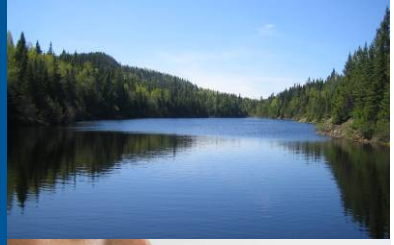
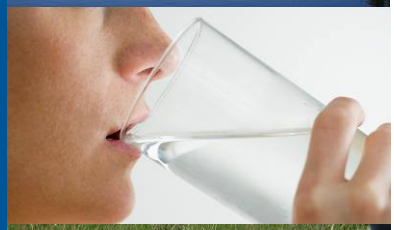






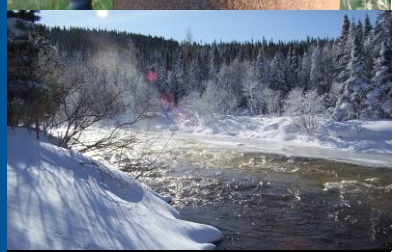

Real Time Water Quality Report
Main River at Paradise Pool

Deployment Period 2010-06-29 to 2010-08-24

2010-10-28

Newfoundland Labrador

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

General

- This station is operated cooperatively with Environment Canada.
- This station is operated seasonally from early spring as soon as the site is free of ice and up until the late fall before ice forms along the river.
- Staff of the Water Resources Management Division (WRMD) monitors the real-time web page on a daily basis. Any unusual observations are investigated.
- This is a remote site accessible by helicopter only and site visits for QA/QC purposes and the installation of freshly calibrated instruments are conducted by staff of the WRMD approximately five or six times per field season.

Maintenance and Calibration of Instrumentation

- On June 29, 2010 the Main River at Paradise Pool **DataSonde®** was removed and replaced with one that was freshly calibrated. This instrument remained deployed continuously until August 24, 2010 when it was removed and replaced with another freshly calibrated one.

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

- Upon deployment, a QA/QC **DataSonde®** 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®** and QAQC **DataSonde®** 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. Unfortunately in this case the field instrument was not calibrated after being removed from the field and therefore the rankings for removal are based on a simple comparison of the field instrument to the QA/QC instrument.
- The ranking at the beginning and end of the deployment period are shown in **Table 2**.
- 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. Corrected data can be obtained upon request.

Main River at Paradise Pool (NF02YG0009)		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2010-06-29 Deployment	Temp (^oC)	Excellent
	pH (units)	Fair
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2010-08-24 Removal	Temp (^oC)	Excellent
	pH (units)	Excellent
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (%)	Excellent
	Turbidity (NTU)	Poor*

Table 2

* At the time of removal, the turbidity probe was impacted by significant bio-fouling due to warmer than normal waters caused by prolonged low flow conditions. The turbidity probe was giving false high turbidity readings which meant it compared poorly with the QA/QC data.

Data Interpretation

- The water temperature (**Figure 1**) ranged from a minimum of 12.7 ˚C to a maximum of 22.8 ˚C, with no clear long term trend throughout the deployment period.

- Temperature shows a diurnal trend with warming during the day and cooling at night.

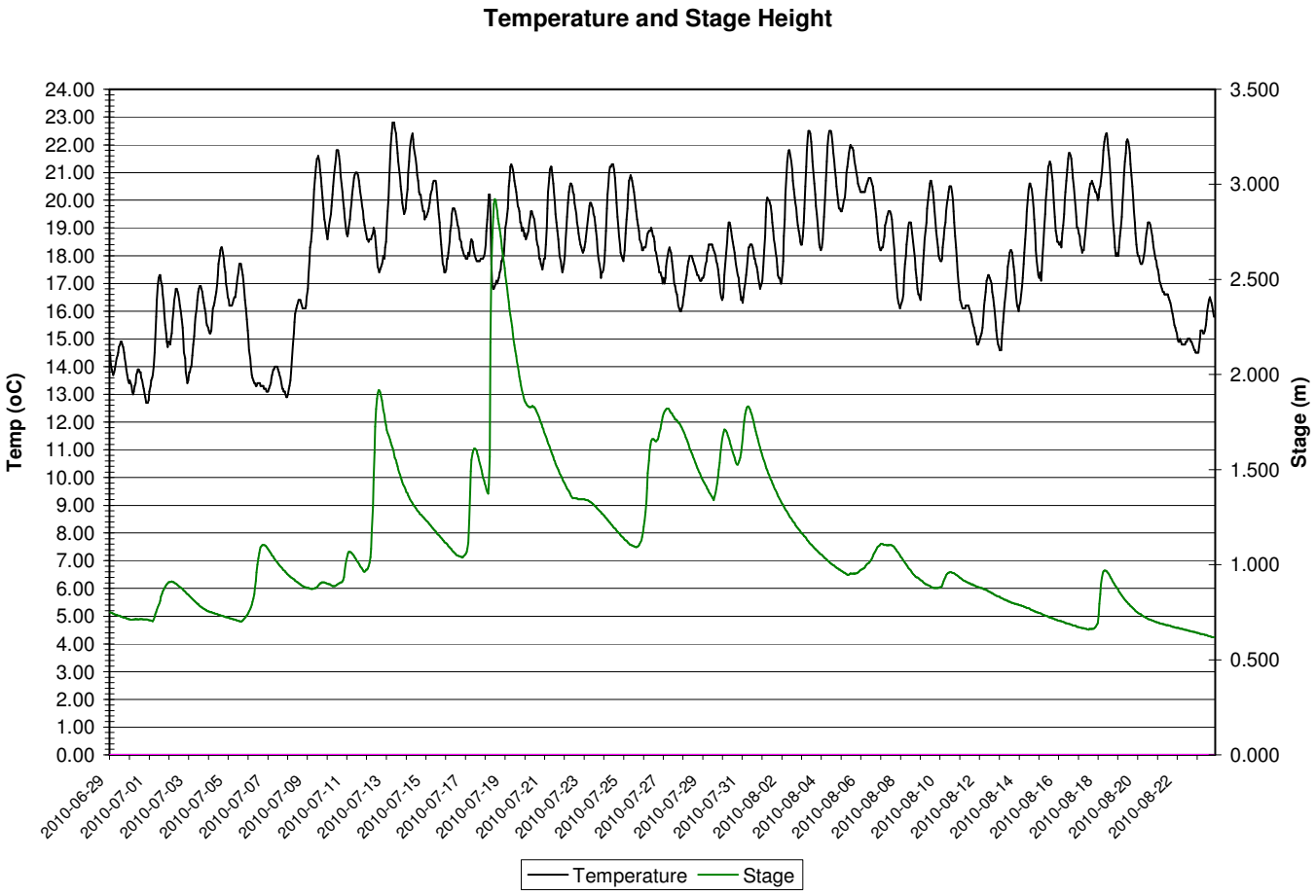

Figure 1

- The pH ranged from a low of 4.40 to a high of 5.78 and remained quite stable throughout the deployment period. (**Figure 2**).

- It should be noted that on two occasions around July 12th and July 18th there are noticeable dips in pH which are related to significant rises in stage height and flow.

- All pH readings were below the range of 6.5 to 9.0 recommended by CCME for the protection of aquatic life. It should be noted that these pH readings are normal for Main River and that its aquatic ecosystems are healthy with abundant aquatic life. The CCME guidelines are developed for the country as a whole and cannot accommodate the site specific conditions of all aquatic ecosystems such as Main River's.

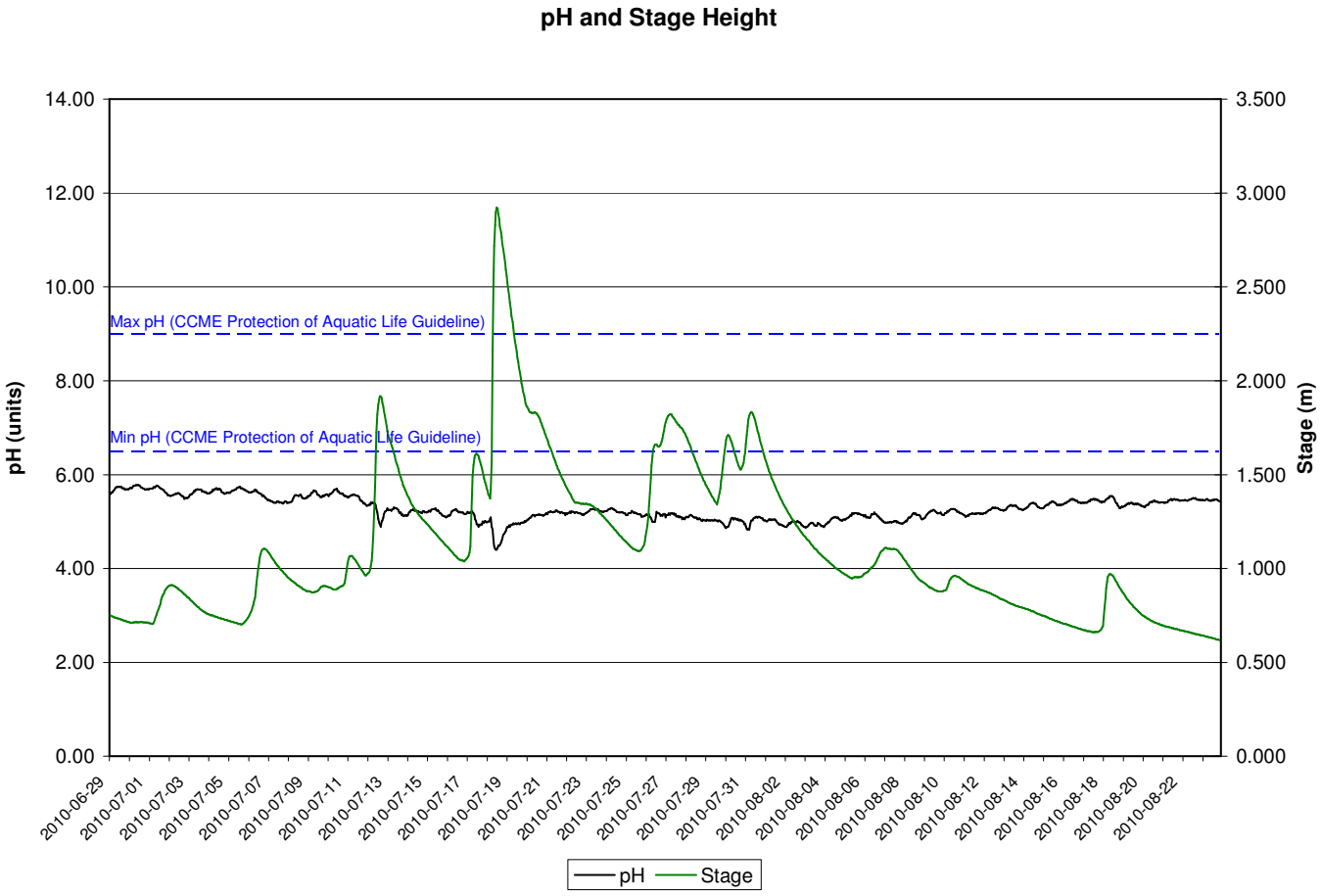

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 16.1µS/cm to a maximum of 20.7 µS/cm and was relatively stable over the deployment period.

- It appears that significant increases in stage height and flow around July 12th, 18th, 27th, 30th and 31st were all correlated with noticeable dips in specific conductivity. Conversely a spike in flow during low flow conditions around August 18th seems to be related to an increase in specific conductivity.

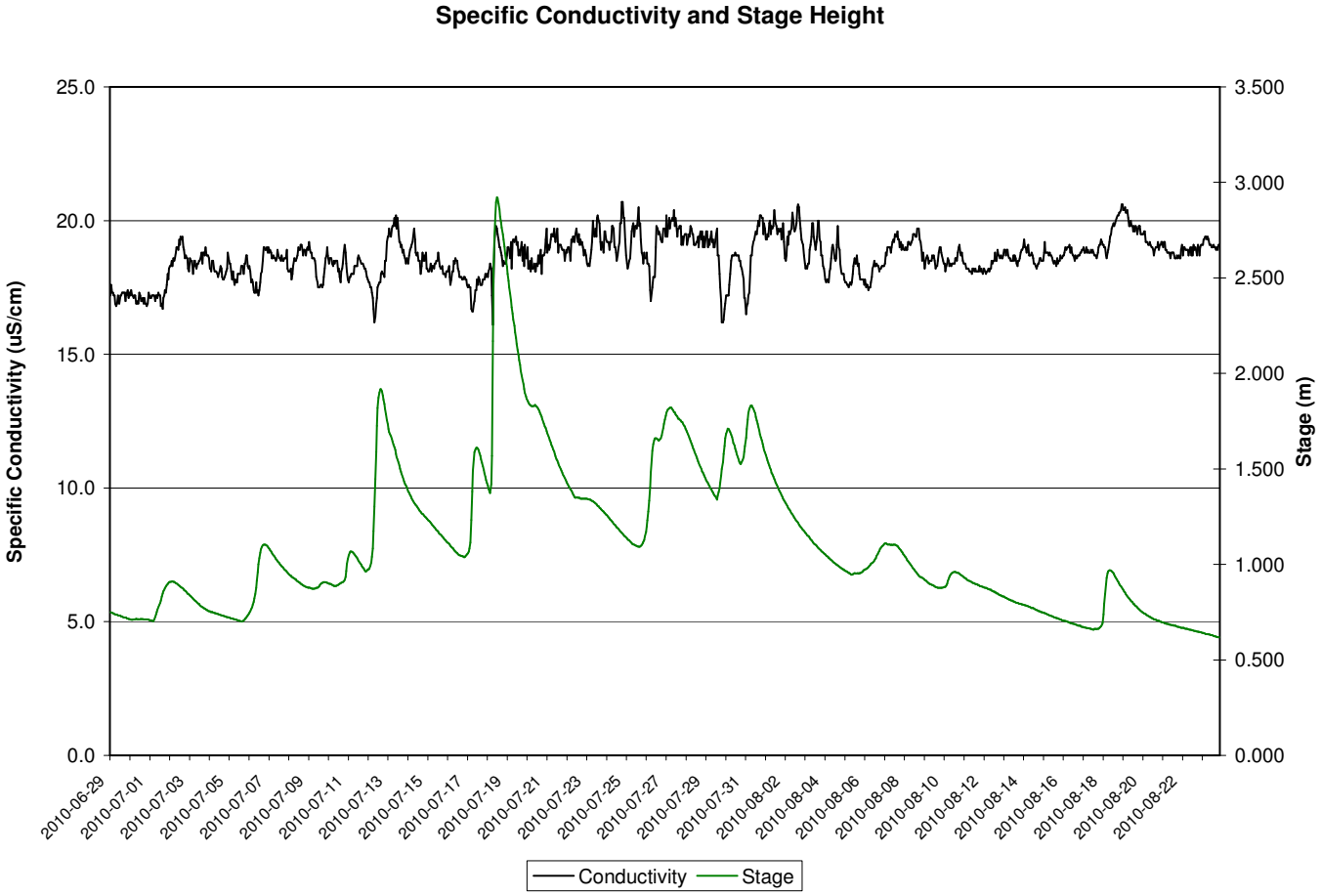

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 6.94 mg/L to a maximum of 9.57 mg/L over the deployment period with the corresponding percent saturation ranging between 74.6% and 96.8%.

- While these levels may seem low for a pristine river it should be noted that this deployment period was during the warmest part of summer when there was an extended low flow period with relatively warm water temperatures ranging from 12.7 ˚C to 2.8 ˚C with a median temperature of 18.2 ˚C.

- Throughout the deployment period almost all of the dissolved oxygen values fell below the limits recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* for the Protection of Cold Water Early Life Stages (9.5 mg/l) and above the Guideline for the Protection of Cold Water Other Life Stages (6.5 mg/l).

- There is a clear diurnal trend for dissolved oxygen which is related to the diurnal temperature trend.

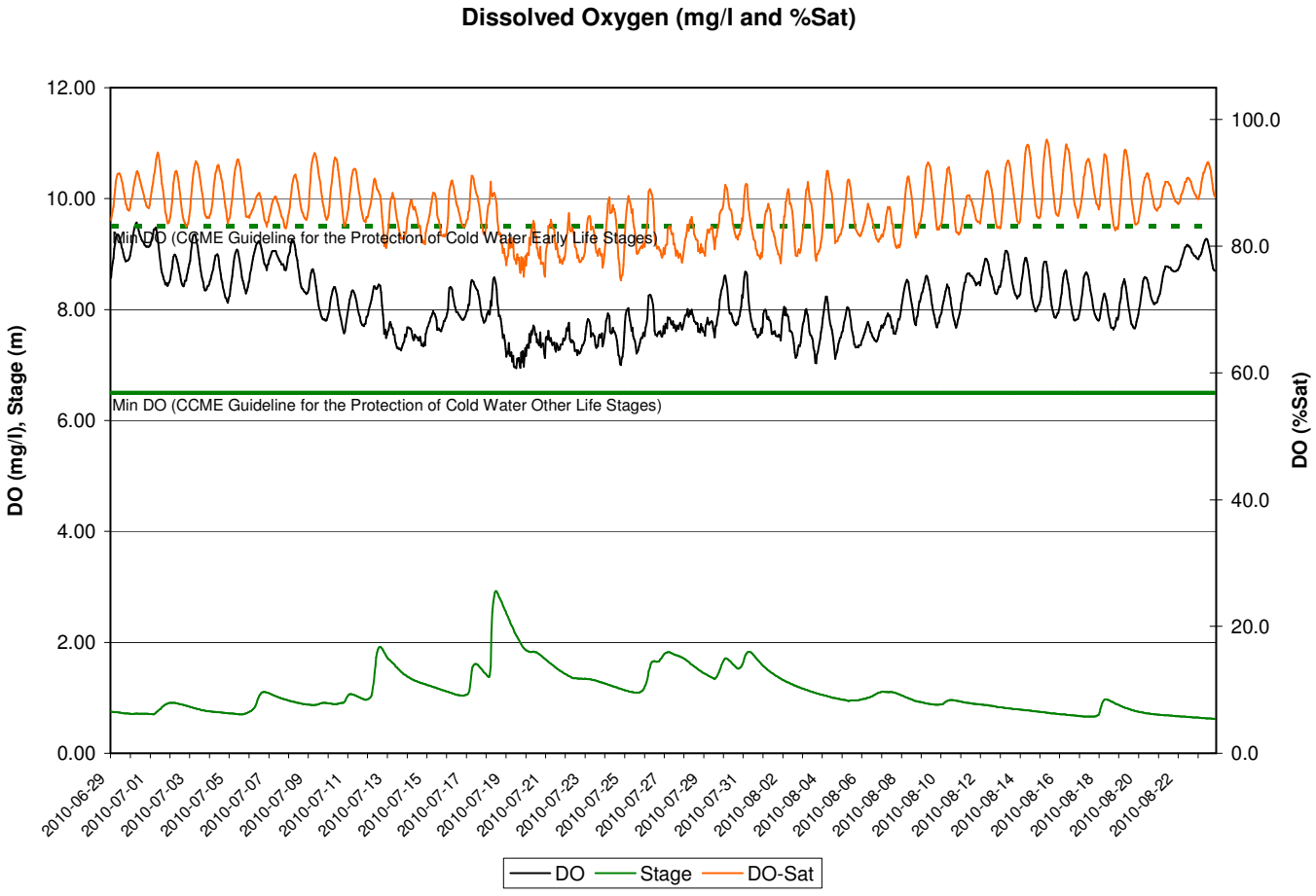

Figure 4

- The turbidity values **(Figure 5)** ranged from a minimum of 0.0 NTU to a maximum of 77.6 NTU.

- While the high turbidity value around July 18th is most likely related to the rapid rise in stage height and flow, the higher turbidity values during the latter half of the deployment period are related to bio-fouling of the probe during the warm low flow conditions and do not reflect actual turbidity levels in the river.

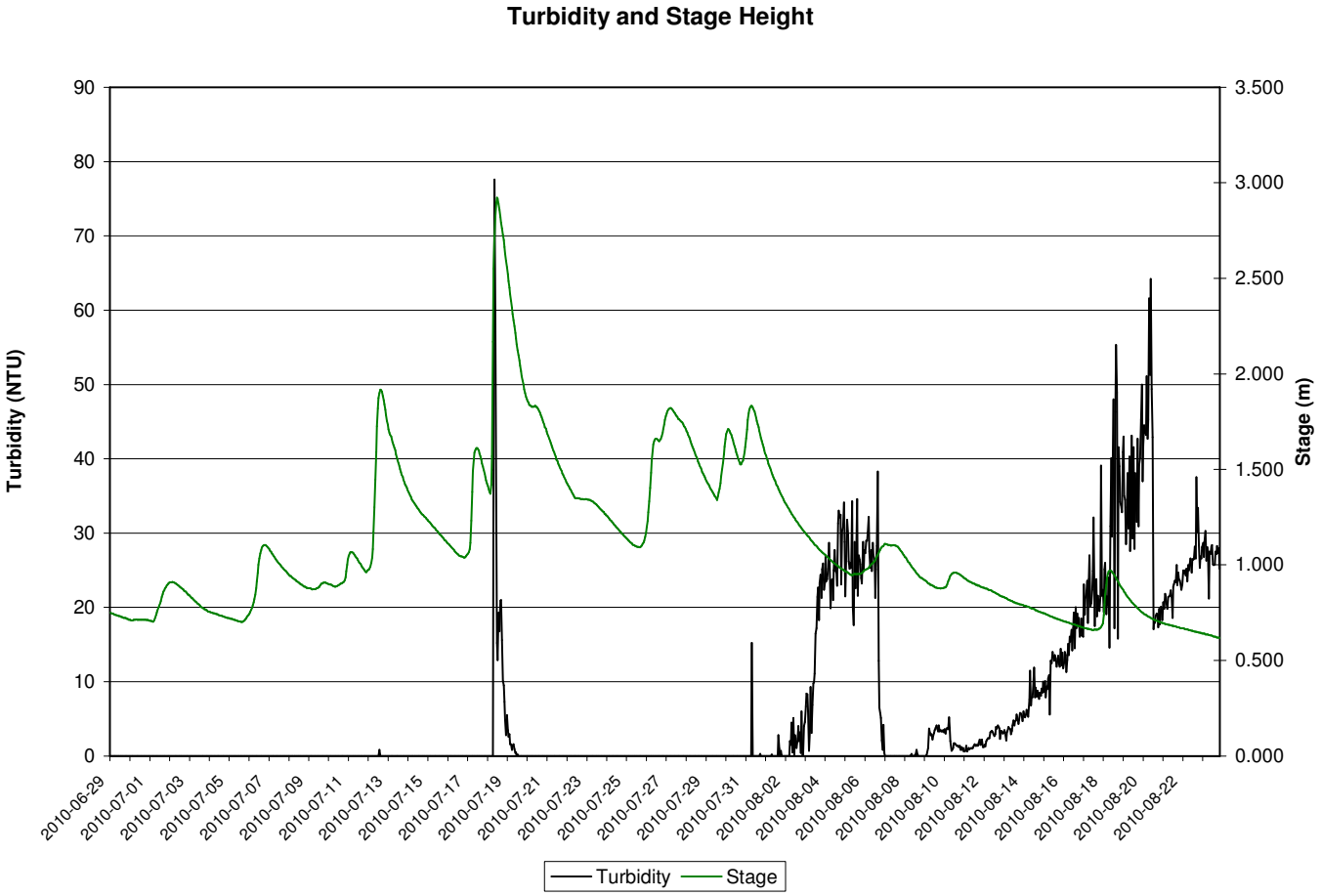

Figure 5

- The stage height (**Figure 6)** or water level ranged from a minimum of 0.618 m to a maximum of 2.922 m which corresponds to a range of flow values from 5.36 m^3/s to 223 m^3/s with the highest peaks resulting from significant precipitation events. The precipitation data in Appendix A is from the Rocky Harbour weather station and gives an indication of conditions in the headwaters of Main River.

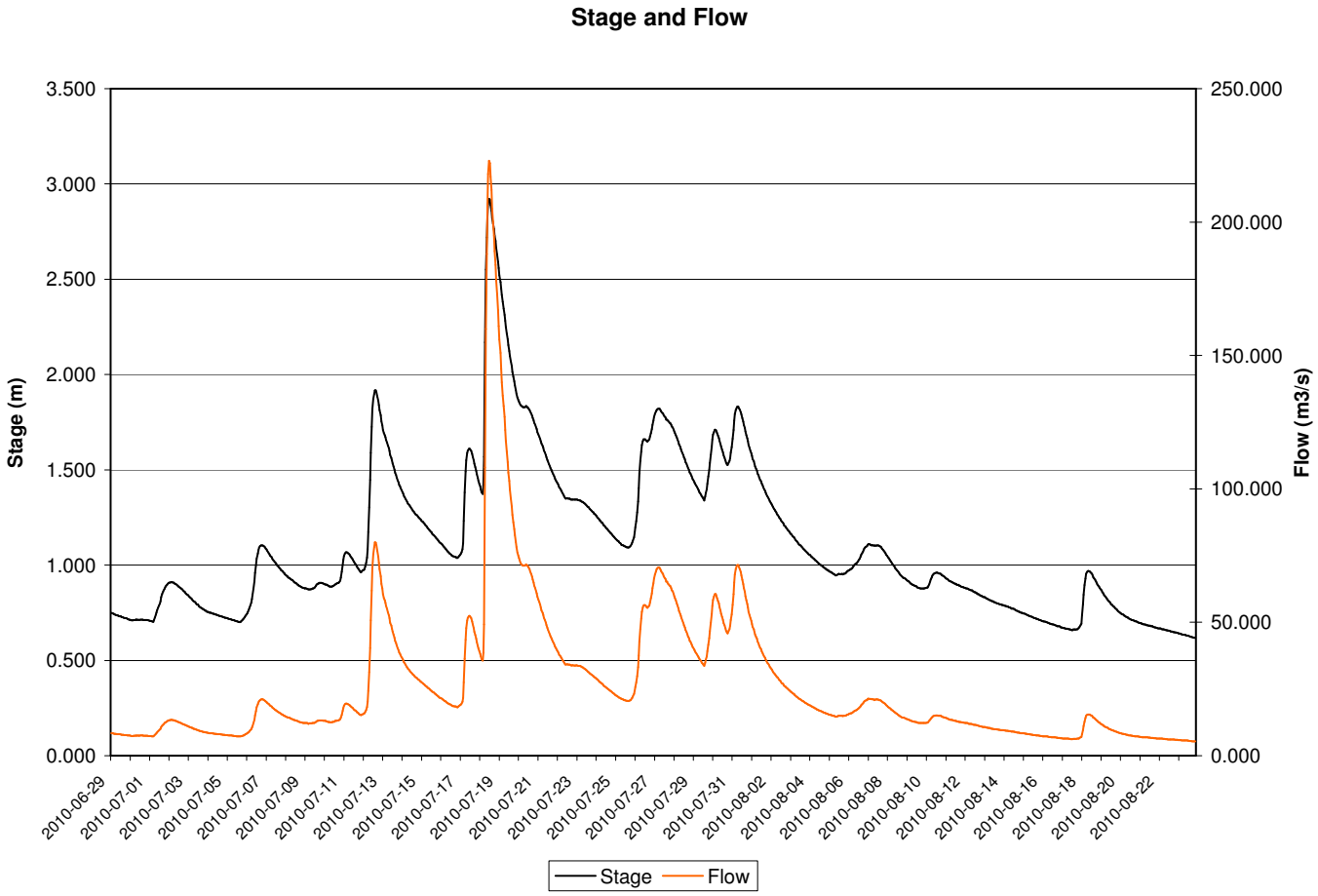

Figure 6

Climate Data

- Climate data for the full deployment period from the nearest station (Rocky Harbour) is included in Appendix A.

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Appendix A

Daily Data Report for June 2010

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
29	M	7.7E	M	M	M	M	M	M			<31
30	16.7	10.6	13.7	4.3	0.0	M	M	1.5		14E	48E

Daily Data Report for July 2010

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	21.9	8.2	15.1	2.9	0.0	M	M	0.0			<31
02†	14.8	7.2	11.0	7.0	0.0	M	M	0.0		28E	32E
03†	21.3	8.4	14.9	3.1	0.0	M	M	0.3		23E	43E
04†	17.7	11.2	14.5	3.5	0.0	M	M	1.7		22E	44E
05†	21.7	11.6	16.7	1.3	0.0	M	M	5.9			<31
06†	13.7	10.5	12.1	5.9	0.0	M	M	14.9			<31
07†	16.9	10.6	13.8	4.2	0.0	M	M	0.0			<31
08†	19.6	13.1	16.4	1.6	0.0	M	M	0.0			<31
09†	20.4	16.7	18.6	0.0	0.6	M	M	2.1			<31
10†	23.2	15.5	19.4	0.0	1.4	M	M	3.8		23E	52E
11†	23.0	14.5	18.8	0.0	0.8	M	M	0.0			<31
12†	23.1	16.1	19.6	0.0	1.6	M	M	40.8		23E	48E
13†	26.3	16.1	21.2	0.0	3.2	M	M	1.4			<31
14†	22.7	15.5	19.1	0.0	1.1	M	M	2.9			<31
15†	19.7	9.3	14.5	3.5	0.0	M	M	2.1			<31
16†	23.4	9.5	16.5	1.5	0.0	M	M	0.7			<31
17†	19.2	15.9	17.6	0.4	0.0	M	M	10.7			<31
18†	26.5	17.3	21.9	0.0	3.9	M	M	3.2			<31
19†	22.7	12.5	17.6	0.4	0.0	M	M	0.0			<31
20†	19.5	12.9	16.2	1.8	0.0	M	M	11.8			<31
21†	25.1	11.6	18.4	0.0	0.4	M	M	0.0		24E	33E
22†	24.5	10.7	17.6	0.4	0.0	M	M	8.1			<31
23†	22.2	10.0	16.1	1.9	0.0	M	M	0.3			<31
24†	22.7	9.1	15.9	2.1	0.0	M	M	0.0			<31
25†	22.8	9.7	16.3	1.7	0.0	M	M	12.0			<31
26†	19.4	14.1	16.8	1.2	0.0	M	M	26.1			<31
27†	14.1	6.5	10.3	7.7	0.0	M	M	M			<31
28†	22.8	6.5	14.7	3.3	0.0	M	M	0.0		21E	43E
29†	20.2	14.9	17.6	0.4	0.0	M	M	18.8		27E	33E
30†	21.8	12.2	17.0	1.0	0.0	M	M	0.0			<31
31†	17.5	12.4	15.0	3.0	0.0	M	M	14.0			<31
Sum				**59.8**	**13.0**	**M**	**M**	**181.6***			
Avg	**21**	**11.9**	**16.46**								
Xtrm	**26.5**	**6.5**								**23E**	**52E**

Daily Data Report for August 2010

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	20.9	10.7	15.8	2.2	0.0	M	M	0.0			<31
02†	23.6	9.7	16.7	1.3	0.0	M	M	0.0			<31
03†	23.0	10.6	16.8	1.2	0.0	M	M	0.0			<31
04†	25.1	11.4	18.3	0.0	0.3	M	M	0.0			<31
05†	24.6	17.7	21.2	0.0	3.2	M	M	8.7			<31
06†	24.8	17.0	20.9	0.0	2.9	M	M	17.8			<31
07†	20.2	12.9	16.6	1.4	0.0	M	M	5.9		26E	35E
08†	21.6	13.0	17.3	0.7	0.0	M	M	0.0		24E	44E
09†	21.6	15.5	18.6	0.0	0.6	M	M	8.8		22E	43E
10†	22.9	9.8	16.4	1.6	0.0	M	M	0.9			<31
11†	21.1	9.8	15.5	2.5	0.0	M	M	0.3			<31
12†	19.8	7.5	13.7	4.3	0.0	M	M	0.0			<31
13†	20.7	7.2	14.0	4.0	0.0	M	M	0.0			<31
14†	24.1	9.5	16.8	1.2	0.0	M	M	0.0			<31
15†	25.6	9.2	17.4	0.6	0.0	M	M	0.0			<31
16†	25.3	10.1	17.7	0.3	0.0	M	M	0.0			<31
17†	25.7	12.5	19.1	0.0	1.1	M	M	10.2			<31
18†	25.1	10.8	18.0	0.0	0.0	M	M	2.5			<31
19†	24.3	10.1	17.2	0.8	0.0	M	M	0.0			<31
20†	23.9	10.1	17.0	1.0	0.0	M	M	0.0		10E	33E
21†	17.4	13.2	15.3	2.7	0.0	M	M	0.0			<31
22†	16.8	12.2	14.5	3.5	0.0	M	M	0.0			<31
23†	20.3	7.1	13.7	4.3	0.0	M	M	0.0			<31
24†	21.6	8.7	15.2	2.8	0.0	M	M	0.0			<31