



Badger Flood Event – Field Report February 2013

Prepared By: Krista Rebello, P.Eng



**Government of Newfoundland and Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, Canada
A1B 4J6**

Badger Flooding Event – Field Report

February 2013

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1.0 Background

1.1 History of Flooding in Badger

Flooding has occurred on several occasions at Badger since the early 1900's. The floods are caused by excessive frazil ice formation in the Exploits River due to high winds and low temperatures when the ice front is at or is passing Badger. This causes an ice jam in the river and in turn causes the river to spill its banks resulting in a flood. The ice cover forms near Grand Falls and travels upstream to Red Indian Lake.

Since 1977, Water Resources Management Division (WRMD) has provided flow monitoring and flood forecasting services for the Town of Badger. The Badger Flood Forecasting Service is initiated in December of each year and extends until the end of March or until it is confirmed the ice cover no longer poses a threat of flooding to the Town.

On February 15, 2003 Badger experienced the most severe flooding in terms of the depth of inundation.

To improve the flood forecasting service, the WRMD has been using satellite RADAR imagery since December 2003 to monitor ice in the Exploits. This innovative space satellite based river ice service has been pioneered by WRMD in collaboration with C-CORE and is now being adopted by a variety of provinces in Canada and internationally in Russia. The flood forecasting service for Badger uses this innovative space satellite based river ice service, in conjunction with an Ice Progression Model, a network of monitoring stations which include hydrometric stations, a weather station and two web cameras.

Data collected and information pertaining to flooding at Badger is publicly available through WRMD's "Badger Water Level Information" webpage <http://www.env.gov.nl.ca/env/waterres/flooding/badger.html>. The webpage is updated regularly throughout the flood season.

Ice Jam Advisories and Flood Warnings are issued to Fire and Emergency Services NL and the Town of Badger based on the forecast of ice generation rates by the Ice Progression Model.

As part of the data collection network that is critical for the operation of the Ice Progression Model, the Division maintains and monitors five hydrometric gauging stations on the Exploits River. A primary and backup station are located in the Town of Badger, the primary station is directly accessible by the Town for use in daily monitoring and emergency situations. Additionally, the Division maintains and monitors a webcam and a weather station located in the Town and a second webcam located at Badger Steps, a critical and inaccessible section of the Exploits River.

WRMD's protocol is to issue an ice jam advisory when the forecasted ice generation rate exceeds 900,000 m³ and a Flood Warning when it exceeds 1,920,000 m³. An ice jam advisory indicates that the river will overtop the river banks and may cause flooding within the 1:20 year food zone.

1.2 February 2013 Flood Event

Discordant water levels from the hydrometric stations, *Exploits River at Badger* and the *Exploits River at Badger - Backup*, at Badger were first observed on Feb 3, 2013. At first, this was attributed to heavy ice flows and the progression of a nearby ice cover.

On February 5th, 2013 the Town of Badger began observing ice buildup in the Exploits River as you can see from the webcam images below.

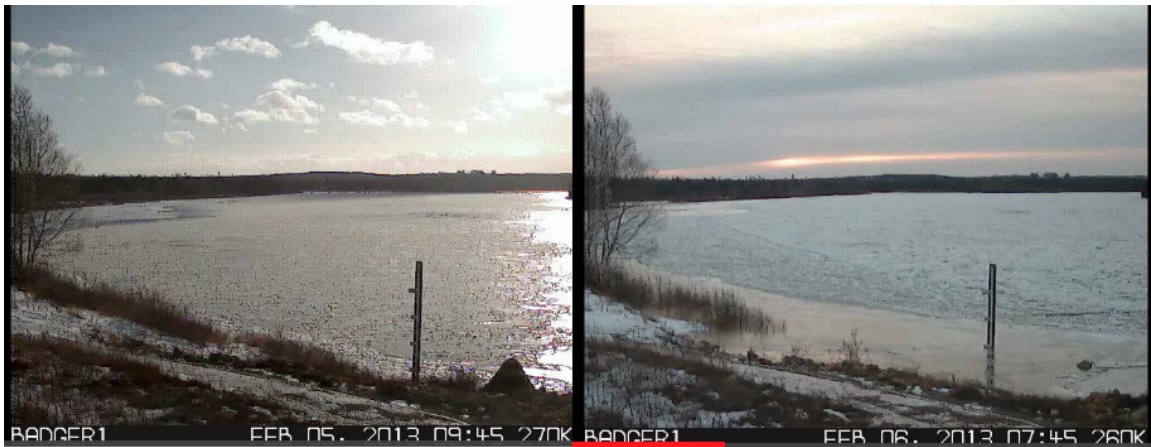


Figure 1 - Screen Captures of Badger Webcam February 5th and 6th, 2013.

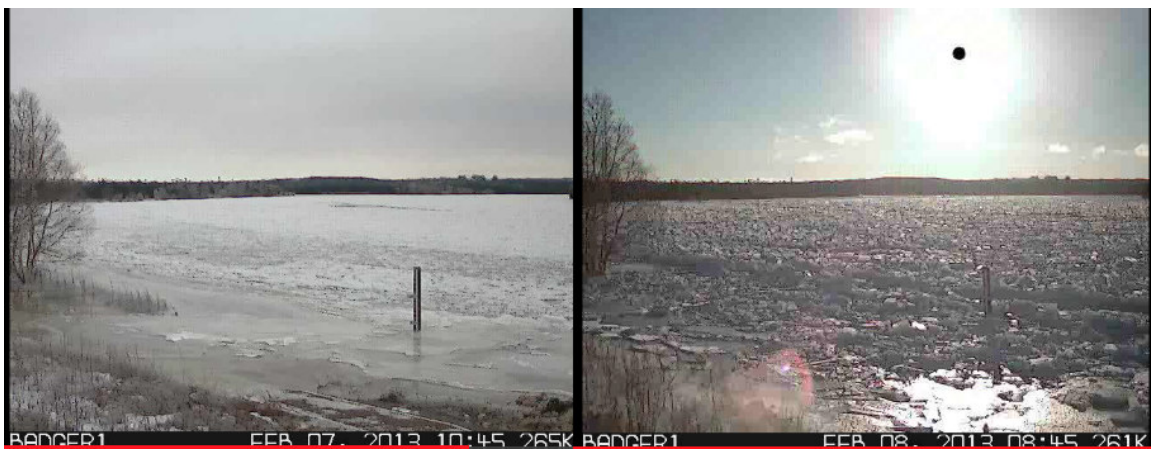


Figure 2 - Screen Captures of Badger Webcam February 7th and 8th, 2013.

On Feb 6, 2013, based on an updated flood forecast, Town of Badger and Fire Emergency Services – NL were informed about the increase in ice buildup and its potential impact.

On the morning of Feb 7, 2013, a flood event occurred in Badger. The *Exploits River at Badger* was indicating a flood event greater than the 100 year event while the *Exploits River at Badger - Backup* was indicating an event close to the 20 year event.

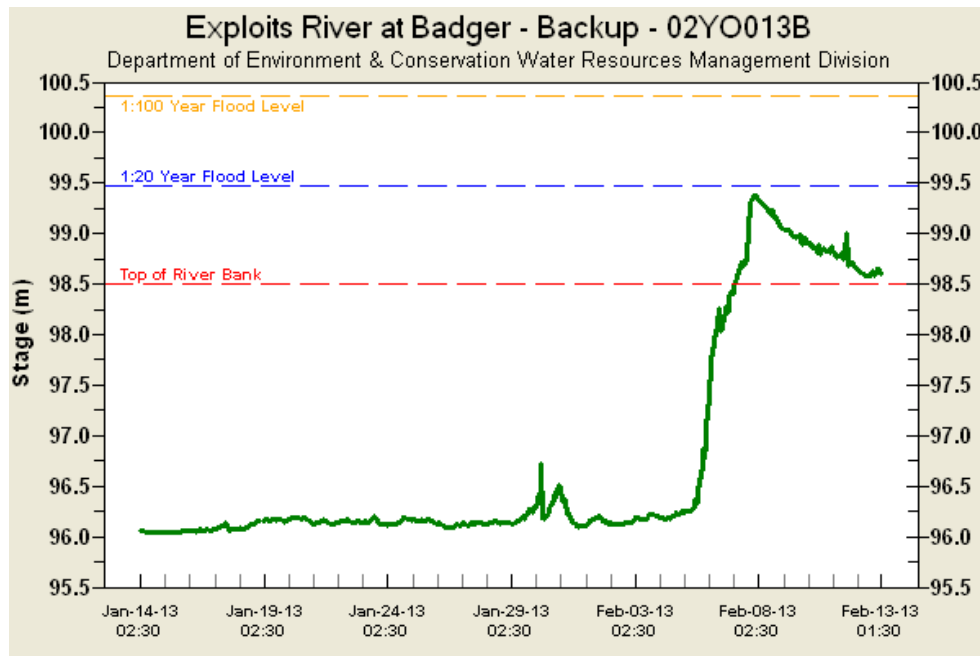


Figure 3 - Backup Badger Hydrometric Station

On February 8th, Fire and Emergency Services – NL issued a public advisory, encouraging residents to avoid the lower end of Badger Brook and Little Red Indian Brook until further notice (Appendix I). Mayor Mike Patey was reported as saying that the water started pouring down Beothuck Street and they acted quickly to block off River Road (Appendix II).



Figure 4 - Beothuck Street, River Road, Google Earth.

As of 12:30am (Feb 8th) the water level remained steady (Appendix III). Environment Canada staff were on site on WRMD's request to do a level check on the primary hydrometric station. Environment Canada indicated that Badger's Backup hydrometric station (02YO013B) was correct, while station 02YO013 was not providing accurate results.

On February 8th, 2013 WRMD deployed Rob Wight (Appendix IV) from the Grand Falls-Windsor office and Krista Rebello from St. John's to meet with local officials and assess the extent of the flooding.

2.0 Site Investigation - Observations of Ice Front at Vantage Points

2.1 Saturday February 9, 2013

On Saturday February 9th, WRMD met with Wilmore Eddy, Nalcor Energy Exploits Generation Manager and Mayor Mike Patey, Town of Badger to observe the ice conditions at pre-determined vantage points upstream from the Town of Badger: Three Mile Island, Gull Rocks, and Badger Arena.



Figure 5 - Saturday February 9, 2013, 9:12am: Looking upstream Exploits River, Three Mile Island from Buchans Highway.



Figure 6 - Saturday February 9, 2013, 9:15am: Looking perpendicular to Three Mile Island from Buchans Highway.

It was at Gull Rocks that a significant decrease in the water elevation was first observed:



Figure 7 - Saturday February 9, 2013, 9:22am: Decrease in water elevation observed at Gull Rocks.

The decrease in water elevation was evident throughout the flood investigation.



Figure 8 - Saturday February 9, 2013, 9:46am: Decrease in water elevation observed at residential property on Beothuck Street.

The following photo illustrates the estimated drop in water level at the time of flood investigation.



Figure 9 - Saturday February 9, 2013, 1:41pm: Measurement illustrating decrease in water elevation during investigation.

The following sequence of photos are panning from right to left, looking upstream at Little Red Indian Brook, moving toward downstream of the Exploits River:



Figure 10 - Saturday February 9, 2013, 9:34am: Looking upstream on Little Red Indian Brook from Badger Arena



Figure 3 - Saturday February 9, 2013, 9:34am: Looking upstream on the Exploits River at the junction with Little Red Indian Brook from Badger Arena



Figure 4 - Saturday February 9, 2013, 9:34am: Looking downstream on the Exploits River towards hydrometric station from Badger Arena



Figure 5 - Saturday February 9, 2013, 9:38am: Looking downstream of the Exploits River towards hydrometric station from Badger Arena

2.2 Monday February 11, 2013

Sunday February 10th, 2013 the region experienced a snowfall event, dumping ~ 30cm of snow in the area (unable to confirm as there is no precipitation data available for that day).

On Monday February 11th, 2013 WRMD met with Wilmore Eddy and Mayor Patey again to observe the ice formation at the vantage points: Noseworthy's Cabin, Three Mile Island and Gull Rocks.



Figure 6 - Monday February 11, 2013, 10:44: Looking upstream Exploits River, Noseworthy's Cabin, Buchans Highway.



Figure 7 - Monday February 11, 2013, 11:04am: Looking downstream of Exploits River, Three Mile Island from Buchans Highway

Mayor Patey and Wilmore Eddy discussed having trees removed along the shoreline to improve visibility at the identified vantage points along Buchans Highway.



Figure 8 - Monday February 11, 2013, 11:14am: Looking upstream Exploits River, Gull Rocks.

The following Ice Front Product was produced by CCORE:

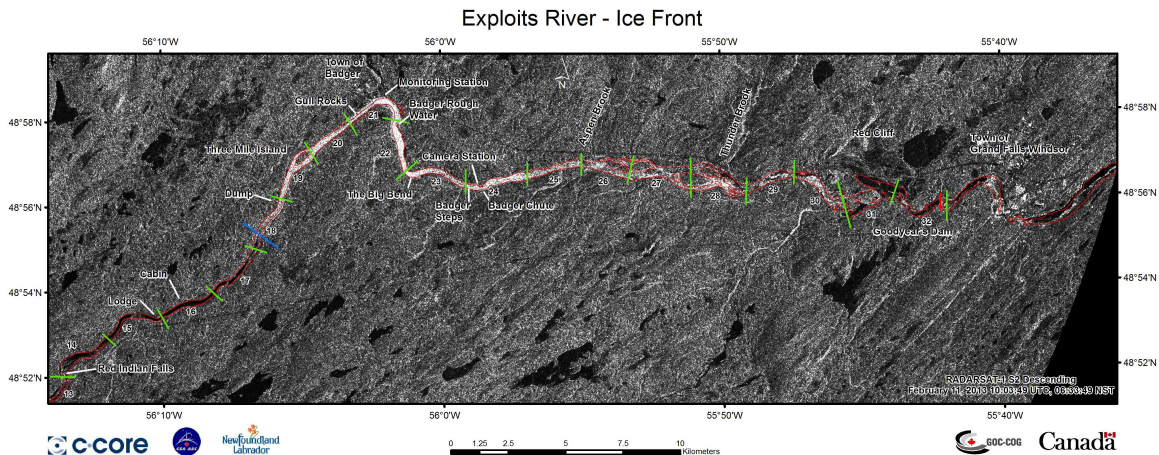


Figure 9 – February 11, 2013, 10:10am: CCORE Ice Front Product

Mayor Patey and Wilmore Eddy explained that some residents were worried that they observed water on the ice, fearing that the water levels had elevated, however, they explained that it was the weight of the snow that had pushed the ice to a lower elevation than the previous day.

3.0 Site Investigation - Flood Extents

3.1 Saturday February 9, 2013

Field Notes indicating extent of flooding taken on Saturday February 9, 2013 are as follows:

WP #	Time	Easting	Northing	Notes:
79	12:54	0570656	5425246	Beothuck Street: between white house & green house.
80	1:13	0570455	5425198	River Road: 1/3 way into ball field from arena.
81	1:21	0570532	5425267	River Road & Beothuck Street intersection.
82	1:35	0570348	5425248	End of dirt road past church.
83	1:56	0569911	5425172	Perimeter of abandoned house on Buchans HWY
84	1:58	0569934	5425208	Perimeter of abandoned house on Buchans HWY
85	2:01	0569977	5425179	Perimeter of abandoned house on Buchans HWY
86	2:03	0569994	5425122	Perimeter of abandoned house on Buchans HWY
87	2:04	0570057	5425065	Perimeter of abandoned house on Buchans HWY
88	2:34	0570658	5425667	First location d/s from HWY bridge (Main Street) *snow has begun*
89	2:44	0570567	5425575	Driveway of #20 Main Street ** See Appendix V
90	2:55	0570629	5425397	Rear of properties on Main Street until Kinsmen Drive
91	2:57	0570651	5425350	Rear of properties on Main Street until Kinsmen Drive
92	2:58	0570642	5425338	Rear of properties on Main Street until Kinsmen Drive *snow fall worsening*
93*	3:17	0569702	5425463	Maple Street location where flood waters overtopped the street. *heavy snowfall at this point*

The snowfall was reducing visibility, so the investigation was concluded for the day.

*Waypoint #93 did not appear to correspond to the correct location on the public information map, so it was decided to take another set of coordinates at this location when the weather was more suitable.

3.2 Monday February 11, 2013

The flood extents for two locations were acquired:

1. Maple Street (to confirm or negate WP# 93) and
2. The Purple Frog Pub on Main Street – some construction was approved under WRA at this location.

Field Notes taken on Sunday February 10th, 2013 are as follows:

WP #	Time	Easting	Northing	Notes:
94	11:39	0569917	5425383	Rear of property on Maple Street. *
95	12:01	0570622	5425465	Rear of property of Purple Frog Pub on Main Street.

*The resident living at WP #94 advised that he had experienced some water in his basement during this flood event. He also advised that the flood waters had not overtopped Maple Street. There is a culvert at this location which allowed the flood waters to the other side of the road, negating waypoint #93. Therefore, waypoint #93 was not used to map out the flood extents.

4.0 Photos Taken During Flood Extents Investigation

4.1 Saturday, February 9, 2013



Figure 10 - House located at end of Main Street, across from Badger Arena



Figure 19 - House located at end of Main Street, across from Badger Arena



Figure 11 - Looking towards Little Red Indian Brook (Waypoint #80)



Figure 12 - Flood extents at end of dirt road (Waypoint #82)



Figure 13 - Looking upstream on Little Red Indian Brook, abandoned house on Buchans Highway (Waypoint #87)



Figure 14 - Looking upstream on Badger Brook towards TCH (Waypoint #88)



Figure 15 - Main Street, Badger



Figure 16 - Main Street, Badger



Figure 17 - Looking upstream on Badger Brook, Main Street, Badger



Figure 18 - Looking downstream on Badger Brook, Main Street, Badger

4.2 Monday February 11, 2013



Figure 19 - Looking perpendicular to Little Red Indian Brook, Maple Street, Badger

5.0 Badger Flood 2013 Extents Maps

The following screen captures illustrate the Badger Flood 2013 Flood Extents.

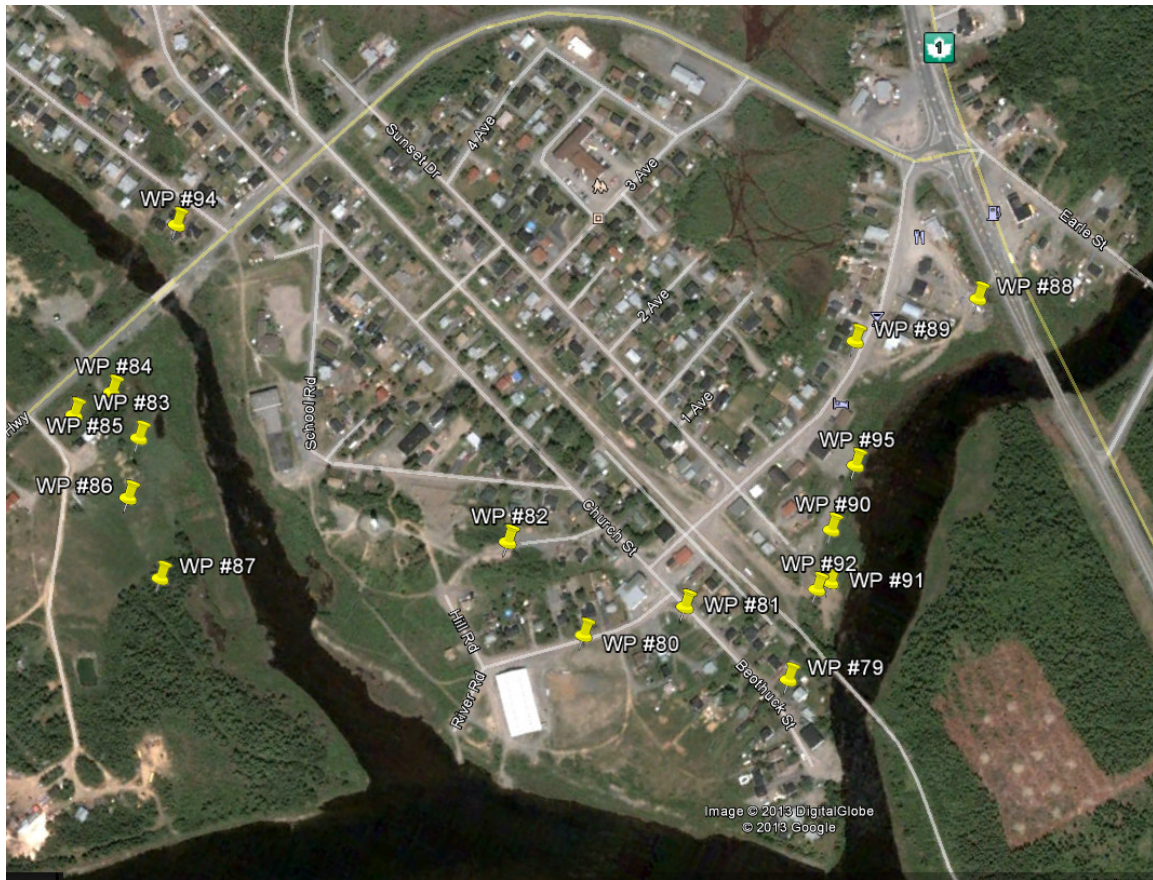


Figure 29 - Badger Flood 2013 Extents, Google Earth



Figure 20 - Badger Flood 2013 Extents, Badger Arena, Beothuck Street, Google Earth



Figure 21 - Badger Flood 2013 Extents, Buchans Highway, Google Earth



Figure 22 - Badger Flood 2013 Extents, Main Street, Google Earth



Figure 23 - Badger Flood 2013 Extents, Maple Street, Google Earth



Figure 24 - Badger Flood 2013 Extents, Purple Frog Pub, Google Earth



Figure 25 - Waypoint identifiers removed for clarity, Google Earth



Figure 26 - Badger Flood 2013 Extents, 1:100 (yellow) & 1:20 (orange) year flood lines, Google Earth

6.0 House Construction in 1:20 year Flood Zone

During the flood investigation, it was observed that a new house construction was built at the intersection of a small side road off Maple Street and Church Street. The house is at a higher elevation and is located in the 1:20 year flood zone.



Figure 27 - New house construction in 1:20 year flood zone.



Figure 28 - New house construction in 1:20 year flood zone

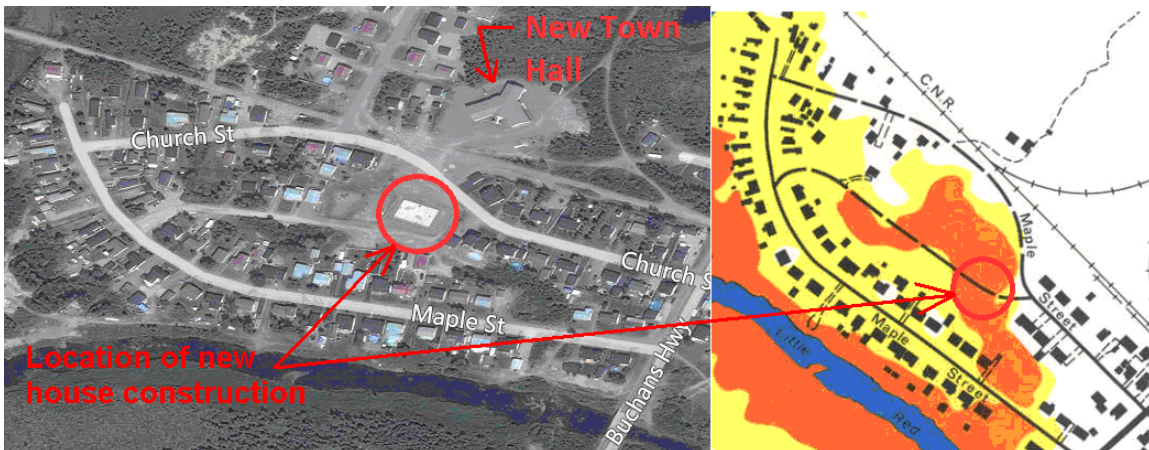


Figure 39 - Location of new house construction in 1:20 year food zone, Bing Maps, Public Information Map

7.0 Conclusion

A flood extent investigation was carried out by WRMD on Saturday February 9th and Monday February 11th, 2013. Based on the field observations at that time, the flood event was close, but did not appear to exceed the 1:20 year flood elevation.

APPENDIX I

Municipal Affairs
February 8, 2013



Public Advisory: Residents Urged to Use Caution in Town of Badger

In the interest of public safety, Fire and Emergency Services – Newfoundland and Labrador (FES-NL), is encouraging residents and visitors to the Town of Badger to take necessary precautions in light of the ice jam advisory by the Department of Environment and Conservation.

Residents are advised they should avoid the lower end of Badger Brook and Little Red Indian Brook until further notice, as water and ice conditions in the area are potentially dangerous. These brooks flow directly into the Exploits River. Individuals, either travelling on foot or by snowmobile, should pay particular attention to where they are travelling and avoid the areas of the lower end of Badger Brook and Little Red Indian Brook throughout the coming days.

FES-NL, in conjunction with the Town of Badger and other Provincial Government, departments, continues to monitor the situation and will provide further advisories as necessary.

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Media contact:
Cheryl Gullage
Public Relations Specialist
Fire and Emergency Services – Newfoundland and Labrador
709-729-0857, 631-9962
cherylgullage@gov.nl.ca

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APPENDIX II

FEB
8
2013

Badger Under Flood Watch



The town of Badger, no stranger to flooding, is currently under a flood watch. Mayor Mike Patey says the water started pouring down Beothuck Street yesterday and they acted quickly to block off River Road. He says 4 or 5 families in the flooded area have been evacuated on their own accord. Patey says they will keep a close eye on Badger Brook and will be trying to assess the situation today. VOCM News will continue to track this story and have updates as soon as they are available.

APPENDIX III

Town of Badger on flood watch as ice blocks sections of Exploits River



Published on February 8, 2013

Topics : [Exploits River](#) , [Newfoundland](#) , [Grand Falls-Windsor](#)

Ice blocking sections of the Exploits River in central Newfoundland have caused flooding in Badger.

Badger Mayor Michael Patey said the water came up two roads in the town and people in the seven or eight homes on the streets were evacuated.

The stadium and ball field were flooded.

Patey said the water hasn't risen since 12:30 this morning, and is now ice.

He said the town and fire department are monitoring.

Patey noted the Avoca Collegiate has been closed as a precaution, and some other residents chose to leave and spend the night with family in Grand Falls-Windsor.

APPENDIX IV

Summary of Rob Wight's Badger Update 2013-02-08

I had a quick look at the situation at Badger this morning and met briefly with the Mayor Mike Patey, Clerk Pansy Hurley and the lads from Nalcor, Wilmore Eddy and Peter Robbins.

The river is bank full of fairly well packed ice to well above 3 Mile Island. Water levels rose to a point last night where it flooded the field that we use to access the weather station and gauge house. Beothuk Street is flooded down by the STP as is the area near the stadium. It has receded a little since about midnight. The town has their full watch system well established.

As you can see from the attached photos, there is quite a lot of ice around. The water did reach the weather station enclosure and has since dropped a little leaving a good layer of ice inside. There may be some damage. Can't get the gate open due to the ice.

There is a lot of ice piled against the pole/staff gauge. It is now leaning about 5 degrees off plumb.

Up until last night when the water came up, the poles was checked at least hourly. Now access is hazardous and difficult.

The Hydromet station is high and dry for now, but access across the field is difficult. Can't drive and walking is hazardous as there is a layer of ice with water filling the lower spots.

I advised the group that Techs from Water Survey are en route to assess the differential in the two gauges. Consensus is that Backup Unit is pretty accurate.

Mayor Patey asked of there is anything that we can do about clearing some vegetation to allow for greater visibility at key access points up-river; Gull Rocks and 3 Mile Island. I advised that that was not our jurisdiction, but that I would pass his request along to you folks.

There was also some discussion about access to a Helicopter to look at the river. Upstream of 3 Mile Island there is a long distance with no access from the highway.

MHA Susan Sullivan is at the TCO this afternoon. I will stay here in GF-W, and make myself available to Krista Rebello should she want an orientation to the site and introduction to the key individuals.

Robert Wight
Environmental Scientist
Water Resources Management Division
Department of Environment and Conservation
Government of Newfoundland and Labrador
4th Floor, Provincial Building
3 Cromer Avenue
Grand Falls - Windsor, NL A2A 1W9







APPENDIX V

FEB
9
2013

Badger Residents Asked to Take Precautions



The department of Fire and Emergency Services is asking residents of Badger to take precautions in light of an ice jam affecting the central Newfoundland community. The department says residents should avoid the lower end of Badger Brook and Little Red Indian Brook until further notice. Water and ice conditions in the area are potentially dangerous. The brooks flow directly into the Exploits River.

The department says individuals either travelling on foot or by snowmobile should pay particular attention to where they are travelling and avoid the areas of the lower end of Badger Brook and Little Red Indian Brook throughout the coming days.