *Excellent*, except for pH and Specific Conductivity (µS/cm). The pH sensor generally takes the longest to stabilize when placed in a water body. The values take some time to climb to the appropriate pH reading, if a reading is taken too soon it may not accurately portray pH. The *Poor* ranking of pH may be due to this.

- Specific Conductivity (µS/cm) was ranked at *Fair*; this could be a reflection on comparing the data between two different methods of water sampling, one value is taken from the instrument and the other value is identified by a grab sample. Specific conductivity data collected by grab samples are liable to change over time and as the temperature adjusts in the sample. In some environments specific conductance changes are continuous. To ensure an accurate comparison value the grab sample needs to correspond directly with the exact place/time of the data collected by the instrument.

- All parameters ranked excellent upon removal.

- With the exception of water quantity data (Stage), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent Quality Assurance and Quality Control (QA/QC) protocol. Water Survey of Canada is responsible for QA/QC of water quantity data (Stage). Corrected data can be obtained upon request. Where appropriate, corrected data for water quality parameters are indicated.

Minipi River Station		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2010-06-24 Deployment SN:47589	Temp (°C)	Excellent
	pH (units)	Poor
	Sp. Conductivity (uS/cm)	Fair
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2010-07-24 Removal SN:47384	Temp (°C)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (%)	Excellent
	Turbidity (NTU)	Excellent

Table 2: QA/QC Data Comparison Rankings for deployment between June 24 and July 24, 2010

DATA INTERPRETATION

TEMPERATURE

- The water temperature (**Figure 1**) ranged from a minimum of 11.94˚C to a maximum of 19.06˚C.
- The temperature ranges are depicting the steady increase in water temperature from June onwards as the climate gets warmer.
- Stage can be defined as the height of the surface of a river or other fluctuating body of water above a set point. The set point is the bottom axis of this graph.
- It may seem that there is a correlation between temperature and stage; however it is possible that both parameters are influenced by the increase in air temperature and climatic change. Water temperature increases with warmer temperatures and stage decreases through evaporation and/or less rainfall.
- There is slight evidence that water temperature may have been influenced by several rainfall events that occurred around July 16, 2010. The temperature values of Minipi River level out slightly around this time.
- As neither fouling nor calibration drift occurred on the temperature probe, there was no need to correct the raw data for temperature.

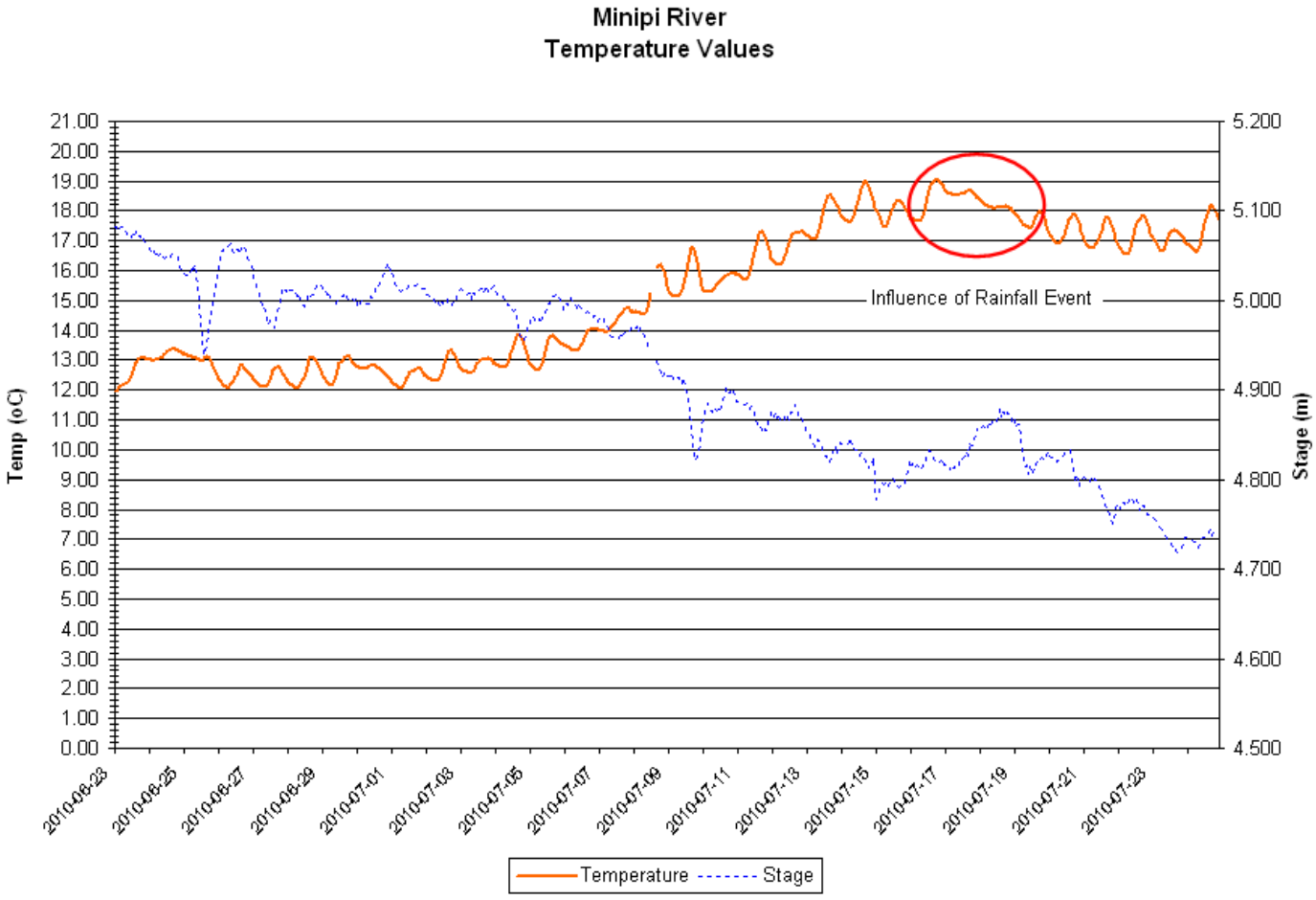

Figure 1: Water Temperature at Minipi River

pH

- Throughout the deployment period pH values (**Figure 2**) ranged from a minimum of 6.21 to a maximum of 7.04.
- There is a slight increase in the pH maximum and minimum values from last month, this may be due to an increase in temperature which influences natural processes in the water body adjusting the pH range.
- From June 24, 2010 onwards the pH values are within the recommended range (6.5 – 9.0) for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.
- The background pH of Minipi River is historically constant around the minimum limit for the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* recommended range.
- As fouling and calibration drift were negligible, no data corrections were required for pH.

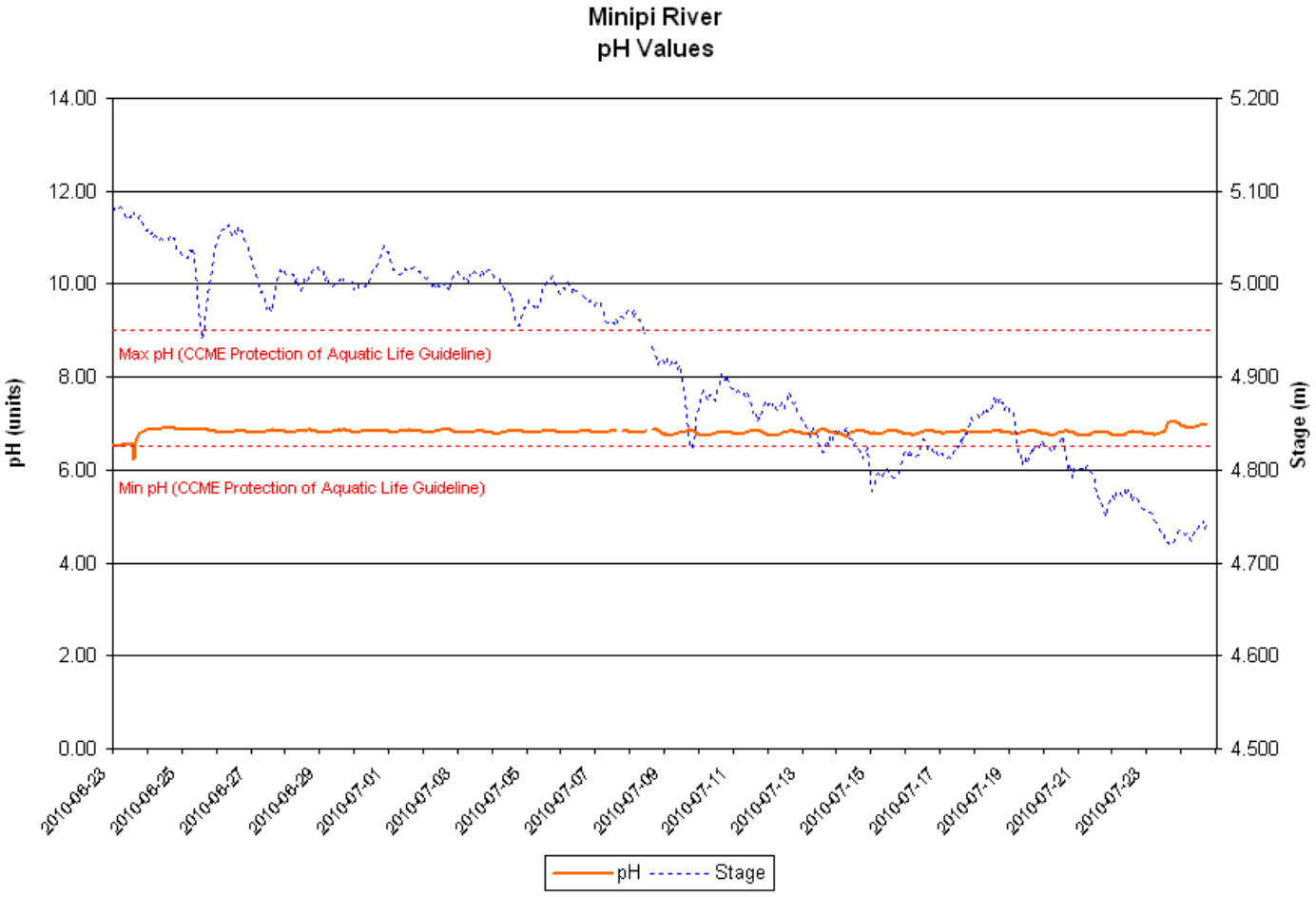

Figure 2: pH values at Minipi River

SPECIFIC CONDUCTIVITY

- The specific conductivity **(Figure 3)** ranged from a minimum of 13.0 µS/cm to a maximum of 15.0 µS/cm over the deployment period.
- Specific Conductivity remained reasonably constant during the deployment month. There are several small increases in the values although still within the historical range for Minipi River. The difference between 13.0 µS/cm and 15.0 µS/cm is minimal; it appears significant due to the scale of the graph.
- As fouling and calibration drift were negligible, no data corrections were required for Specific Conductivity.
- There is no apparent correlation between specific conductivity and stage. However the small increase in conductivity from 13.0 µS/cm to 14 µS/cm may be due to the drop in stage.
- This area did have several rainfall events however it was not enough to influence the conductivity levels in Minipi River.

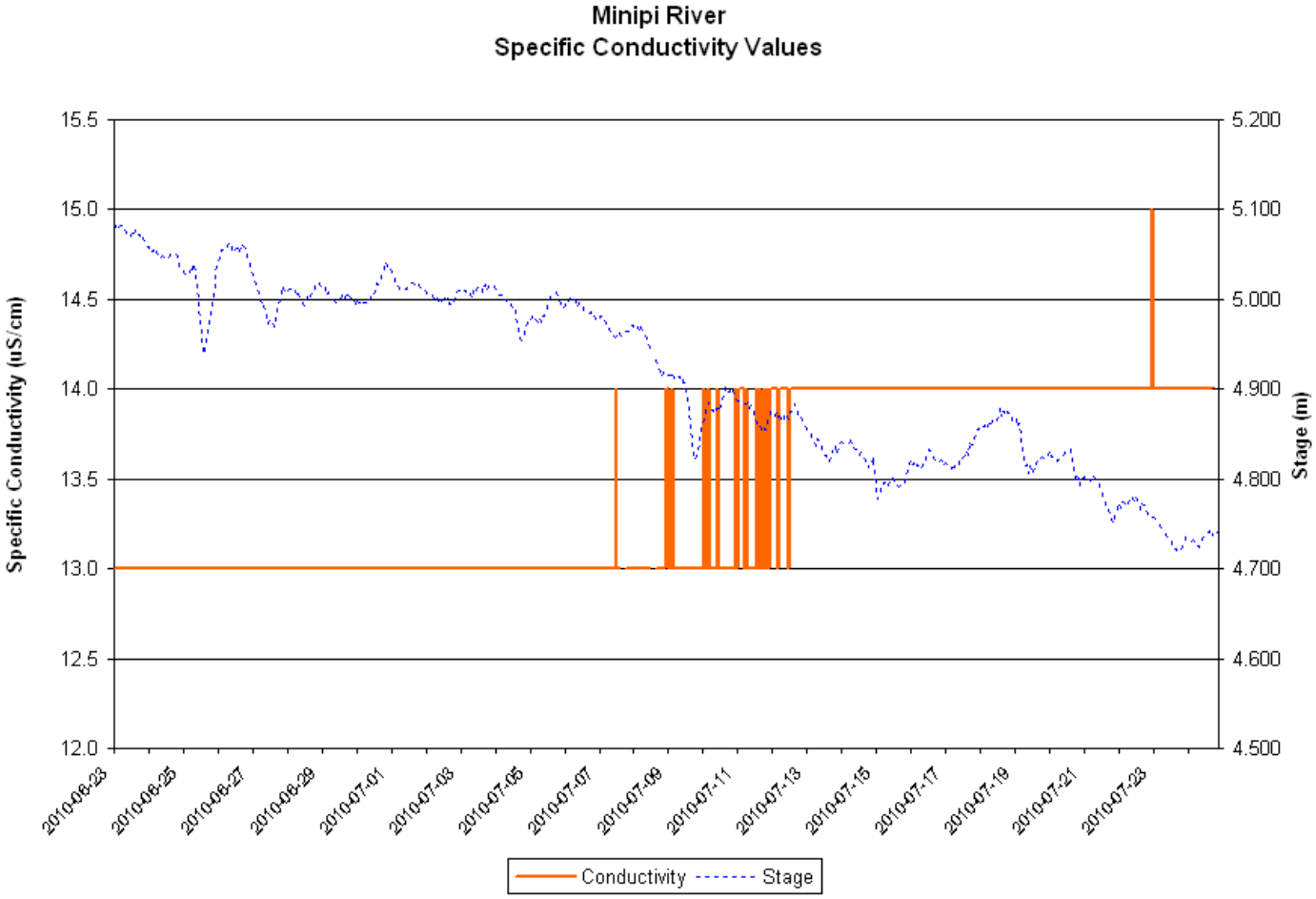

Figure 3: Minipi River Specific Conductivity Values

DISSOLVED OXYGEN

- The dissolved oxygen (DO) (**Figure 4**) values ranged from a minimum of 8.94 mg/L to a maximum of 10.43 mg/L over the deployment period.
- Dissolved oxygen is inversely proportional to water temperature. There is slight evidence that DO (mg/L) may have been influenced by several rainfall events that occurred around July 16, 2010. The DO (mg/L) values of Minipi River level out slightly around this time.
- Throughout the deployment period, all dissolved oxygen values fell slightly below the limits recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (Cold Water/Early Life Stages – above 9.5 mg/L). Though still above the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (Cold Water/Other Life Stages – above 6.5 mg/L)
- There was evidence of drift with the Dissolved Oxygen (%Sat) values therefore the data was automatically corrected. Dissolved Oxygen (% Sat) had a total (combined fouling/calibration) error of -0.20, which was used to correct the raw data for Dissolved Oxygen (% Sat). The corrected data is marked in brown on Figure 4, it may be hard to visualize due to the DO (%Sat) line in bright blue sitting almost on top of the Corrected DO (%Sat) line.
- DO (mg/L) does not require correction; this data is shown on Figure 4, in dark green.
- Upon deployment the DO (mg/L) ranked excellent when compared with the QA/QC instrument and during removal the DO (%Sat) ranked excellent when compared with the QA/QC instrument, one can be confident that the readings are reasonably accurate.

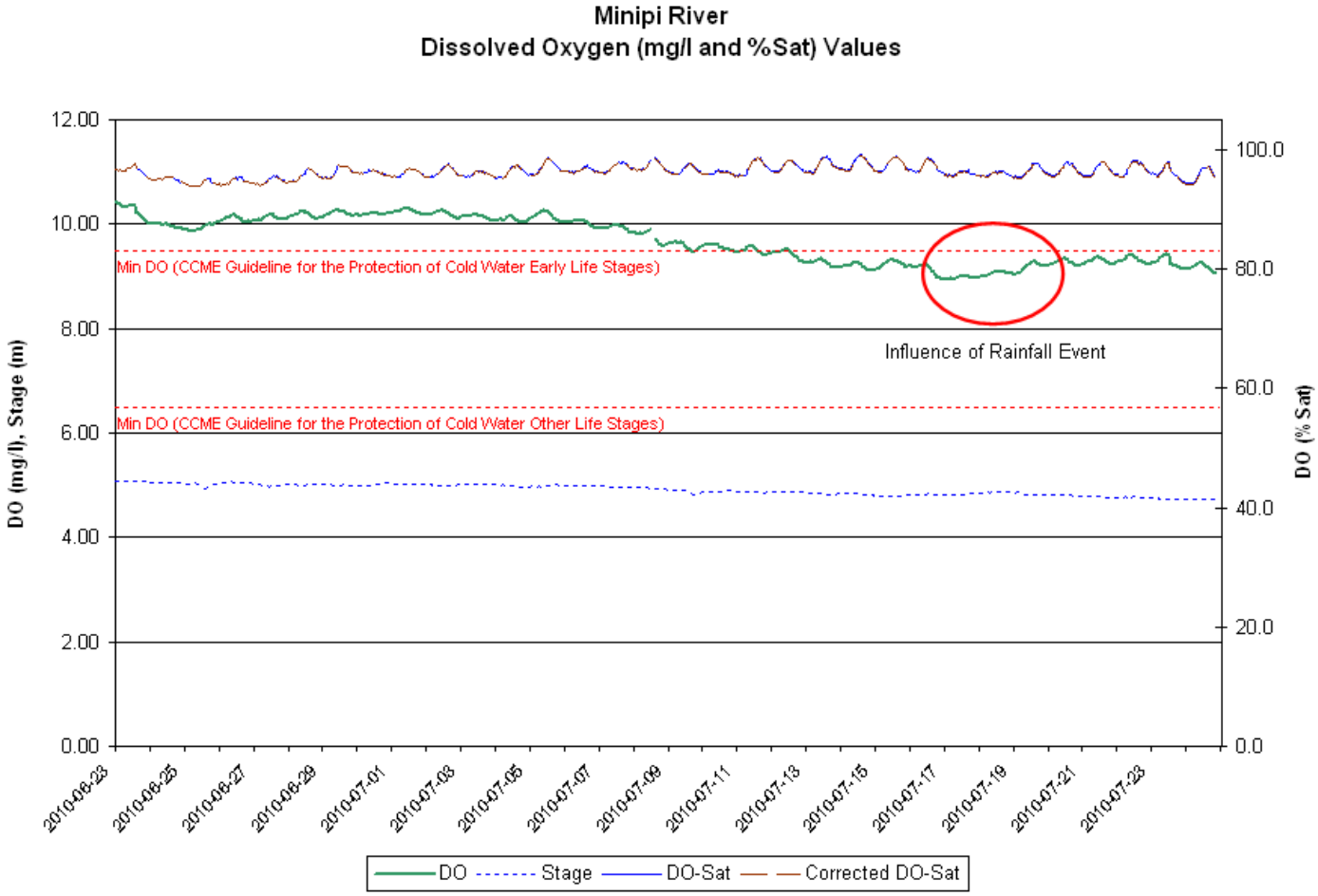

Figure 4: Dissolved Oxygen (mg/L & % Sat) at Minipi River

TURBIDITY

- The turbidity values **(Figure 5)** range from a minimum of 0.0 NTU to a maximum of 2.5 NTU over the deployment period.
- There was no evidence of fouling or calibration drift influence to the turbidity values, during this deployment period.
- Historically turbidity levels are low in Minipi River, the graph depicts two small increases in turbidity on June 30, 2010 to ~1.4 NTU then again on July 16, 2010 to ~2.5 NTU, after both events the turbidity drops back down to 0.0 NTU.
- These events may be corresponding with several small precipitation events.

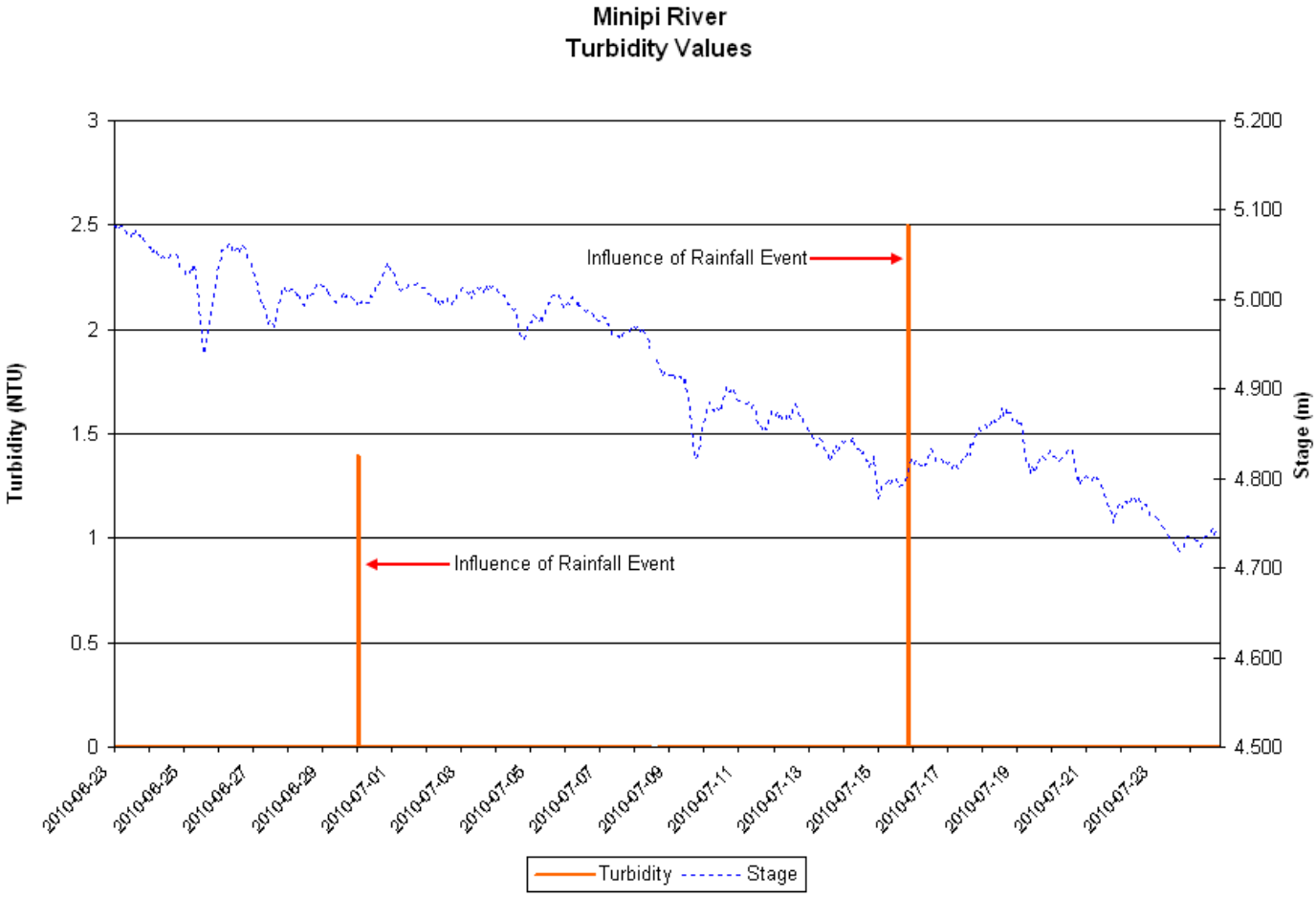

Figure 5: Turbidity Values for Minipi River

STAGE AND STREAM FLOW

- Stage can be defined as the height of the surface of a river or other fluctuating body of water above a set point. The set point is the bottom axis of this graph.
- The stage (**Figure 6**) ranged from a minimum of 4.718 m to a maximum of 5.083 m with the highest peaks corresponding with precipitation events.
- The stream flow ranged from minimum of 76.5 m³/s to a maximum of 107 m³/s. Stream flow can be influence by precipitation events and corresponding runoff.
- Stream flow will naturally decrease during the summer months as they are the hotter and drier months of the year creating greater evaporation and less runoff.

PRECIPITATION

- The closest recorded rainfall to Minipi River is at a weather station in Happy Valley – Goose Bay. This station is monitored by Environment Canada, where the data is available at http://www.climate.weatheroffice.gc.ca/climateData/dailydata_e.html?Prov=XX&timeframe=2&StationID=6777&Day=1&Month=5&Year=2010&cmdB1=Go
- **Figure 6** indicates the range of precipitation for this area between June 24 and July 24, 2010.
- According to the rainfall recorded in Happy Valley- Goose Bay, the highest rainfall was 21.6 mm on June 25, 2010 and the lowest rainfall recorded was 0.0 mm which occurred on several deployment days.
- As noted on Figure 6, there is evidence of a small influence in the stage and stream flow on June 24, 2010. After several precipitation events toward the end of the deployment period there is evidence of a change in stage and stream flow around July 18, 2010.

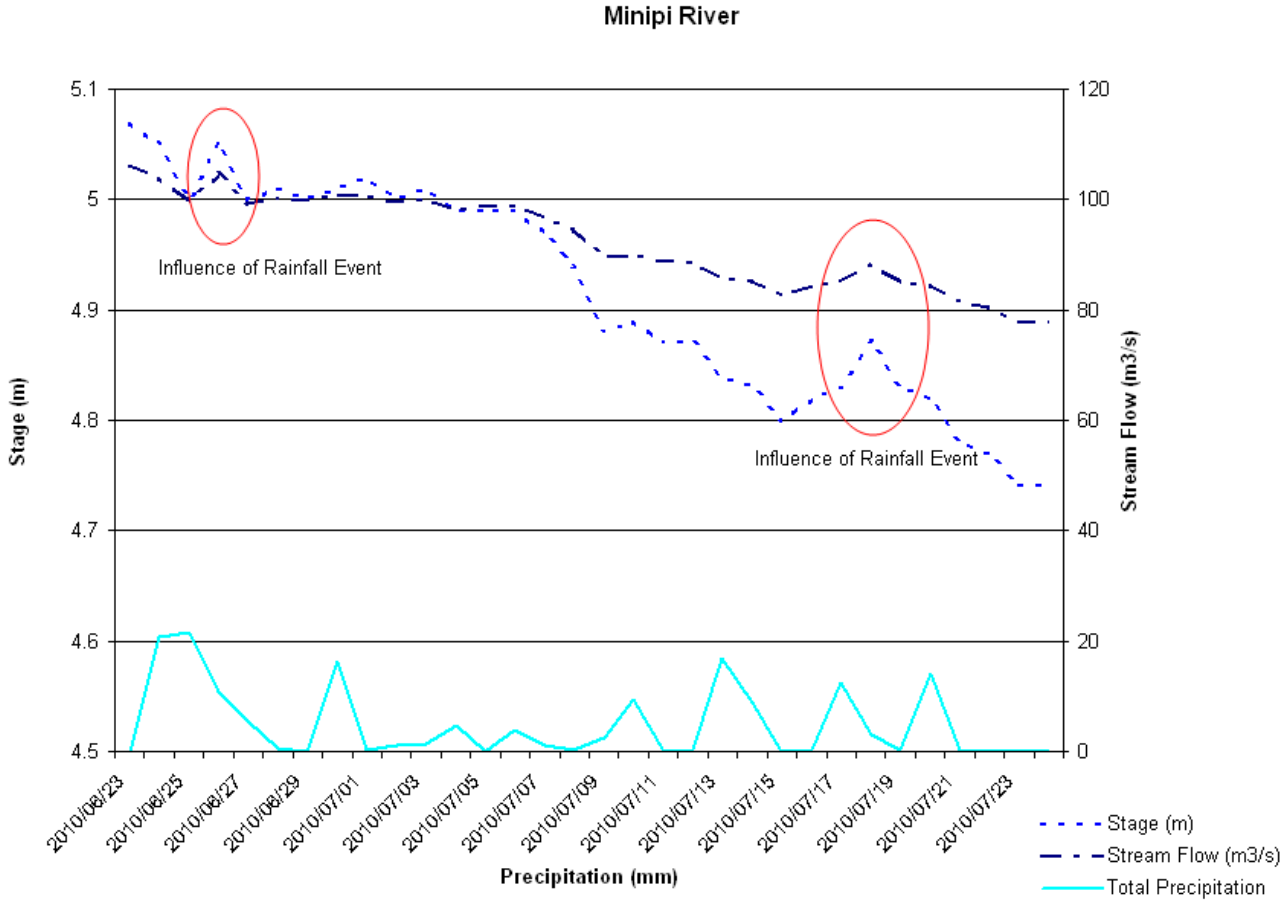

Figure 6: Minipi River stream flow and stage, compared with Happy Valley-Goose Bay precipitation.

CONCLUSION

The water quality monitoring instrument was deployed at the station on Minipi River below Minipi Lake between June 24, 2010 and July 24, 2010. During this deployment period, no momentous water quality events were recorded at the Minipi River Station below Minipi Lake. There was indication of rainfall events throughout this deployment period; these events were evident in the water temperature values, dissolved oxygen values and turbidity values. However there was no noticeable correlation with the other parameters; pH and specific conductance. Typical seasonal patterns are evident in temperature, dissolved oxygen and stage as the air temperature increases during the summer months, natural continual changes will occur in the water body.

Throughout the deployment period, the dissolved oxygen values fell slightly below the limits recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (Cold Water/Early Life Stages – above 9.5 mg/L). However the values were still above the CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (Cold Water/Other Life Stages – above 6.5 mg/L). The range of pH values is within the lower scale of the *CCME Guidelines for the Protections of Aquatic Life;* background pH for Minipi River indicates that these values are the norm for this station.

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