

Annual Weather Station Maintenance Report

2015



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

Prepared by:

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Overview

The Department of Environment and Conservation's Water Resources Management Division (WRMD) operates and maintains a network of automated weather stations across the province. Reliable weather data is needed to support water resources management decisions and policy development. This network (see table below) is maintained by Environmental Scientists within WRMD.

Automated Weather Stations in Operation (2015)

	Camera	Snow Monitoring	Meteorological
Pippy Park in St. John's			✓
Exploits River at Badger East of Stadium	✓		✓
Sandy Lake near Birchy Narrows (Camp 55)	✓	✓	✓
Humber River At Humber Village Bridge	✓		✓
Upper Humber River above Black Brook	✓	✓	✓
Churchill River at End of Mud Lake Road	✓		✓
Muskrat Falls MET	✓		✓
Waterford River at Kilbride	✓		
Exploits River at Badger Steps	✓		
Steady Brook 470 meters above Confluence to Humber River	✓		
Churchill River Above Grizzle Rapids	✓		

Purpose

Annual maintenance and accuracy checks are necessary to ensure not only the longevity of the equipment but, more importantly, to ensure the accuracy and validity of the data that is being reported by the stations. This is necessary to ensure ongoing program reliability, effectiveness and delivery of high quality results for the existing automated weather station network.

Pippy Park Weather Station

Station Details:

- Station Identification: NLENCL0001
- Station Installed: August 2004
- Parameters measured every fifteen minutes and downloaded three times daily:
 - Air Temperature
 - Relative Humidity
 - Precipitation
 - Wind Speed
 - Wind Direction
- Site Selection Rationale: Pilot weather station test site, verified that this particular technology can be integrated without issues within our existing infrastructure. Microclimate exists at this site due to the height of surrounding trees and development in close proximity to the weather station.
- Date Visited: August 10th, 2015
- Location: N 47° 35' 16.7" W 52° 44' 1.3"
- Elevation: 332 ft

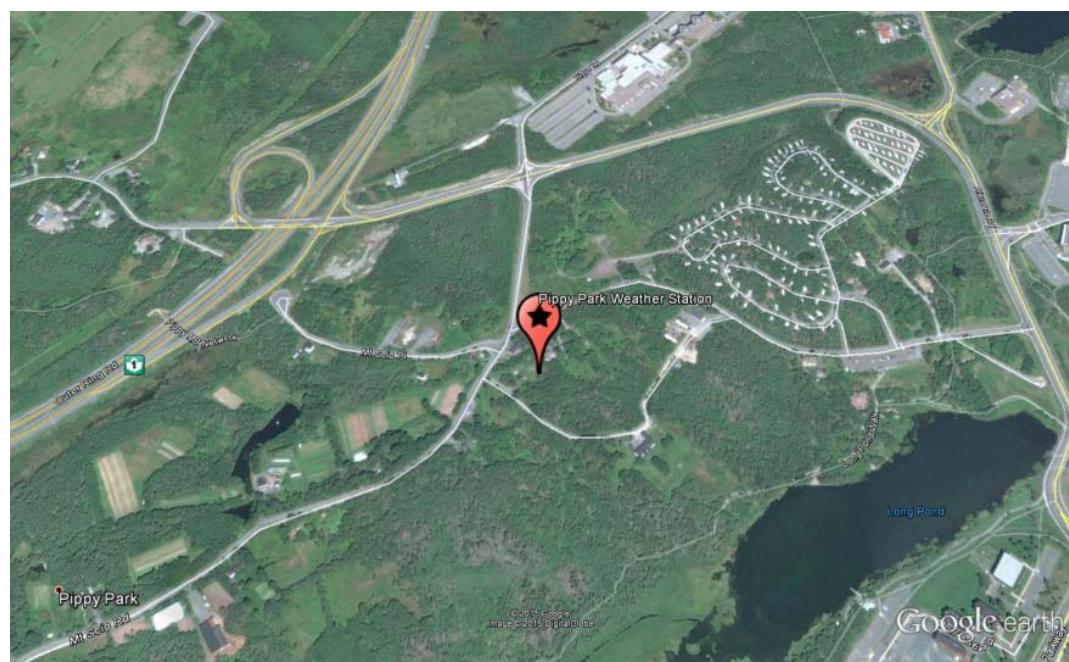


Figure 1: Pippy Park Weather Station Location

Tasks accomplished:

- Datalogger:
 - Replaced desiccant
- Anemometer:
 - Replaced the potentiometer (soldering boards, soldering wires etc.)

- Replaced the bearings, O-rings
- Installed and calibrated the sensor
- Tipping Bucket
 - Verified tipping bucket was within calibration and no debris
- Air Temperature/Humidity
 - Sensor calibrated and verified

Follow-up tasks required: WRMD staff to remove excess vegetation, IDF table programming needs to be verified at this site.

Exploits River at Badger East of Stadium

Station Details:

- Station Identification: NLENCL0002
- Station Installed: September 2008
- Image taken and transmitted every hour
- Parameters measured every fifteen minutes and downloaded three times daily:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the community of Badger in the Exploits River Basin.
- Date Visited: August 10th, 2015
- Location: N 48° 58' 29.83" W 56° 2' 4.43"
- Elevation: 289 ft

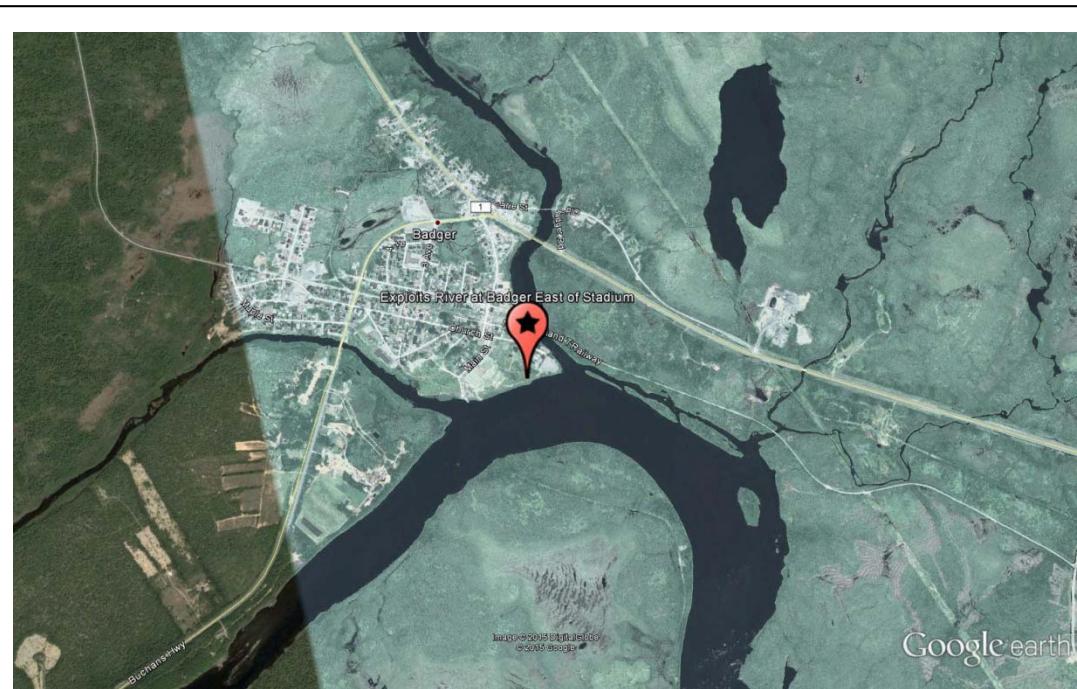


Figure 2: Exploits River at Badger Weather Station Location

Tasks accomplished:

- Datalogger:
 - Replaced desiccant
 - Added new SR50 code to take measurements only during winter months
 - Programmed Intensity-Duration-Frequency tables

- Fixed the Solar Radiation issue caused by an incorrect coordinate calculation
- Camera:
 - Repositioned camera as per OH&S protocols
 - Cleaned enclosure and replaced desiccant
- Anemometer:
 - Replaced the potentiometer (soldering boards, soldering wires etc.)
 - Replaced the bearings, O-rings
 - Installed and calibrated the sensor
- Temperature/Relative Humidity:
 - Replaced chip in probe due to calibration failure and then calibrated the new Temperature/Relative Humidity chip
- Snow Fall Sensor:
 - Replaced SR50 transducer with an open faced corrosion resistant transducer

Follow-up tasks required: Regular scheduled maintenance.

Sandy Lake near Birchy Narrows (Camp 55)

Station Details:

- Station Identification: NLENCL0005
- Station Installed: November 2010
- Image taken and transmitted once a day at 12pm NST
- Parameters measured every fifteen minutes and downloaded three times daily:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Soil Moisture
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Snow monitoring involves determining the extent of snow cover (SE) and its snow water equivalent (SWE). SWE is a measurement of both the depth of snow and its density. It represents the depth of water that would result if the entire snow cover melted at once. Snow monitoring provides essential information for flood forecasting, hydropower generation, and for climate change adaptation in the province. WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the communities of Deer Lake and Steady Brook in the Humber River Basin.
- Date Visited: August 11th, 2015
- Location: N 49° 16' 28.30" W 56° 51' 5.80"
- Elevation: 393 ft

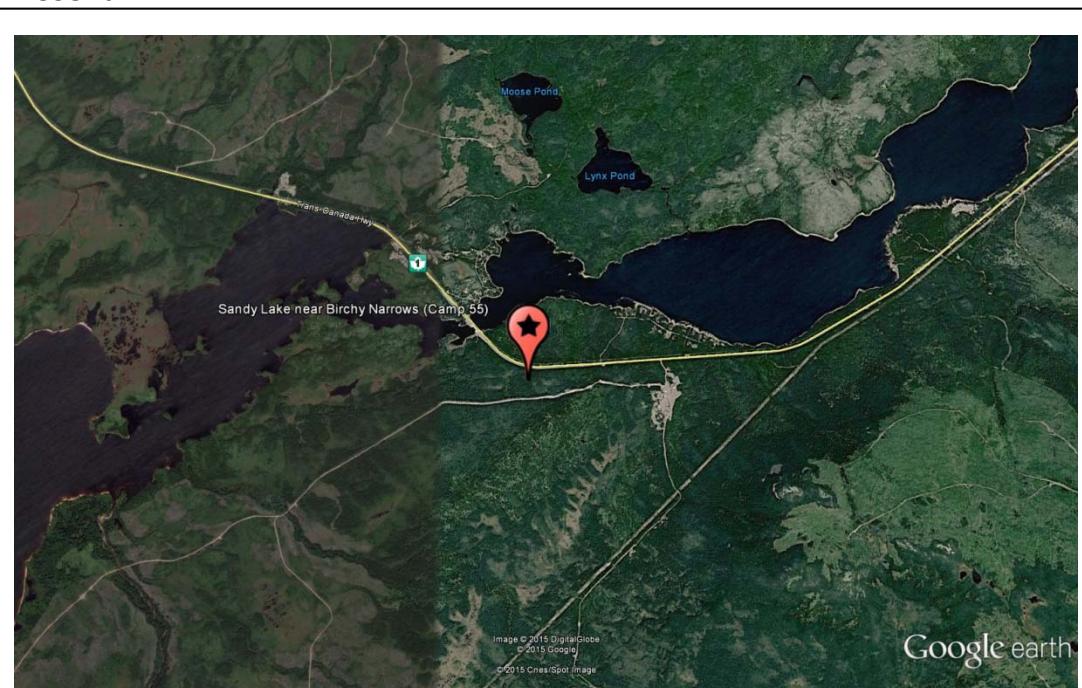


Figure 3: Sandy Lake near Birchy Narrows (Camp 55) Snow Monitoring Station Location

Tasks accomplished:

- Tower:
 - The integrity of the tower was in question due to expanding metal brought on by ice intrusion (see Figure 4 below) The 10 metre tower was replaced and spray foam was installed to prevent future incidents
- Datalogger:
 - Replaced desiccant
 - Added new SR50 code to take measurements only during winter months
 - Verified Intensity-Duration-Frequency tables were programmed
- Camera:
 - Cleaned enclosure and replaced desiccant
- Anemometer:
 - Replaced the potentiometer (soldering boards, soldering wires, etc.)
 - Replaced the bearings, O-rings
 - Installed and calibrated the sensor
- Temperature/Relative Humidity:
 - Replaced probe head in RH probe due to calibration failure
 - Sent probe head to Campbell Scientific Canada Corp for technical servicing
- Snow Fall Sensor:
 - Replaced SR50 transducer with an open faced corrosion resistant transducer

Follow-up tasks required: contact Campbell Scientific Canada concerning the Temperature/Relative Humidity sensor

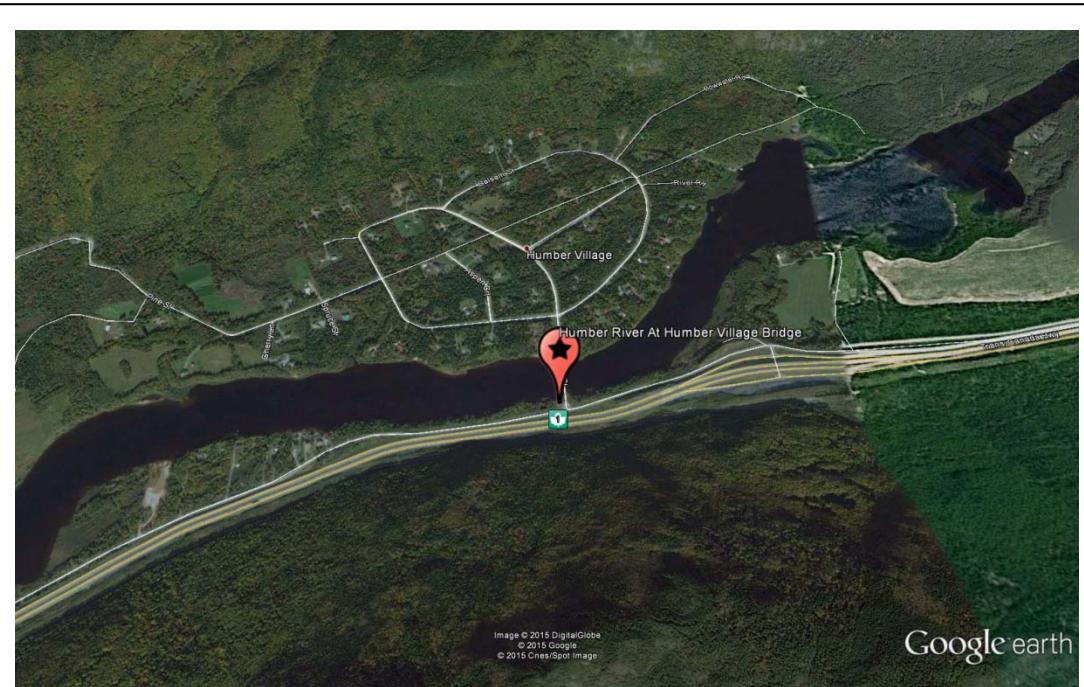


Figure 4: Compromised Tower Integrity at Sandy Lake near Birchy Narrows (Camp 55)

Humber River At Humber Village Bridge

Station Details:

- Station Identification: NLENCL0003
- Station Installed: September 2009
- Image taken hourly and transmitted three times daily
- Parameters measured every fifteen minutes and downloaded three times daily:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the communities of Deer Lake and Steady Brook in the Humber River Basin.
- Date Visited: August 12th, 2015
- Location: N 48° 58' 58.21" W 57° 45' 38.04"
- Elevation: 25 ft



Tasks accomplished:

- Datalogger:
 - Replaced desiccant
 - Added new SR50 code to take measurements only during winter months
 - Verified Intensity-Duration-Frequency tables were programmed

- Camera:
 - Cleaned enclosure and replaced desiccant
- Anemometer:
 - Replaced the potentiometer (soldering boards, soldering wires, etc.)
 - Replaced the bearings, O-rings
 - Installed and calibrated the sensor
- Temperature/Relative Humidity:
 - Replaced chip in RH probe due to calibration failure
 - Calibrated and installed new temperature/RH probe
- Snow Fall Sensor:
 - Did not replace SR50 transducer because the sensor was replaced within the previous year

Follow-up tasks required: The tripod was bent due to wind (see Figure 6 below). WRMD Staff were notified to monitor the tripod for further damage.

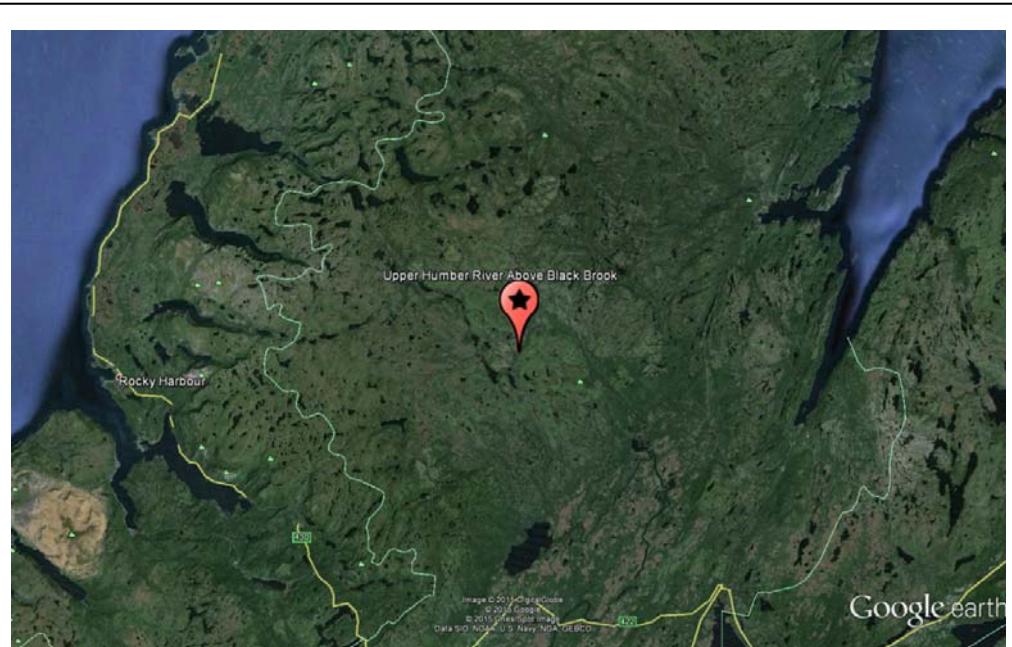


Figure 6: Compromised Tripod Integrity at Humber River At Humber Village Bridge Station

Upper Humber River above Black Brook

Station Details:

- Station Identification: NLENCL0007
- Station Installed: September 30th 2015
- Image taken and transmitted once a day at 12pm NST
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Snow monitoring involves determining the extent of snow cover (SE) and its snow water equivalent (SWE). SWE is a measurement of both the depth of snow and its density. It represents the depth of water that would result if the entire snow cover melted at once. WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the communities of Deer Lake and Steady Brook in the Humber River Basin.
- Location: N 49° 37' 6.24" W 57° 17' 41.20"
- Elevation: 992 ft



Tasks accomplished:

- This station was installed September 30th 2015.

Follow-up tasks required: Regular scheduled maintenance.

Churchill River at End of Mud Lake Road

Station Details:

- Station Identification: NLENCL0004
- Station Installed: July 2010
- Image taken and transmitted every hour during winter months (October to May) and once a day at 12pm NST during the summer (June to September)
- Parameters measured every fifteen minutes and downloaded hourly:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale:
 - Snow monitoring provides essential information for flood forecasting, hydropower generation, ice monitoring, wildlife studies, and for climate change adaptation in the province.
 - Captures image of the ice road
 - Provides weather data to better understand water quality data for Churchill River
- Date Visited: August 13th, 2015
- Location: N 53° 20' 15.95" W 60° 11' 21.44"
- Elevation: 4 ft

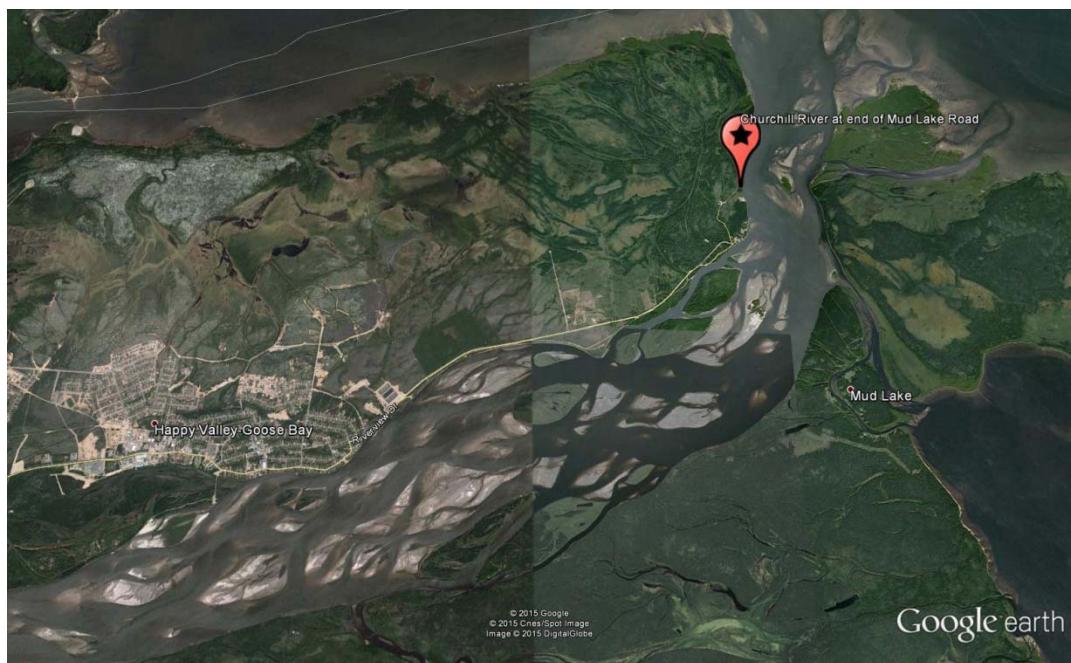


Figure 8: Churchill River at end of Mud Lake Road Weather Station Location

Tasks accomplished:

- Datalogger:
 - Replaced desiccant
 - Added new SR50 code to take measurements only during winter months
 - Verified Intensity-Duration-Frequency tables were programmed
- Camera:
 - Cleaned enclosure and replaced desiccant
- Anemometer:
 - Replaced housing - damage was caused by high wind (see Figure 9 below)
 - Replaced the potentiometer (soldering boards, soldering wires, etc.)
 - Replaced the bearings, O-rings
 - Installed and calibrated the sensor
- Temperature/Relative Humidity:
 - Replaced chip in RH probe due to calibration failure
 - Calibrated and installed new temperature/Relative Humidity chip
- Snow Fall Sensor:
 - Replaced SR50 transducer with an open faced corrosion resistant transducer

Follow-up tasks required: Notified staff that site requires landscaping due to vegetation overgrowth (See Figure 10 below).



Figure 9: Anemometer housing damage at Churchill River at end of Mud Lake Road



Figure 10: Overgrowth at Churchill River at end of Mud Lake Road

Muskrat Falls MET

Station Details:

- Station Identification: NLENCL0006
- Station Installed: July 2014
- Parameters measured every fifteen minutes and downloaded hourly:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Wind Chill
 - Humidex
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Snow monitoring provides essential information for flood forecasting, hydropower generation, wildlife studies, drinking water reservoir operation, and for climate change adaptation in the province.
- Date Visited: August 13th, 2015
- Location: N 53° 14' 43.64" W 60° 46' 42.15"
- Elevation: 39 ft

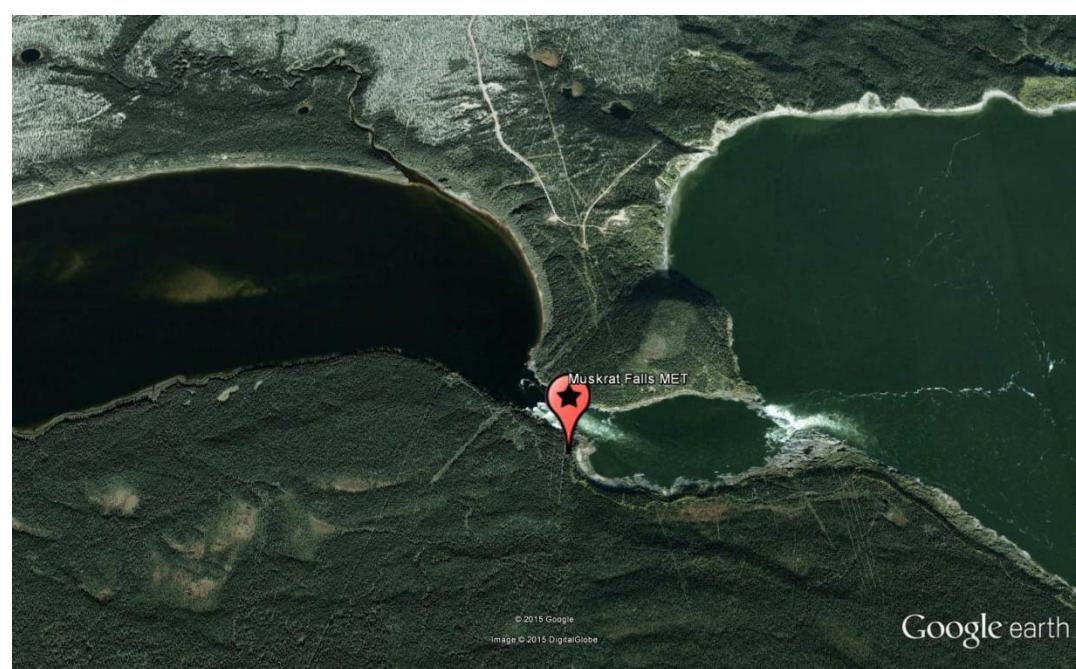


Figure 11: Muskrat Falls Weather Station Location

Tasks accomplished:

- Datalogger:
 - Replaced desiccant in both enclosures
 - Added new SR50 code to take measurements only during winter months

- Verified Intensity-Duration-Frequency tables were programmed
- Camera:
 - Downloaded configuration from both cameras
- Anemometer:
 - Verified sensor was working within acceptable limits
- Snow Fall Sensor:
 - Did not replace SR50 transducer because the sensor was in good working order

Follow-up tasks required:

- Notified Nalcor staff to arrange for a scissor lift to move the cross arm that houses the SR50 and Humidex Sensor. When the tower is lowered for maintenance the sensors are in fear of damage in the current location.
- Due to limitations of site access it would be preferable to purchase extra sensors which could be rotated out during maintenance rather than calibrating in the field and lowering the tower for an extended period of time.
- Purchasing of new internal batteries for the CC5MPX cameras is required as the current batteries are depleted.

Waterford River at Kilbride

Station Details:

- Station Identification: NF02ZM0009
- Station Installed: July 21st 2015
- Image taken and transmitted every hour
- Site Selection Rationale: Provides essential information for visual image of changing water levels in this urban stream.
- Location: N 47° 31' 44.44" W 52° 44' 41.04"
- Elevation: 108 ft

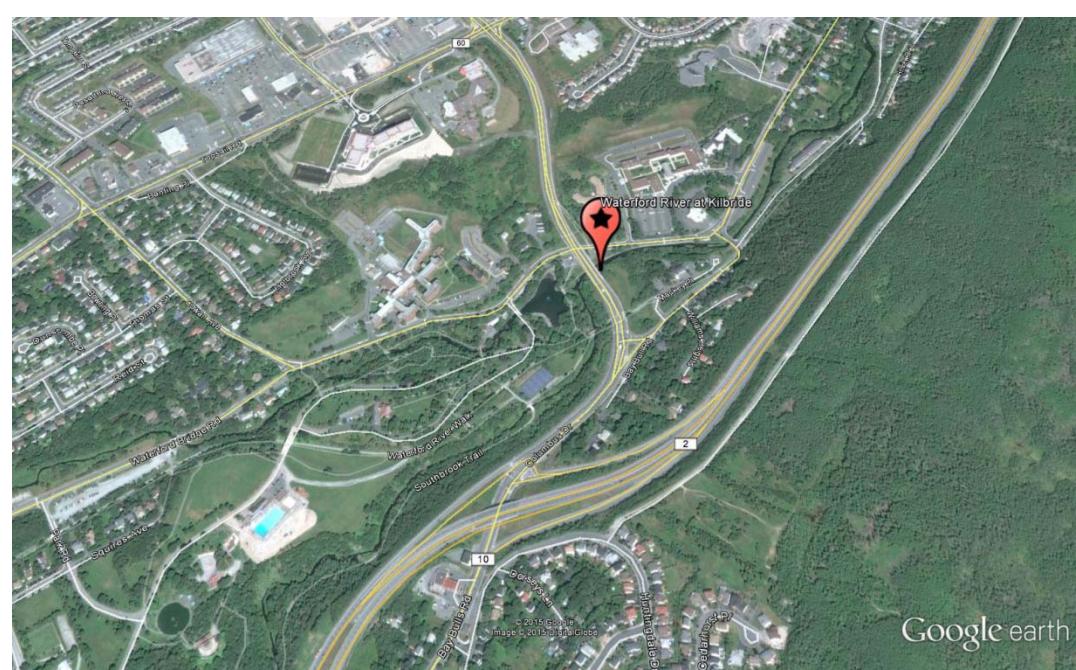


Figure 12: Waterford River at Kilbride Camera Station Location

Tasks accomplished:

- Bench test:
 - Evaluation and configuration of new station equipment in a controlled environment, prior to installation to ensure that it is in perfect condition
 - Programmed datalogger
 - Configured camera/modem
- Station installed on July 21st 2015

Exploits River at Badger Steps

Station Details:

- Station Identification: NLENCM0001
- Station Installed: November 2009
- Image taken and transmitted every hour
- Site Selection Rationale: Snow monitoring provides essential information for flood forecasting, hydropower generation and for climate change adaptation in the province. WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the community of Badger in the Exploits River Basin.
- Date Visited: August 10th, 2015
- Location: N 48°56'25.86" W 55°58'42.98"
- Elevation: 330 ft

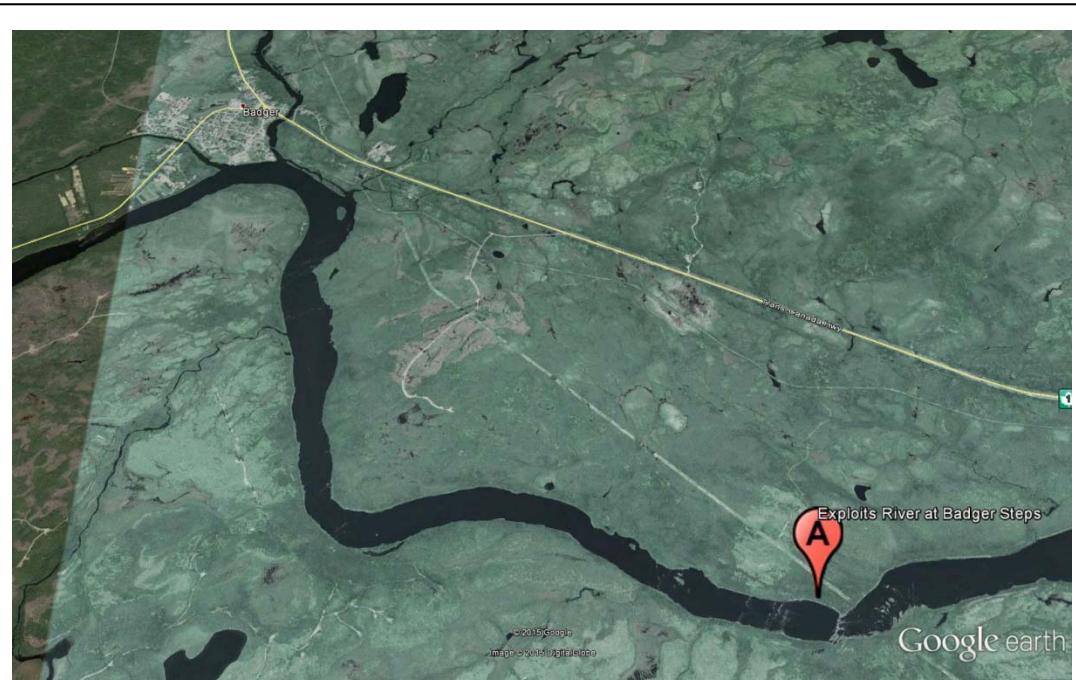


Figure 13: Exploits River at Badger Steps Camera Station Location

Tasks accomplished:

- Datalogger:
 - Replaced desiccant
- Camera:
 - Replaced desiccant
 - Replaced the faulty CC640 camera with a spare
 - Rewired, configured and refocused CC640 camera
 - Sent the original CC640 camera back to Campbell Scientific Canada for servicing

- Cell Modem:
 - Bell had discontinued service to that particular modem
 - Sent preconfigured modem to WRMD staff (installed on September 2nd, 2015)

Follow-up tasks required: Site is highly overgrown and needs specialised landscaping due to the steep incline to ensure the viewpoint needed for the flood forecasting model.



Figure 14: Overgrowth at Exploits River at Badger Steps camera station

Steady Brook 470 meters above Confluence to Humber River

Station Details:

- Station Identification: 02YL012
- Station Installed: June 23rd 2015
- Image taken and transmitted every hour
- Site Selection Rationale: WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the communities of Deer Lake and Steady Brook in the Humber River Basin.
- Location: N 48° 57' 11.59" W 57° 49' 40.02"
- Elevation: 24 ft

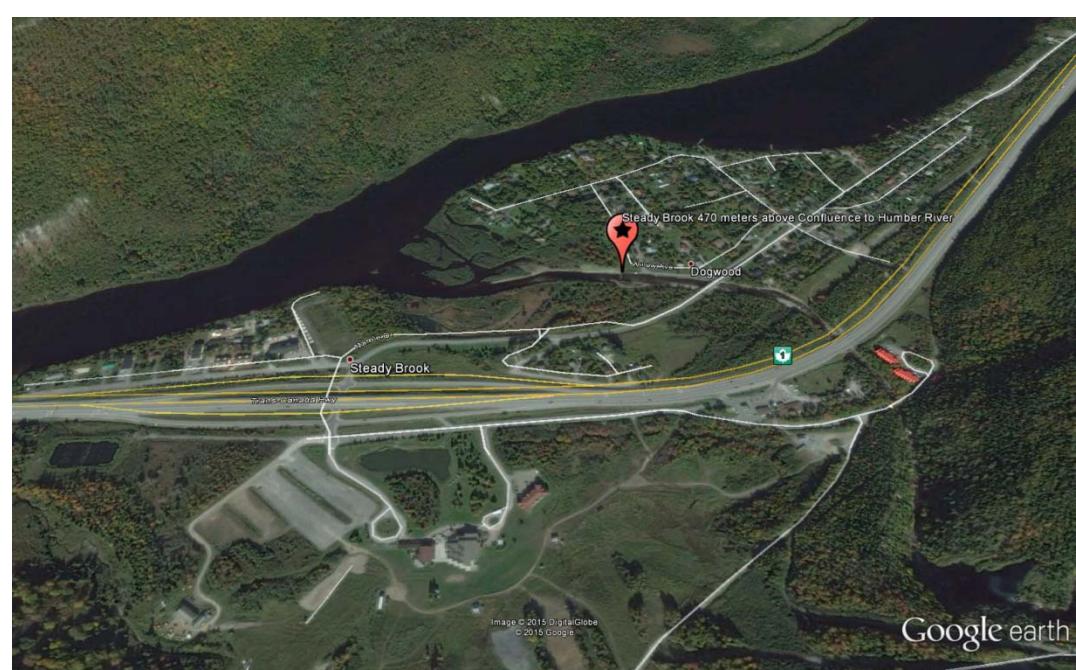


Figure 15: Steady Brook 470 meters above Confluence to Humber River Camera Station Location

Tasks accomplished:

- Bench test:
 - Evaluation and configuration of new station equipment in a controlled environment, prior to installation to ensure that it is in perfect condition
 - Programmed datalogger
 - Configured camera/modem
- Station installed on June 23rd 2015

Follow-up tasks required: Regular scheduled maintenance.

Churchill River Above Grizzle Rapids Camera Station

Station Details:

- Station Identification: 03OE013
- Station Installed: December 2009
- Image taken and transmitted every hour during winter months (October to April) and once a day at 12pm NST during the summer (May to September)
- Site Selection Rationale: Snow monitoring provides essential information for flood forecasting, hydropower generation, ice monitoring, wildlife studies, and for climate change adaptation in the province.
- Date Visited: November 10th 2015 via Labrador staff
- Location: N 52° 58' 12.33 W 61° 26' 43.40
- Elevation: 194 ft

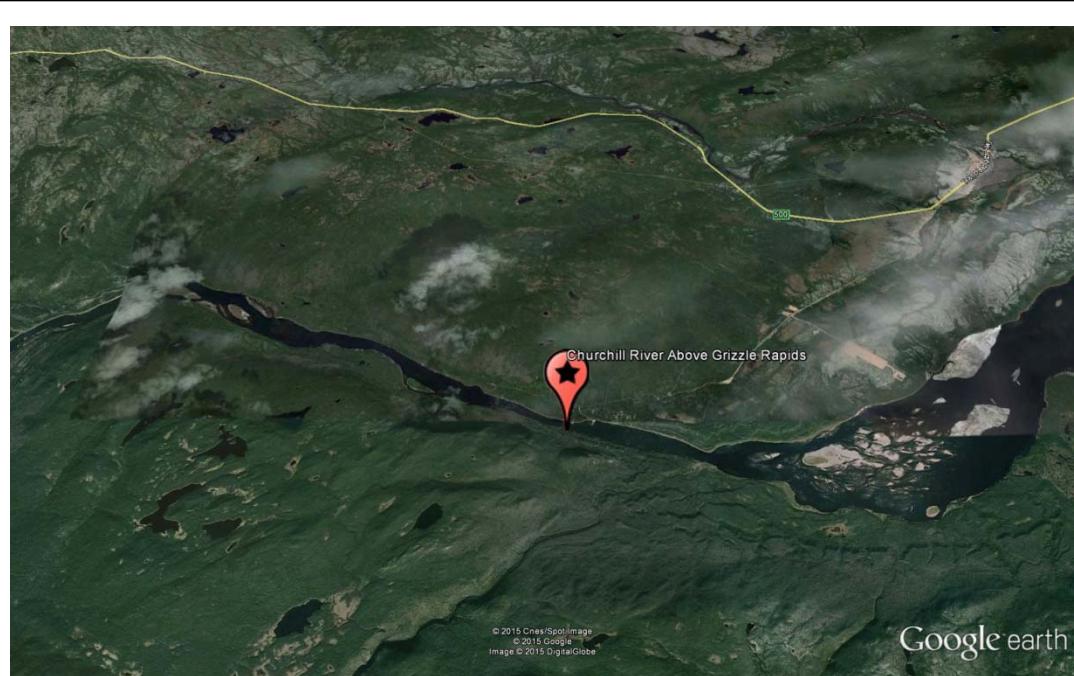


Figure 16: Churchill River Above Grizzle Rapids Camera Station Location

Tasks accomplished:

- Datalogger:
 - Replaced the desiccant
- Camera:
 - Replaced desiccant

Follow-up tasks required: Regular scheduled maintenance.

The next scheduled annual maintenance trip will be completed by September 2017.