# Appendix A

# Flood Inventory Summaries

*This page left intentionally blank*

# Updates to the 2014 Flood Directory – Newspaper Clippings & Archived Media Coverage

Contents

## The January 2018 Flood (and post-flood news coverage)

Chronological list of newspaper clippings and social media posts:

01_13_2018 – The Western Star - Corner Brook, Humber Arm South declare state of emergency amid flooding, road washouts in Western NL

- https://www.thewesternstar.com/news/local/update-corner-brook-humber-arm-south-declare-state-of-emergency-amid-flooding-road-washouts-in-western-nl-177008/
- Heavy rain is wreaking havoc on the west coast and parts of central. Flooding, mudslides, and washed out roads are reported in several locations. Above average temperatures causing snow melt is exacerbating the problem.
- Motorists are advised to stay off Route 430 from Deer Lake to Wiltondale due to flooding in multiple areas. Traffic is moving again on the Trans-Canada Highway near Little Rapids. The bypass around the washed-out section opened shortly before 5:30 p.m. Saturday, but drivers should expect minor delays. People are asked to only travel if necessary.

01_14_2018 – Social Media Post – VIDEO - Ice Flowing Past the Nicholsville Bridge (Melvin Hoyles)

- https://www.facebook.com/m.n.u.hoyles/videos/10211783064507169/

01_16_2018 – CBC Media - Water levels dip in Deer Lake, NL, holding off possible evacuation

- https://www.cbc.ca/news/canada/newfoundland-labrador/western-newfoundland-flood-ice-jam-1.4489091

01_16_2018 – CBC Media – VIDEO – Deer Lake Residents on Evacuation Alert

- https://www.youtube.com/watch?v=JFRLR0BqcLo

01_16_2018 – The Western Star - Rising Humber River may require evacuation order for Deer Lake neighborhood

- https://www.thewesternstar.com/news/local/rising-humber-river-may-require-evacuation-order-for-deer-lake-neighbourhood-177881/
- Florence Cooper was keeping a close eye on the water creeping into her backyard in the last few days. Late Tuesday afternoon, the Deer Lake resident could see town officials going door-to-door in her **Moss's Lane** neighborhood, advising folks to be prepared to leave if the water got too close. The Coopers house is on the banks near the mouth of the Upper Humber River. On Tuesday afternoon, the water was **within about 30 feet of the home and getting closer**.
- Cooper has lived in the area for 24 years. I've seen this much water before, but usually during the spring melt," she said. "But this does seem to be different." The mighty river's level has been rising steadily since this past Saturday's major rainstorm that not only dumped about 100 millimetres of rain, but also caused significant snowmelt throughout the region.
- The Upper Humber River is fed by many tributaries running off the mountains located on the eastern side of Gros Morne National Park. The water that flowed downriver brought with it ice pans and slob, along with other debris. The ice and debris began piling up on the island located at the mouth of the river, where it empties into Deer Lake itself. The rafting ice caused the river to begin backing up. The wind direction wasn't helping conditions Tuesday either as it was essentially blowing upriver and pushing ice in Deer Lake towards the mouth of the Humber, adding to the pressure.

- **Two sections of the town's walking trails, specifically the sections that run along the Humber River, were closed due to flooding. Bridge structures on the trail section between Route 430 and Deer Lake Regional Airport were under water and the trail was not deemed safe for use.**

01_16_2018 – The Western Star - Rising water levels of Humber River in Deer Lake being closely monitored

- https://www.thewesternstar.com/news/local/rising-water-levels-of-humber-river-in-deer-lake-being-closely-monitored-177654/
- Officials in Deer Lake are keeping a watchful and hopeful eye on the rising waters of the Upper Humber River today. This past weekend's rainstorm and substantial snowmelt has not only led to a rise in the river's water levels, but has also sent a large amount of ice and debris downstream.
- **At the mouth of the Upper Humber River, where it empties into Deer Lake, there is an island that separates the flow into two channels. Ice and debris have begun collecting on the eastern side of the island in particular, causing rafting of ice and the already high water to begin backing up into the river.**

01_17_2018 – CBC Media – VIDEO - Televised Interview with Dean Ball (Mayor of Deer Lake)

- https://www.youtube.com/watch?v=Ht6f5JypES8

01_18_2018 – The Western Star - Clean-up efforts continue in Western Newfoundland Communities days following weekend thaw

- https://www.thewesternstar.com/news/local/clean-up-efforts-continue-in-several-western-newfoundland-communities-days-following-weekend-thaw-178264/
- A large wooden dock seems to have found a new home after being washed down the flooded Humber River. The structure, which was seen floating past Steady Brook Tuesday afternoon and wound up stuck on Shellbird Island later in the day, was still hung up on the small island just east of Corner Brook Wednesday afternoon.
- Work was continuing on the eastbound lane of the Trans-Canada Highway near Little Rapids, which was washed out in last Saturday's heavy rains. The westbound lane has been repaired, but is handling traffic from both directions until the divided highway is repaired further.

01_18_2018 – The Western Star - Mayor Dean Ball says Humber River's eroding banks will continue to be a serious concern for Deer Lake

- https://www.thewesternstar.com/news/local/mayor-dean-ball-says-humber-rivers-eroding-banks-will-continue-to-be-a-serious-concern-for-deer-lake-178265/
- Section of Riverbank Road in Deer Lake dropped about six inches. It was another impact of the high-water levels in the Humber River since last Saturday's rain, milt temperatures and accompanying snow melt.
- "The water level is not as high as in some springs, but it's not spring — it's freezing," said Sullivan as he watched ice and water steadily flow and gather at the mouth of the Humber River where it empties into Deer Lake.
- Town of Deer Lake were replacing utility poles on foundering ground on Pinetree Drive.

01_18_2018 – The Western Star - Two homes on Pine Tree Drive in Deer Lake urged to evacuate because of riverbank erosion

- https://www.thewesternstar.com/news/local/two-homes-on-pine-tree-drive-in-deer-lake-urged-to-evacuate-because-of-riverbank-erosion-178663/
- Access to Pine Tree Drive has been limited to its residents because of the situation. A similar situation exists on Riverbank Road on the other side of the Nicholsville bridge from where Pine Tree Drive is. A section of that road has dropped, access is limited to residents who live on the road and has also been reduced to one-way traffic. Residents of other nearby streets are still on alert for a possible evacuation, although the water levels in the Humber River have dropped considerably in the last day.
- While the river was down by more than another foot Thursday afternoon, according to Ball, there are around two kilometers of ice backed up from the mouth where the river empties into Deer Lake. Ball flew the Upper Humber River late Wednesday afternoon. He said there was still another 27 kilometers of river with more ice that could still come down and continue to create a risk of flooding in the town. The mayor said there was slob ice still moving downriver and, further up the river, solid but weak ice that could also still make its way downriver.
- **Residents of the following streets in Deer Lake are still on alert for possible evacuation:** Riverside Drive, Oakes Road, Reginald Drive, Tower Road, Moss's Lane, Bailey's Avenue

01_18_2018 – The Western Star - Riverside homeowners in Deer Lake hope the Humber River recedes before evacuation is ordered

- https://www.thewesternstar.com/news/local/riverside-homeowners-in-deer-lake-hope-the-humber-river-recedes-before-evacuation-is-ordered-178263/
- This week, Moss and her husband, Ryan, have watched the waters of the Humber River creep closer to their home on Bailey's Avenue in Deer Lake. Their street is among seven roads where homes were placed under threat of evacuation Tuesday should the river rise much more than it already has.
- Ryan grew up on Bailey's Avenue and has seen the Humber River this high before. All the previous high-water situations he has seen, though, were in the spring. This situation is different, with their backyard freezing over and the ice collecting just downstream, threatening to force the dangerous water levels to go even higher. Ryan has been measuring the water levels with his own homemade gauge in the backyard. It had come down almost an inch within about two hours by noon Wednesday. "If it stays the way it is, it will gradually run off and eventually freeze in," he said. "Hopefully, it doesn't get any worse."
- According to Deer Lake Mayor Dean Ball, the water had dropped about an inch and a half between 10 a.m. and noon Wednesday.
- Usually in the spring, when the water creeps into their backyard, the Mosses let their kids kayak around the yard.

01_22_2018 – CBC Media – A look at the flood, ice damage on Newfoundland's west coast (Photos of Deer Lake and Highway Near Little Rapids)

- https://www.cbc.ca/news/canada/newfoundland-labrador/water-damage-roads-washed-out-west-coast-newfoundland-1.4488529
- Photos of water damage inside the home of Robert and Nadine Delaney of Pasadena
- Photos of damage to the highway near Little Rapids

01_22_2018 – The Western Star – Four homes now in jeopardy on Pine Tree Drive in Deer Lake

- https://www.thewesternstar.com/news/local/four-homes-now-in-jeopardy-on-pine-tree-drive-in-deer-lake-179409/
- The Town of Deer Lake says four homes on Pine Tree Drive are now in jeopardy from the eroding banks of the Humber River. Late last week, residents of two homes on the road were urged to evacuate because the riverbank near their properties was sliding into the flooded Humber River and getting closer to houses.

01_23_2018 – The Western Star – Tense times as mild weather set to possibly worsen Humber River erosion issue in Deer lake

- https://www.thewesternstar.com/news/local/tense-times-as-mild-weather-set-to-possibly-worsen-humber-river-erosion-issue-in-deer-lake-179974/
- Four homes in Pine Tree Drive had been on a voluntary evacuation alert, with the Town urging residents to leave. On Tuesday, a crew from Newfoundland Power finished relocating four utility poles from the river side of Pine Tree Drive to the opposite side. One of those poles had been dangling in the foundering sand beneath it.

02_01_2018 – The Western Star – Engineers drawing up plan to try and mitigate Deer Lake's riverbank erosion issues

- https://www.thewesternstar.com/news/local/engineers-drawing-up-plan-to-try-and-mitigate-deer-lakes-riverbank-erosion-issues-182660/
- January flood event put four private homes on the river's edge in jeopardy. Some residents lost land and personal river since the January 13 storm.
- Engineers confirmed foundering of the riverbank would continue.
- The latest problems all began when mild temperatures, mixed with heavy rains and significant snowmelt, led to a flooded river that got backed up by an ice jam at the river's mouth further downriver from Pine Tree Drive.

02_06_2018 – The Western Star – Woman returns from vacation to property crumbling into Humber River

- https://www.thewesternstar.com/news/local/woman-returns-from-vacation-to-property-crumbling-into-humber-river-183865/
- River claimed two apple trees and her pumpkin patch, along with some windows for her greenhouse. Stairs leading down to the river are compromised by shifting sands.
- Janes is all too familiar with January thaws. She remembers being awakened in the middle of the night by loud crashes and bangs as sheets of ice clashed with one another on their migration towards Deer Lake during previous mid-winter mild spells.
- The chunky pack ice that jammed the mouth of the river last month, causing it to back up and rise so high that the banks began eroding in places, was unlike anything Janes has ever experienced in all her years living on the river. "This was the worst year yet," she said. "I've never seen it like this before."

05_03_2018 – CBC Media – Deer Lake Embankment Disappearing Daily After Winter Flooding

- https://www.cbc.ca/news/canada/newfoundland-labrador/deer-lake-embankment-humber-river-1.4646340
- "We have seen some erosion over the years but not to this extent. It seems because of the flooding we had in January, It's very unusual," Moss said.
- "My dad is 82 and he says he's never seen this before."

- Deer Lake Mayor Dean Ball says now that the snow has melted, engineers have looked at the site and fixing the crumbling embankment will cost millions of dollars.
- "We want to make sure the money spent is spent well and we are not talking about this again in five or 10 years," Ball said.
- "The piece of work has got a lot larger. We were talking four or five hundred feet in February, now we are talking at least triple that."
- "I'm surprised. This is armor stone that was put in 10 or 15 years ago and this stone, it's big rock and it's 15-20 feet from the river and to see that drop, ya, something underneath there is happening for sure." said Moss.

05_07_2018 – The Western Star - It could be a month before Deer lake can begin to address erosion along banks of the Humber River

- https://www.thewesternstar.com/news/local/it-could-be-a-month-before-deer-lake-can-begin-to-address-erosion-along-banks-of-the-humber-river-208298/
- Mayor Dean Ball visited residents on Pine Tree Drive.
- Some of the trees sinking on the properties are moving three or four inches per day.
- Some cracks had moved inwards 15-20 feet with new cracks forming.
- In one section of the road the erosion is within 12 inches of the asphalt and in another It is about eight feet from the town's water and sewer line.

05_29_2018 – The Western Star - Deer Lake still waiting on cost to address erosion along banks of Humber River

- https://www.thewesternstar.com/news/local/deer-lake-still-waiting-on-cost-to-address-erosion-along-banks-of-humber-river-214083/
- Erosion along the riverbank became an issue after a major rainstorm in mid-January.
- Chunks of the sandy bank have fallen in the river taking with them large trees, other vegetation and some private property. Cracks in the soil are also close to some of the town's underground infrastructure.

10_23_2018 – The Western Star - Town of Deer Lake plans to backfill eroded sections of Humber River banks.

- https://www.thewesternstar.com/news/local/town-of-deer-lake-plans-to-backfill-eroded-sections-of-humber-river-banks-252672/
- Access to Pine Tree Drive was still restricted to local traffic only.
- Erosion along Pine Tree Drive ate away at several properties along the riverbank and jeopardized some public water and sewer infrastructure below the road.
- Sections of Riverbank Road dropped after being undermined by the floodwaters.
- According to Mayor Dean Ball, the plan is to place armor stone into the areas where the bank shifted, then backfill and reshape the remediated banks. It was anticipated that this approach would cost significantly less than the initial estimates of the remediation cost. Essentially, this would be the same approach taken on Pine Tree Drive during a similar erosion event there nearly two decades ago.

09_3_2018 – The Western Star - Province has provided western Newfoundland with nearly $2 million in assistance for January flooding issues

- https://www.thewesternstar.com/news/local/province-has-provided-western-newfoundland-with-nearly-2-million-in-assistance-for-january-flooding-issues-238432/

- Here is a breakdown of funding provided to communities under the Newfoundland and Labrador-Disaster Financial Assistance Program for flooding in western Newfoundland, as of Aug. 31:  Deer Lake: $9,385.74 (Engineering consultant assessment)
- The following communities have claims under the program, but still have work outstanding and no funds have been provided under the program to date: Reidville (walking trail system)

01_11_2019 – The Western Star - Deer Lake resident Angus Janes still concerned about future of property on unstable riverbank.

- https://www.thewesternstar.com/news/local/deer-lake-resident-angus-janes-still-concerned-about-future-of-property-on-unstable-riverbank-275172/
- Resident lives on Pine Tree Drive in Deer Lake and owns one of the homes the town advised should be evacuated last January when the flooded Humber River began eating away the sandy banks on which the street sits.  Neither Hanes not any of the other affected homeowners ever left their property.  Residents on Riverbank Road were also impacted.
- Buffer zone between private and provincial property along Pine Tree Drive has essentially crumbled into the river. Mayor Dean Ball wants the residents that live on Pine Tree Drive and Riverbank Road – which was also affected by erosion, to work with the town towards addressing the situation. The eroded area along Riverbank Road has been remediated back to the condition it was prior to January 2018 flooding.  Engineers and the town are still working out the final details of the contract for the work required for Pine Tree Drive (likely the riverbank will be shored up using armor stone or a combination of that and other large rock).

01_19_2019 – CBC Media – West Coast Towns Still in Need of Serious Repair One Year After 2018 Floods

- https://www.cbc.ca/news/canada/newfoundland-labrador/2018-floods-nl-west-coast-1.4984413
- **Mayors fighting for better repairs to infrastructure to prevent future devastation**
- In Deer Lake, large sections of the riverbank crumbled into the water when the Humber River filled with rain and chunks of snow, pushing land with it. Now, when there is a rainfall, people's backyards shift with the earth. "The last rainfall, we had a couple spruce trees that were hanging on. We lost them in the last month. It is continuing, the erosion," said Mayor Dean Ball. "The bank is scraped off to the sand and gravel, so each and every time there is a major rainfall, it's still continuing."
- With some disaster funding along with capital works money, the town plans to install strong armour stone along the riverbank this summer to reinforce the crumbling land, **at a cost of $1.5 million.**
- The mayor says it was a long process to apply for relief funding with the province and he's not certain the stone wall will hold up for years to come.
- "With the way weather, climate is changing, it's a guess, you know. We're hoping. Our engineers, we have been working very closely with, and we are hoping this is going to be a long-term fix," said Ball.

## Steady Brook – Councilor's Flood Concerns

September 30, 2017 – Steady brook councilor Claude Wilton wants Deer Lake Power Company to address concerns about flooding

- https://www.thewesternstar.com/news/local/steady-brook-councilor-claude-wilton-wants-deer-lake-power-company-to-address-concerns-about-flooding-120406/
- Wilton, a town councilor in Steady Brook, shared his concerns about high water levels in Grand Lake, Deer Lake and the Humber River during Saturday's monthly meeting of the Great Humber Joint Council at Pasadena Place.

## Pasadena – South brook Ice Jam Flooding (February 2018)

02_03_2018 – CBC News – Flooding in Pasadena Forces Evacuation of 5 Residents Saturday

- https://www.cbc.ca/news/canada/newfoundland-labrador/flooding-pasadena-evacuation-5-1.4518381
- Five residents of the Maple Place area of Pasadena, on Newfoundland's west coast, were evacuated from their homes Saturday morning due to dangerously high-water levels.
- The road, which only has a few houses on it, is near a brook that courses through the middle of town. The brook flooded after Friday's heavy rains and mild temperatures and overflowed onto the road, rendering it impassable by regular traffic.

02_03_2018 – The Western Star – UPDATED: Five Residents Evacuated Safely from Flooded Maple Place in Pasadena

- https://www.thewesternstar.com/news/local/five-residents-evacuated-safely-from-flooded-maple-place-in-pasadena-183102/
- The cause of the flooding concerns in Pasadena today has been identified as an ice jam in South Brook.
- Mayor Gary Bishop and other officials flew over the brook coursing through the heart of the town earlier today to see if they could find out why three homes on Maple Place had to e evacuated Saturday morning.
- According to Bishop, an ice jam in a bend in the river has forced the brook to redirect its flow towards Maple Place.
- He said a plan is being worked on to break up the jam and get the water flowing back on its regular course towards Deer Lake.
- Power has been cut to the three homes because floodwaters are dangerously close to the home's electrical services. With temperatures expected to drop to around -16 C tonight, Bishop hopes the situation can soon be rectified to the point where power can be restored, and homes can be warmed up.

02_03_2018 – The Western Star – VIDEO - Maple Place Flooding

- https://youtu.be/yTwYaWc8uk8

02_05_2018 – VOCM – VIDEO - Flooding on Maple Place in Pasadena

- https://youtu.be/euZy6vGU1k0
- http://vocm.com/news/pasadena-assesses-flood-damage-after-five-displaced/

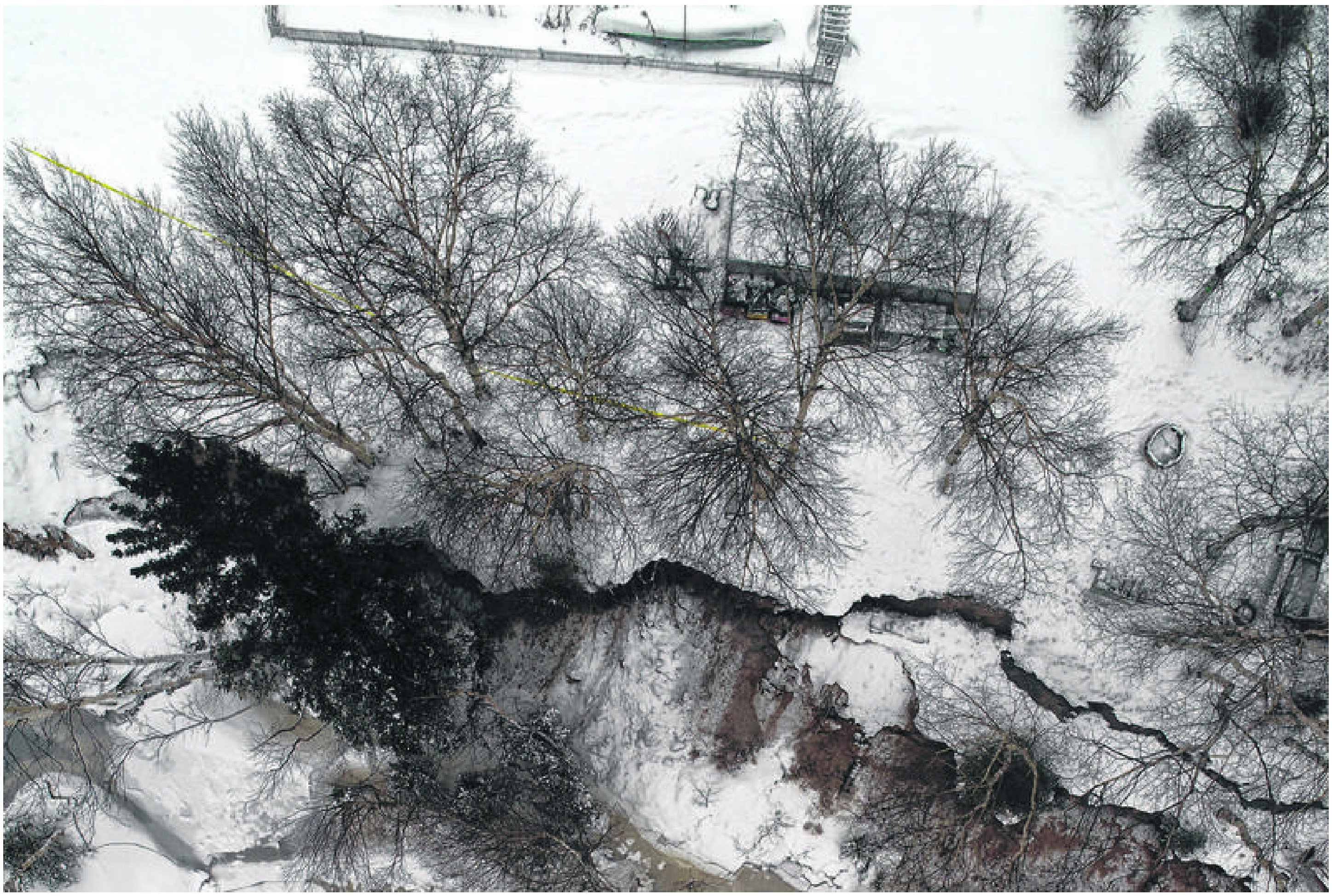
02_06_2018 – The Western Star – Pasadena says it will have to revisit what can be done to prevent future South Brook Flooding

- https://www.thewesternstar.com/news/local/pasadena-says-it-will-have-to-revisit-what-can-be-done-to-prevent-future-south-brook-flooding-183552/
- There are only three homes on Maple Place, a low-lying road situated on the banks of the brook. They were all evacuated, but residents were permitted to return to their homes Sunday after a trench was dug to direct the water back on its normal course toward Deer Lake
- Colson has lived in the area for about 22 years and has seen flooding there before**. He says something should have been done long ago to prevent what happened Saturday.**
- **Hudson said there was little that could be done with the several hundred metres of ice damming on South Brook, which extended from the mouth of the brook at Deer Lake back to beyond Maple Place.**
- He noted the fact the brook is S-shaped as it courses past the Maple Place area makes South Brook susceptible to problematic ice damming.


Grace Ave
Meadow Ln
George Aaron Dr
Nicholsville
River Bank Rd
River Bank Rd
Pine Tree Dr
Mosses Ln
River Bank Rd
Goose Arm Rd
Scott Dr
Jeddores Ln
Cross' Rd
Humber View Dr
Ball St
Leria St
Oakes Rd
Bennett Ave
Park Ln
Queen St
1
Nicholsville Rd
Commerce St
Trans-Canada Hwy
Pine St
Google Earth
Image © 2019 DigitalGlobe
© 2018 Google
1 km
N

# Deer Lake resident Angus Janes still concerned about future of property on unstable riverbank

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 11 at 6:15 p.m.



This riverbank in Deer Lake has under siege by the rising waters of the Humber River last January. - FILE

Angus Janes was hoping more would have been done by now.

And, his mayor is urging patience.

Janes lives on Pine Tree Drive in Deer Lake and owns one of the homes the town advised should be evacuated last January when the flooded Humber River began eating away at the sandy banks on which the street sits.

RELATED:

'Town of Deer Lake plans to backfill eroded sections of Humber River banks'

'Deer Lake still waiting on cost to address erosion along banks of Humber River'

'It could be a month before Deer Lake can begin to address erosion along banks of the Humber River'

'Engineers drawing up plan to try and mitigate Deer Lake’s riverbank erosion issues'

'Woman returns from vacation to property crumbling into Humber River'

Neither Janes, nor any of the other affected homeowners, ever left their property. That doesn’t mean they weren’t concerned and weren’t keeping a close eye on the worsening situation.

The Town of Deer Lake has spent the last year trying to figure out the best way try and mitigate the erosion, which is still occurring. At first it was thought that sheets of metal pilings could be driven into the riverbank to absorb and redirect the forceful current.

That idea has proven to be too costly, likely in the millions. Instead, the town’s plan now is to place stone along the banks to stabilize it.

There was already stone in a section of the riverbank, but some of it got washed away. The plan is to put more back.

“They haven’t done anything to fix it yet,” said Janes. “They had something bigger in mind with a steel wall, but that didn’t happen because it was too expensive. They should have known that. They should have just went with the big boulders long ago. Anything at all would have been a help.”

Janes is concerned about his property. He has tried to get home insurance, which he had been without, but has been told he can’t get it in light of the precarious riverbank.

Amanda Dean, vice-president Atlantic for the Insurance Bureau of Canada, told The Western Star there is no insurance policy available anywhere to protect against erosion, but she did say there should be no reason Janes shouldn’t still be able to get insurance against fire, theft and so on.

Dean did say an insurer will obviously want to know the risks involved in any property. She said the insurer will also want to know of any mitigation measures against a threat such as flooding taken by the homeowner or by any public body such as a municipality.

Janes said he intends to withhold his municipal taxes if something is not done to protect his property.

Mayor Dean Ball said there is nothing to be gained by withholding taxes. He said being in arrears will still just wind up being referred to a collection agency at some point.

He wants the folks who live on Pine Tree Drive, as well as Riverbank Road — which was also affected by erosion, to work with the town towards addressing this situation.

The eroded area along Riverbank Road has been remediated back to the condition it was prior to last January’s flooding.

Engineers and the town are still working out the final details of the contract for the work required for Pine Tree Drive. Ball said it is close to going to tender and the only decisions left are to determine if the material to be used to shore up the riverbank will be all armour stone or a combination of that and other large rock, as well as the elevation and grade of the designed stone wall.

When asked if the rock will also be placed on the riverbanks next to the homes that are in jeopardy, Ball said that might take more work to figure out as the contract will only replace rocks in the area where they were before.

The part of the federal Disaster Financial Assistance Arrangements program the town is availing of does not cover private property. Ball said the buffer zone between private and provincial property along Pine Tree Drive has essentially crumbled into the river, so the issue has been complicated by that factor.

“We’re still working on that issue, but no decision has been made,” he said. “This issue is at the forefront for us and it will be given the time and necessary conversation until this decision is made.”

# Update: Corner Brook, Humber Arm South declare state of emergency amid flooding, road washouts in Western N.L.

Juanita Mercer (juanita.mercer@thetelegram.com)
**Published:** Jan 13, 2018 at 10:57 a.m.
**Updated:** Jan 13, 2018 at 10:31 p.m.

Heavy rain and snow melt is causing flooding, mudslides, and washed-out roads all across Newfoundland's west coast Saturday. This photo of flooding in Benoit's Cove was taken by Michael Durnford. - Submitted

## Highways closed into and out of Corner Brook due to damage

Corner Brook Mayor Jim Parsons declared a state of emergency late Saturday afternoon just before 4 p.m. Multiple roads are closed in the city, and the highway going in and out of Corner Brook is closed due to infrastructure damage.

Parsons says the city's emergency plan is in place as crews deal with damages and an overwhelmed municipal drainage system caused by heavy rainfall and melting snow.

"We are dealing with a very severe rainfall event," said Parsons. "For the time being, we ask residents to stay off the streets in affected areas."

Residents are advised to stay off roads and sidewalks, especially where rushing water is present, and to avoid standing near riverbanks because they may be unstable.

The city also has a precautionary boil-water advisory in effect for some areas. Residents can call the Water Information Line at 634-7711 to find out if their area is affected.

Details about Corner Brook road closures:

Corner Brook declares state of emergency because of flooding

Shortly before 6 p.m., Humber Arm South mayor Glenn Savard declared a state of emergency for the entire area from Halfway Point to Frenchman's Cove. The area is dealing with infrastructure damage and road closures.

**Mudslides, washed out roads all across western N.L.**

Heavy rain is wreaking havoc on the west coast and parts of central. Flooding, mudslides, and washed out roads are reported in several locations. Above average temperatures causing snow melt is exacerbating the problem.

Motorists are advised to stay off Route 430 from Deer Lake to Wiltondale due to flooding in multiple areas. The Trans-Canada Highway is also closed west of Hampden Junction and at George's Lake.

Traffic is moving again on the Trans-Canada Highway near Little Rapids. The bypass around the washed out section opened shortly before 5:30 p.m. Saturday, but drivers should expect minor delays. People are asked to only travel if necessary.

Water rushes through a culvert at Little Rapids, west coast on the TCH Saturday morning. This photo was tweeted by Newfoundland

Tractor trailer drivers are advised to stay off roads in the Wreckhouse area due to high winds.

The road is also closed to Frenchman’s Cove. Resident Michael Durnford says he was driving there this morning and workers with the Department of Transportation and Works had the road shut down.

“Shoulders are washed away and a portion of the road is under water in one area,” he said.

As of 5 p.m. Saturday, crews were still working to secure a culvert and municipal water line in the area.

A landslide near Rocky Harbour is shown in a Twitter post from Newfoundland Hydro.

Durnford also says there is a landslide just outside Benoit's Cove.

Transportation and Works. The road has been closed in both directions.

**Power outages**

NL Hydro says power is out in the area of the landslide on the Northern Peninsula, impacting the following communities: Birchy Head, Glenburnie, Woody Pt., Winterhouse Brook, and Trout River.

Crews found downed trees on a line and are now working to remove the trees and restore power. Estimated restoration time is 7:30 p.m.

Meanwhile, NL Hydro is asking people to report and stay away from any broken poles or downed lines.

**Wild weather**

Environment Canada has wind and rainfall warnings in effect for the west and south coasts of the province. They are warning residents to stay away from washouts near rivers, creeks and culverts, and suggesting people move valuable items to higher levels. Heavy rain is expected to taper to showers and drizzle by this evening.

Environment Canada advised that plummeting temperatures in the evening could cause pooling water to ice over as flash freezes take hold in some areas. At 6 p.m., the Department of Transportation and Works advised extreme caution if driving on the Baie Verte Peninsula due to freezing rain and slippery conditions.

Marble Mountain has been closed since Friday. In a Facebook post, a ski resort spokesperson wrote that they lost a lot of snow. They are monitoring weather conditions and will begin making more snow when temperatures cool down, noting they will "attempt to rebuild our mountain in the coming days."

Around 8:30 Saturdayk night the RCMP in Rocky Harbour reported about four feet of standing water on Route 430 between Jack Ladder and Wiltondale. In the interest of safety, motorists were asked to refrain from travelling in this area of the Northern Peninsula Highway.

More details will be added as they become available.

A Newfoundland Works photo of the TCH shows the collapse of the pavement.

# Rising Humber River may require evacuation order for Deer Lake neighbourhood

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 16, 2018 at 9:30 p.m.

A crew works on a utility pole that was on ground being eroded by floodwaters on the banks of the Humber River in the Deer Lake neighbourhoood of Pine Tree Drive Tuesday. - Photo by Roxanne Ryland

Florence Cooper was keeping a close eye on the water creeping into her backyard in the last few days.

Late Tuesday afternoon, the Deer Lake resident could see town officials going door-to-door in her Moss's Lane neighbourhood, advising folks to be prepared to leave if the water got too close.

The Coopers house is on the banks near the mouth of the Upper Humber River. On Tuesday afternoon, the water was within about 30 feet of the home and getting closer.

Cooper has lived in the area for 24 years.

"I've seen this much water before, but usually during the spring melt," she said. "But this does seem to be different."

The mighty river's level has been rising steadily since this past Saturday's major rainstorm that not only dumped about 100 millimetres of rain, but also caused significant snowmelt throughout the region.

The Upper Humber River is fed by many tributaries running off the mountains located on the eastern side of Gros Morne National Park. The water that flowed downriver brought with it ice pans and slob, along with other debris.

The ice and debris began piling up on the island located at the mouth of the river, where it empties into Deer Lake itself. The rafting ice caused the river to begin backing up.

The wind direction wasn't helping conditions Tuesday either as it was essentially blowing upriver and pushing ice in Deer Lake towards the mouth of the Humber, adding to the pressure.

**Related story**

**Deer Lake asking some residents to be ready for evacuation**

The Coopers have a wharf down on the river, but it was completely underwater Tuesday afternoon.

"There's a lot of ice around the wharf," she said. "If it keeps coming, we might lose the wharf."

Even if it stays where it is, Cooper is concerned the wharf may be damaged or the integrity of the surface under it compromised.

As she waited for the town officials to come and knock on her door with the latest information, Cooper hoped she and her husband wouldn't have to leave.

She was ready to go if they had to.

"I told my husband to get the suitcase ready," she said.

Earlier in the day, Mayor Dean Ball, along with town staff, provincial government officials and the police were monitoring the situation and warning people living near the river that the rising water may jeopardize their properties if it doesn't recede.

Over on Pinetree Drive, which also courses alongside the river, a work crew had to remove a utility pole that was situated on foundering ground.

The Town of Deer Lake issued notices to its residents to stay off the bridges in the area, along with any wharf structures and other areas close to the riverbank until further notice.

Two sections of the town's walking trails, specifically the sections that run along the Humber River, were closed due to flooding. Bridge structures on the trail section between Route 430 and Deer Lake Regional Airport were under water and the trail was not deemed safe for use.

Barricades were placed at either end of the trails and residents were urged to stay off the trails until further notice.

# Rising water levels of Humber River in Deer Lake being closely monitored

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 16, 2018 at 11:21 a.m.
**Updated:** Jan 16, 2018 at 11:59 a.m.

A man stands on a wharf, watching the high water levels and ice pans and slob drifting down the Humber River Sunday. - Photo by Roxanne Ryland

Officials in Deer Lake are keeping a watchful and hopeful eye on the rising waters of the Upper Humber River today.

This past weekend’s rainstorm and substantial snowmelt has not only led to a rise in the river’s water levels, but has also sent a large amount of ice and debris downstream.

At the mouth of the Upper Humber River, where it empties into Deer Lake, there is an island that separates the flow into two channels. Ice and debris have begun collecting on the eastern side of the island in particular, causing rafting of ice and the already high water to begin backing up into the river.

Adding to the problem is the wind, a northeasterly breeze at nearly 20 kilometres per hour as of late Tuesday morning, keeping the ice nestled into the mouth of the river.

Mayor Dean Ball said the town, provincial government officials and the police are monitoring the situation and have warned people who own riverside property in the area that the rising water may jeopardize their properties if it doesn't recede.

The Town of Deer Lake has issued notices to its residents to stay off the bridges in the area, along with any wharf structures and other areas close to the riverbank until further notice.

Two sections of the town's walking trails, specifically the sections that run along the Humber River, have been closed due to flooding. Bridge structures on the trail section between Route 430 and Deer Lake Regional Airport are under water and the trail is not deemed safe for use.

Barricades have been placed at either end of the trails and residents are urged to stay off the trails until further notice.

CBC

# Water levels dip in Deer Lake, N.L., holding off possible evacuation

Mayor hoping to get through the night without calling for residents to flee

CBC News · Posted: Jan 16, 2018 9:36 AM NT | Last Updated: January 16, 2018

Ice was building up in the Humber River near Deer Lake Tuesday morning, as the area continues to clean up following excessive flooding over the weekend. (Colleen Connors/CBC)

Water levels dipped slightly in Deer Lake, N.L., late Tuesday, holding off the possibility that some residents would be forced to evacuate the town's west end — if only for the night, said the mayor.

"Right now, we're feeling we're going ot get through tonight," Deer Lake Mayor Dean Ball told CBC News Tuesday night.

Monitoring stations reported that water levels had dropped slightly on Tuesday night, slightly easing concerns of flooding after a day spent preparing to flee. Town officials sent an advisory Tuesday afternoon asking residents of the west end of the town to pack up and be prepared to leave their homes quickly.

**Premier of NL**
@PremierofNL

UPDATE: Monitoring Stations at Reidville, Deer Lake, Humber Village Bridge and Steady Brook reporting small decreases in levels. Monitoring will continue overnight, but we are asking that everyone please ensure they have emergency numbers close by in the case of any changes.

40 8:56 PM - Jan 16, 2018

39 people are talking about this

They also went door to door Tuesday evening to talk to residents and make sure everyone was aware of the situation.

The advisory came just three days after floodwaters rushed western Newfoundland and caused major damage.

Ball stressed that the drop in water levels was slight and that things could change easily.

And if they do, he said, "everything is ready to go."

## Waters steadily rising

River ice had been moving smoothly into Deer Lake, as was seen near the Nicholsville Bridge Monday afternoon.

However, that changed Tuesday morning, when ice started jamming up on a small island at the mouth of the Humber River.

**Colleen Connors**
@colleencbc

The land behind this house in Deer Lake is crumbling. Water levels are very high and washing away the embankment. #nlwx #nltraffic #cbcnl

2 11:53 AM - Jan 16, 2018

See Colleen Connors's other Tweets

"We weren't expecting this," Ball told CBC earlier Tuesday.

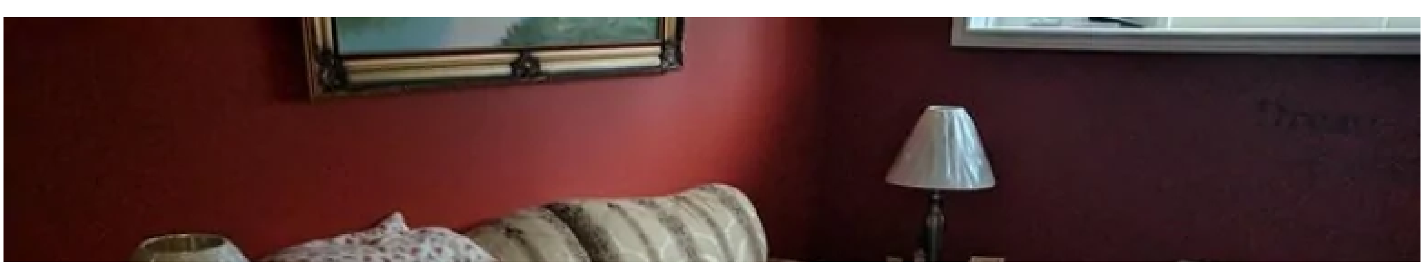
"I guess overnight there were edges that broke off up through the river area, and it's causing grief this morning."

Ball said town workers are trying to figure out what to do to clear the ice jam and prevent flooding. He said the situation is not life-threatening, but eight or 10 homes could be at risk of flooding. The town is asking people to stay away from the area, he added.

## 4 communities still under state of emergency

Communities affected by last weekend's flooding in western Newfoundland are still assessing the damage, and how much it will cost.

Heavy rains and unseasonably high temperatures caused several road washouts and flooding to public and private property Friday night and Saturday.



The basement of Robert and Nadine Delaney's home in Pasadena, seen here Saturday morning, was flooded with more than an foot of water Friday night. (Submitted by Nadine Delaney)

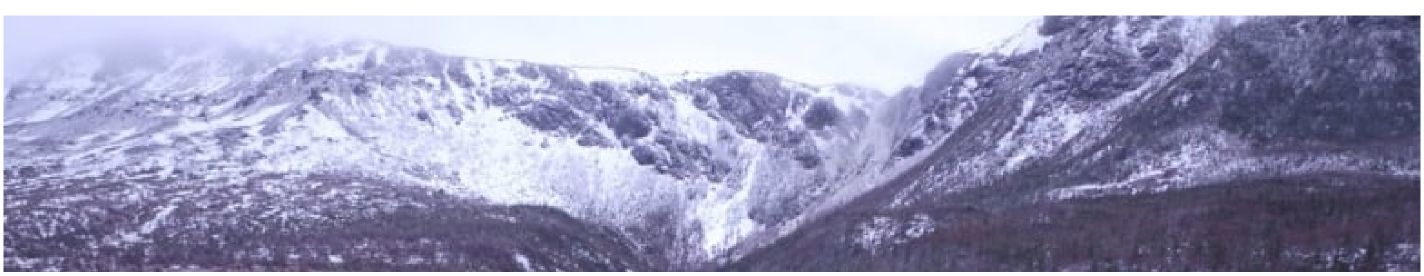
Trout River, York Harbour, Lark Harbour and Woody Point were all still under a state of emergency late Tuesday afternoon.

In Trout River, the state of emergency has been lifted, but the town is still dealing with the aftermath of severe flooding that surrounded many homes and buildings in the Northern Peninsula community.

The small community of Trout River is ramping up rebuilding efforts following a severe winter storm over the weekend. 5:49

The Trans-Canada Highway at Little Rapids was still being repaired, though traffic can pass through on a temporary access point.

Route 450 at John's Beach has one lane open for heavy equipment, but repairs are still ongoing there and at Rattler Brook in Humber Arm South.



Repairs are ongoing on a bridge at Rattler Brook in the Bay of Islands, which connects the communities of Lark Harbour and York Harbour with the rest of the province. (Twitter/@TW_GovNL)

Gudie Hutchings, the Liberal MP who represents the region, said communities with significant damage should have no trouble getting access to federal disaster funding.

Hutchings, who has lived in western Newfoundland her entire life, said she's never seen flood damage in the region like this week.

"Trust me, from what I've seen over the weekend the province will have no problem meeting the [cost] thresholds and will be able to help," she told CBC's *Here and Now*.

## Federal funding

Federal funding would come from the Disaster Financial Assistance Arrangement program. Funding is approved after communities report to the Newfoundland and Labrador government, which then does an assessment and approaches the federal government to work out payback.

Hutchings said her office has been busy taking calls from residents with damage to their property, and her staff have been helping connect residents with the appropriate authorities.

She said while repair is underway, it could take months to fully assess damage that's not obviously visible, and that people should be aware that not all areas have been assessed and could still be dangerous.


**Transportation & Works NL**
@TW_GovNL

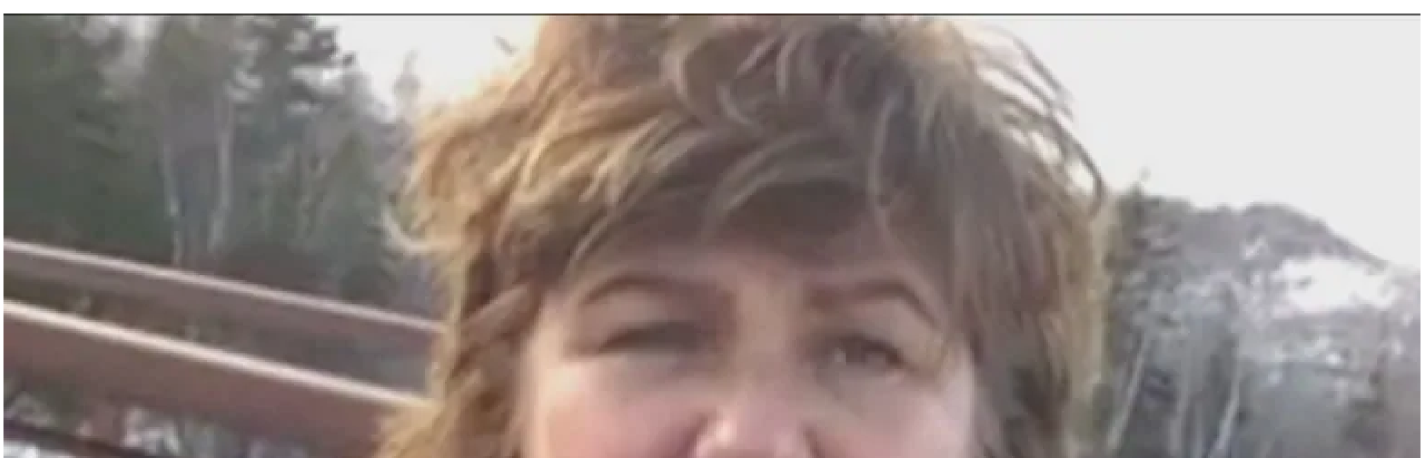
Current view from the TCH at Little Rapids. Five lengths of culvert now in the ground. #nltraffic

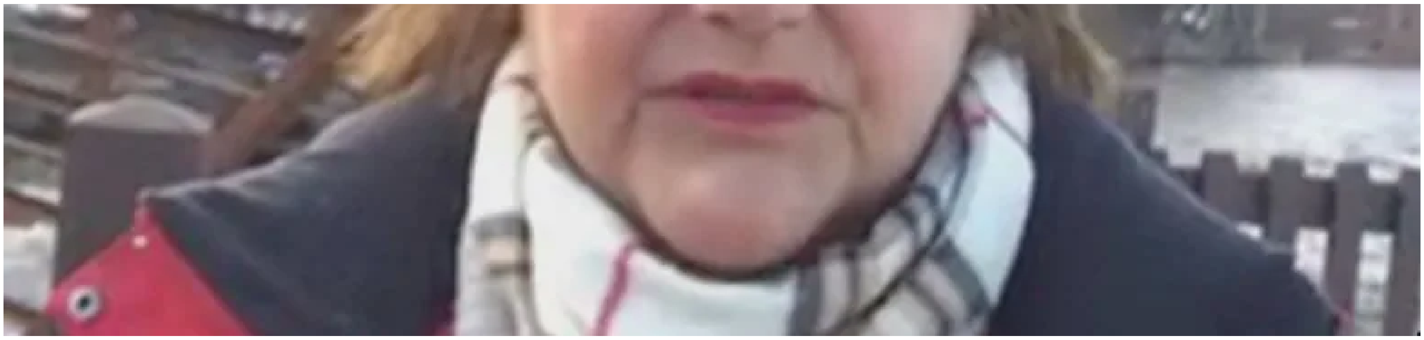
7 5:11 PM - Jan 15, 2018

See Transportation & Works NL's other Tweets

A helicopter was being used to bring medications to people stranded in the Humber Arm South region, and a post on social media shows at person had to be airlifted Monday out to get kidney dialysis treatment.

Helicopter service was delayed on Tuesday due to low clouds in the area, and the Department of Transportation and Works said those who may need to use the helicopter service should consult its website for updates.





Long Range Mountains MP Gudie Hutchings says federal funding is likely to come for communities dealing with damage from this weekend's flooding. (CBC)

According to Hutchings, things are still tough for people in several communities that are cut off in the Bay of Islands and the Bonne Bay areas.

"There was a lack of medication for some and thankfully the coast guard was able to get in and help out there," she said. "The coast guard has a helicopter in that area, helping out getting people back and forth to medical appointments."

## Hockey Day in Corner Brook

The City of Corner Brook is still assessing the extent of the damage and scrambling to get ready for the Hockey Day in Canada events scheduled for this weekend.

The warm weather and flooding over the weekend destroyed the ice on the outdoor rinks the city was preparing for the event, but Mayor Jim Parsons said workers are rebuilding the ice surfaces as quickly as possible.

"Teams have been putting water on our rink. It is lined, so we don't lose the water and fingers crossed, we will have a skating rink or two skating rinks by Saturday," Parsons told CBC News.

Marble Mountain Ski Resort, usually in full swing for the season by now, lost most of its snow as a result of flooding and high temperatures over the weekend. (CBC)

Falling temperatures should help with the ice-making effort, as well as for snowmaking at Marble Mountain, which also saw significant damage over the weekend.

- **Damage at Marble Mountain, but slopes could open this week**

"Obviously when you have this kind of weather it's not good for your ski hill," said Parsons. "But not all is lost. [Marble Mountain official Tony Abbott] has got a plan to get things up and running very soon."


SKI-DOO

# Mayor Dean Ball says Humber River's eroding banks will continue to be a serious concern for Deer Lake

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 18, 2018 at 12:19 a.m.
**Updated:** Jan 18, 2018 at 6:05 a.m.

These homes on the banks of the Humber River were not far from being inundated with water from the dangerously high Humber River Wednesday. - Gary Kean

Robin Sullivan isn't worried his property will be flooded, but he is concerned about it remaining accessible.

Sullivan lives on Riverbank Road in Deer Lake, which was closed to all traffic other than local residents Wednesday.

The precaution had to be taken by the Town of Deer Lake after a section of the road dropped about six inches. It was another impact of the high water levels in the Humber River since last Saturday's rain, mild temperatures and accompanying snowmelt.

"The water level is not as high as in some springs, but it's not spring — it's freezing," said Sullivan as he watched ice and water steadily flow and gather at the mouth of the Humber River where it empties into Deer Lake.

The ice moving downstream has been stopping at the river's mouth, forcing water to back up into the river and threaten homes and infrastructure on the banks.

"You don't mind water running when it's keeping on going, but this is backing up a lot," said Sullivan.

He wasn't immediately concerned Wednesday, but hoped the situation didn't get worse.

"I'm not concerned about my property, but my access to it," he said. "There are some back (roads), so it shouldn't be too bad."

Riverbank Road is technically a dead-end street, but there is access to the rest of town at the end of the road that involves using privately owned property. This access was being used Wednesday.

While Riverbank Road is concerning, the Town of Deer Lake was already turning its attention to Pinetree Drive, where the high water has been eroding the riverbank.

Utility poles on foundering ground had to be replaced there Tuesday, and crews were keeping a close eye on the situation there again Wednesday.

Mayor Dean Ball said further erosion at this location is inevitable, though the sandy riverbank seemed to have firmed up a little in the colder weather since last weekend's storm.

"For certain, that ground is going," said Ball. "I don't think it's a maybe. It's just when. … The minute this temperature warms up, you're going to see a lot more of an issue there with land sliding out into the river."

Ball said the erosion of the riverbank is within six or seven feet of the road, and a decision will soon have to be made about limiting access to that unstable part of town.

The town had an engineer at the site to assess the situation Wednesday and was waiting on a report before deciding on a course of action.

Ball said a plan for an alternate exit from the dead-end street was already being worked on Wednesday.

Residents on the river were still being asked to be ready to evacuate Wednesday, despite the river dropping slightly. Ball said that decreasing trend would have to continue before the evacuation precaution could be lifted.


Gathering on Riverbank Road to watch the flooded Humber River flowing by was limited to local residents only after the Town of Deer Lake limited access to the area Wednesday.

Deer Lake Mayor Dean Ball said the Humber River’s water level dropped a bit Wednesday, but not enough as of deadline to lift a notice for affected residents to be prepared to evacuate.

# Two homes on Pine Tree Drive in Deer Lake urged to evacuate because of riverbank erosion

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 18, 2018 at 11:30 p.m.
**Updated:** Jan 18, 2018 at 11:35 p.m.

This landslide happened on the banks adjacent to Pine Tree Drive in Deer Lake earlier this week. - Photo by Roxanne Ryland

It's being left up to them, but  the Town of Deer Lake is urging residents of two homes on Pine Tree Drive to consider evacuation

The homes on the edge of the flooded Humber River are in potential peril because of the foundering riverbank on which their properties sit.

Town officials met with the residents Thursday and urged them to consider leaving.

**Related stories:**

Mayor Dean Ball says Humber River’s eroding banks will continue to be a serious concern for Deer Lake

Riverside homeowners in Deer Lake hope the Humber River recedes before evacuation is ordered

Neither homeowner could be reached for an interview Thursday, but Mayor Dean Ball indicated they were going to discuss the situation with their respective families before making a decision on if or when they should leave.

“This decision has been made on the side of caution,” Ball said in an interview. “It’s a voluntary request, but it has been suggested these families move.”

A landslide on the sandy banks of the Humber River below Pine Tree Drive earlier this week forced the moving of several utility poles. Ball said an engineering report done Wednesday has suggested the bank remains somewhat unstable.

There has been considerable slippage of the riverbank into the Humber River and. In one area, the bank was within six feet of Pine Tree Drive itself, as of Thursday afternoon.

Ball said any further significant land movement near the homes could force a mandatory evacuation.

On Wednesday, Ball had said he believes further erosion of the riverbank beneath Pine tree drive was inevitable.

Access to Pine Tree Drive has been limited to its residents because of the situation.

A similar situation exists on Riverbank Road on the other side of the Nicholsville bridge from where Pine Tree Drive is. A section of that road has dropped, access is limited to residents who live on the road and has also been reduced to one-way traffic.

Motorists entering Riverbank Road near the bridge now have to exit through Goose Arm Road at the other end.

Barricades have been placed on both streets and only those who live in the immediate area are allowed in.

Residents of other nearby streets are still on alert for a possible evacuation, although the water levels in the Humber River have dropped considerably in the last day.

While the river was down by more than another foot Thursday afternoon, according to Ball, there are around two kilometres of ice backed up from the mouth where the river empties into Deer Lake.

Ball flew the Upper Humber River late Wednesday afternoon. He said there was still another 27 kilometres of river with more ice that could still come down and continue to create a risk of flooding in the town.

The mayor said there was slob ice still moving downriver and, further up the river, solid but weak ice that could also still make its way downriver.

**Residents of the following streets in Deer Lake are still on alert for possible evacuation:**

*Riverside Drive*

*Oakes Road*

*Reginald Drive*

*Tower Road*

*Moss's Lane*

*Bailey's Avenue*

*Source: Town of Deer Lake*

*Dolores and Clyde Compton survey the damage to the riverbank on Pine Tree Drive in Deer Lake after a portion of it fell into the flooded Humber River. They live just a couple properties away from where the bank is washing away Since Sunday they have watched their wharf being carried away by the ice. They have moved their trailer and boat away from the edge of the* *riverbank and are keeping a close watch as the washout area creeps closer to their property.*

*Dolores and Clyde Compton survey the damage to the riverbank on Pine Tree Drive in Deer Lake after a portion of it fell into the flooded Humber River. They live just a couple properties away from where the bank is washing away Since Sunday they have watched their wharf being carried away by the ice. They have moved their trailer and boat away from the edge of the riverbank and are keeping a close watch as the washout area creeps closer to their property.*

# Riverside homeowners in Deer Lake hope the Humber River recedes before evacuation is ordered

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 18, 2018 at 12:15 a.m.
**Updated:** Jan 18, 2018 at 6:06 a.m.

Ryan and Angie Moss watch the Humber River flow past and through their riverside backyard on Bailey's Avenue in Deer Lake Wednesday. - Gary Kean

Angie Moss and her parents lost their home and most of their personal belongings in Badger when it disastrously flooded in 2003.

Now living in Deer Lake, there's no way she is going to let that happen to her again.

In Badger, ice jams on three rivers sent a deluge of water into the small town. The water from the rivers then froze, encasing a large part of the community in ice.

This week, Moss and her husband, Ryan, have watched the waters of the Humber River creep closer to their home on Bailey's Avenue in Deer Lake.

Their street is among seven roads where homes were placed under threat of evacuation Tuesday should the river rise much more than it already has.

The water began to recede Wednesday morning, but it was still not low enough to lift the notice issued by the Town of Deer Lake the previous day, which advised residents to be ready to leave their homes.

"I just hope and pray the sump pumps keep keeping the water out," Angie said as she and her husband surveyed the water pooled in their riverside backyard.

The Mosses have no plans to finish their basement because they know it could easily flood if the river rises too high. They've built shelves to put all their keepsakes high and dry, and they have their washer, dryer and hot water tank on platforms to keep them safe.

Fortunately, their pumps have been working to perfection and they have no water in their basement.

While Angie has previously experienced the devastation and heartbreak flooding rivers can cause, Ryan grew up on Bailey's Avenue and has seen the Humber River this high before.

All the previous high-water situations he has seen, though, were in the spring. This situation is different, with their backyard freezing over and the ice collecting just downstream, threatening to force the dangerous water levels to go even higher.

Ryan has been measuring the water levels with his own homemade gauge in the backyard. It had come down almost an inch within about two hours by noon Wednesday.

"If it stays the way it is, it will gradually run off and eventually freeze in," he said. "Hopefully, it doesn't get any worse."

According to Deer Lake Mayor Dean Ball, the water had dropped about an inch and a half between 10 a.m. and noon Wednesday.

Usually in the spring, when the water creeps into their backyard, the Mosses let their kids kayak around the yard.

They're looking at this unexpected situation as positively as possible.

"We might get an ice rink out of it," said Angie.

On the other side of Nicholsville Road, Quintin Dennis had a fantastic view of the weather events of the past few days from a sunroom overlooking the river and the Nicholsville bridge.

He saw the ice rafting up as it collected on the bridge a few days ago.

He also saw that ice and the water levels slowly get closer and closer to his house.

Fortunately, the ice broke up at the bridge and went down the river, but the water still found its way under his fence and into his yard.

“The dogs knew there was something up,” he said. “They were staring at the river and doing their sniffy thing.”

He, too, hopes the worst is over and the water levels will begin to recede, especially before any more warm weather or heavy rain comes.

“We’ve still got quite a ways to go (before the water recedes), but this is the highest we have ever seen it,” said Dennis, who has lived in the house since 2002. “We have never seen it come inside the fence both in the front and back garden.”

Ryan Moss of Deer Lake poses while checking the water levels in his backyard on the banks of the Humber River Wednesday.

Quintin Dennis has a front row seat to the flooding Humber River and hopes he doesn’t have to evacuate his home should the waters keep rising.

# Clean-up efforts continue in several Western Newfoundland communities days following weekend thaw

Chris Quigley (chris.quigley@thewesternstar.com)
**Published:** Jan 18, 2018 at 12:17 a.m.
**Updated:** Jan 18, 2018 at 6:06 a.m.

A deck washed aground on Shellbird Island in the Humber River late Tuesday afternoon. Its just one of the many pieces of debris to find itself in the river after a weekend weather event caused flooding and an increase in water levels. - Submitted

Some communities on the west coast are still dealing with serious ramifications from last weekend's weather, but Corner Brook appears to have mostly escaped that fate.

While there was certainly damage done, the current focus of the city is on assessing exactly how much.

There was at least one more water break on Wednesday, in the Curling area, but Mayor Jim Parsons said those are common for this time of year and not necessarily related to the recent mid-winter thaw. There was another potential break in the Raymond Heights area, but Parsons couldn't confirm that at the time of the interview.

"Other that that, it's business as usual," he said via cell phone from Marble Mountain on Wednesday evening, where he had just witnessed the Stanley Cup be skied down the hill.

Information on how the city could file for disaster relief money was released on Tuesday, so Parsons said the work on putting together that claim is ongoing.

There's so much now hidden under the snow, he said, so workers are trying to document as much of it as possible.

Ice currently exists on the outdoor rinks being constructed for Scotiabank Hockey Day in Canada activities on Saturday, so if they survive the somewhat milder temperature that was expected today, everything should be good to go.

"It's looking good," Parsons said. "We're optimistic."

**Humber Arm South**

Now that the road has been temporarily repaired near John's Beach, Frenchman's Cove is accessible again, so the state of emergency for that section of the four-community town was lifted on Tuesday.

Obviously a full fix won't be possible until summer, so the next big thaw — which Mayor Glenn Savard is praying won't come until spring — will likely cause issues in the area again. The road is currently just flattened out with Class A gravel.

"We have to see what kind of stuff shakes down when the frost comes out of the ground," he said. "It's hard. It's a bad time of year."

There's still a lot of work to be done, with clean-up efforts moving to the Clarke's Brook and Cammie's Brook areas today, Savard said, where flooding caused a lot of damage.

**Lark Harbour/York Harbour**

Lark Harbour Mayor Melanie Joyce was hopeful the section of road washed away near Rattlers Brook would be reopened sometime today for one lane of traffic when contacted by The Western Star on Wednesday night.

"We're just waiting for government officials to say what time," she said.

Later in the evening, following that interview, a media advisory did state traffic lights were in place in the area and that Route 450 was reopened, with crews monitoring and escorting traffic through.

Joyce said residents of Lark Harbour and York Harbour received supplies like eggs, bread, milk, and furnace oil on Tuesday thanks to Coast Guard auxiliary members. Skipper Alan Sheppard and Joyce's husband Gerard took the Western Leader on the run from Lark Harbour to Benoit's Cove to pick up the goods.

Everything else, she said, is looking pretty good as workers continue to patch up the main roads, before turning their attention to the byroads.

**Trout River**

"We didn't have hours, we had minutes."

That's what Trout River Mayor Horace Crocker said of the close call the town experienced with the bank behind Jakeman All Grade School eroding away into the river behind it on Tuesday.

"From the time the first rock fill was gone in the river, I'd say we only had two or three inches of earth between the water and the physical concrete in the wall," he said.

Contractors will continue to work in that area and others today, so the school will remain closed until at least Monday, since Friday was already scheduled as a personal development day for teachers.

"Hopefully everything will be A-OK for Monday morning," Crocker said.

Work was continuing on the eastbound lane of the Trans-Canada Highway near Little Rapids, which was washed out in last Saturday's heavy rains. The westbound lane has been repaired, but is handling traffic from both directions until the divided highway is repaired further.

This large wooden dock seems to have found a new home after being washed down the flooded Humber River. The structure, which was seen floating past Steady Brook Tuesday afternoon and wound up stuck on Shellbird Island later in the day, was still hung up on the small island just east of Corner Brook Wednesday afternoon.

CBC

# West coast towns still in need of serious repair one year after 2018 floods

Mayors fighting for better repairs to infrastructure to prevent future devastation

Colleen Connors · CBC News · Posted: Jan 19, 2019 9:00 AM NT | Last Updated: January 19

Main roads in Corner Brook looked like rivers during January's flood. The city plans to repair culverts permanently this coming construction season. (Colleen Connors/CBC)

It's been a year since heavy rain and melting snow cascaded through communities on Newfoundland's west coast, flooding homes and cracking roads in half.

Most communities and towns applied for financial assistance through the province's disaster relief funding, but many mayors say the money only covered Band-Aid fixes and no permanent repairs took place.

## Deer Lake

In Deer Lake, large sections of the riverbank crumbled into the water when the Humber River filled with rain and chunks of snow, pushing land with it. Now, when there is a rainfall, people's backyards shift with the earth.

"The last rainfall, we had a couple spruce trees that were hanging on. We lost them in the last month. It is continuing, the erosion," said Mayor Dean Ball. "The bank is scraped off to the sand and gravel, so each and every time there is a major rainfall, it's still continuing."

The riverbank in Deer Lake still shifts and moves each time there's a rainfall. The mayor says a strong armour stone wall is coming this spring. (Colleen Connors/CBC)

With some disaster funding along with capital works money, the town plans to install strong armour stone along the riverbank this summer to reinforce the crumbling land, at a cost of $1.5 million.

The mayor says it was a long process to apply for relief funding with the province and he's not certain the stone wall will hold up for years to come.

"With the way weather, climate is changing, it's a guess, you know. We're hoping. Our engineers, we have been working very closely with, and we are hoping this is going to be a long-term fix," said Ball.

## Trout River

In Trout River, some residents are worried the rebuild that's underway won't fix the problem, because they say two levels of government aren't doing the needed work at the same time.

The heavy rains washed an enormous amount of gravel into the river last January, altering the river's depth and the way the water flows.

Trout River residents say repairs that are underway might not fix the problem for good. (submitted photo)

That's still having a huge impact in the community.

"[Our fish harvesters] couldn't even come in to our harbour to sell our fish. We had to moor up in Woody Point, so this year it's looking like we're probably going to be doing the same thing," said Bonnie Brake, chair of the Trout River harbour authority.

"We will have a new wharf but we're not going to be able to access the river because the water is going to be too low."

Brake said the dredging on the lower part of the river that's being done now, with funding from the federal government, "is a waste of time and money" if the provincial government doesn't step up.

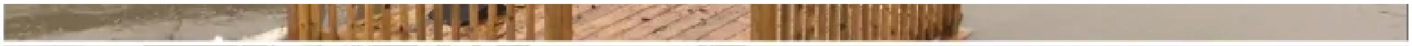
She said the town of Trout River has filed an application with the provincial government — under disaster relief funding — to get money to dredge the upper part of the river.

"Whatever is upstream is going to come back down and fill in.... it's not even logical," she told CBC Radio's *Newfoundland Morning*.

"The time to do it is now, not months down the road," she said.

## Humber Arm South

Community leaders south of Trout River have similar concerns with water flow repair and infrastructure after January's floods ripped open roads and destroyed stream culverts.



Two pictures of the Jesso family home, a year apart. Flooding destroyed the property a year ago. Now the house has to be torn down and the land is not fit to rebuild. (Colleen Connors/CBC)

Clarke's Brook in Benoit's Cove could not handle the influx of rainwater and melted snow. Water pushed across streets and the school parking lot, and flooded one home to the roof's eaves.

"Inside is nothing but a disaster," said Daryl Jesso, whose parents lived in the home. "It's covered in mould. It's done."

His parents were able to salvage only a few memories.

"Just a few things up high, a few videotapes years ago, a few memories, dried out some pictures, but that's it," he said.

It's taken almost the entire year since for the Jesso family to settle their claim with the disaster relief fund. The house has to be torn down, and the land is not fit to build on.

The town tried to fix the nearby brook, so more flooding wouldn't take place.

Humber Arm South Mayor Glenn Savard says his town applied for more money than granted from the provincial disaster relief fund. He worries there could be another flood during the next heavy rainfall. (Colleen Connors/CBC )

"We dug out the brook. We put stuff up on the sides," said Mayor Glenn Savard.

"It's going to founder again. It's just a matter of time. We asked for armour stone and stuff but we were denied that."

The province started a disaster financial assistance program in response to the flooding, but the fund could provide money for repair work only to pre-disaster conditions.

"Compensation for damages caused by the recent flooding is based on criteria established by both the federal and provincial disaster financial assistance programs," says a statement from a provincial spokesperson.

"Only costs associated with repairing or restoring the area to pre-disaster conditions are eligible under the Newfoundland and Labrador Disaster Financial Assistance Program."

The statement goes on to say there are provisions in the financial assistance program to allow for a 15 per cent improvement above what was already in place previously.

## Corner Brook

But in bigger areas like the City of Corner Brook, financial assistance from the disaster relief fund came in way under what was expected.

"We applied for a significant amount of money, I think it was around $2 million, and that reconstruction hasn't been completed yet. We ended up getting about a quarter-million, as it turned out," said Mayor Jim Parsons.

Corner Brook declared a state of emergency after roads were washed out and stream levels rose dangerously high.

"We had boulders out in the road," he said. "And we had flooded areas where you could trap additional people at any time," he said.

The smaller chunk of funding will go towards permanently fixing ditches and side roads this coming construction season.

## $2.5 million in grants

The Department of Municipal Affairs and Environment told CBC it received 123 private sector claims for disaster relief funding and paid over $2 million to private sector claims and over $427,000 to municipalities.

The government claims all repair work is complete in six communities on the west coast while 19 other will be completed with repair work to pre-disaster conditions by this year.

***Read more from CBC Newfoundland and Labrador***

CBC

PHOTOS

# A look at the flood, ice damage on Newfoundland's west coast

Homes, roads and other infrastructure have been destroyed

CBC News · Posted: Jan 20, 2018 3:00 PM NT | Last Updated: January 20, 2018

Flooding in Benoit's Cove, one of the hardest hit areas. (Submitted by Kyle Lowe)

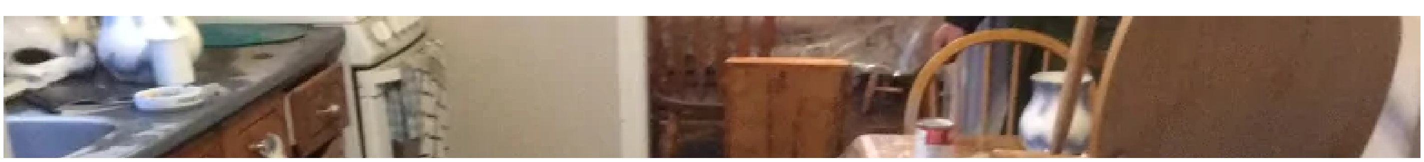
The cleanup continues after heavy rain and fast-melting snow caused massive damage on Newfoundland's west coast last weekend. Over the last few days, new problems emerged due to rising levels of the Humber River, caused by ice jams.

- **'Scary, unreal': 2 families told to leave homes as Deer Lake ice threatens**

- **'I haven't cried this much in a few years:' Western Newfoundland still reeling from weekend flooding**
- **Major damage at Marble Mountain, but staff say some slopes could open this week**
- **Western Newfoundland still cleaning up from flood, request for federal disaster money likely**

Below are some of the most compelling images depicting the fierce weather and the aftermath.

The front step of the Jesso family home in Benoit's Cove (seen also in the photo above) was washed away last Saturday. (Submitted by Kyle Lowe)



It was an emotional day for Wally and Yvonne Jesso as they returned to their Benoit's Cove home, which was engulfed in water during heavy rainfall. (Gary Moore/CBC)

This image shows the extent of the destruction on Route 450 in the Bay of Islands. (N.L. Department of Transportation and Works)

Floodwaters surround homes and other buildings Sunday in Trout River, on Newfoundland's Northern Peninsula. (Twitter/@cormier_keith)

Uprooted mud and earth plunged down the hill into the back of Mildred Hackett's garage in Benoit's Cove. (Coleen Connors/CBC)

That muck and debris actually pushed Hackett's car out through the front door after slamming into her garage. (Coleen Connors/CBC)

A mudslide blocked the main road to and from Woody Point last weekend. (Beverly Burt/Facebook)


More culverts going in the ground on the TCH at Little Rapids. (N.L. Department of Transportation and Works/Twitter)

Robert and Nadine Delaney of Pasadena say the water damage to their basement is extensive. (Submitted by Nadine Delaney)

More damage of the Delaney's basement in Pasadena after a foot of water flooded in. (Submitted by Nadine Delaney)

Water levels in Corner Brook were dangerously high last Saturday, as seen here in Margaret Bowater Park. (Submitted by Cody Avery)

Crews with the province's department of transportation and works do repair work on the Trans-Canada Highway near Little Rapids. (Twitter/@TW_GovNL)

Ground under a section of the Trans-Canada Highway just west of Little Rapids had washed away, leaving the road in danger of collapsing. (Submitted by Sandy Dunphy)

A view underneath a section of washed-out highway near Little Rapids, N.L. (Submitted by Sandy Dunphy)

Deep meltwater covers the road in Halfway Point. (Submitted by Cody Avery)

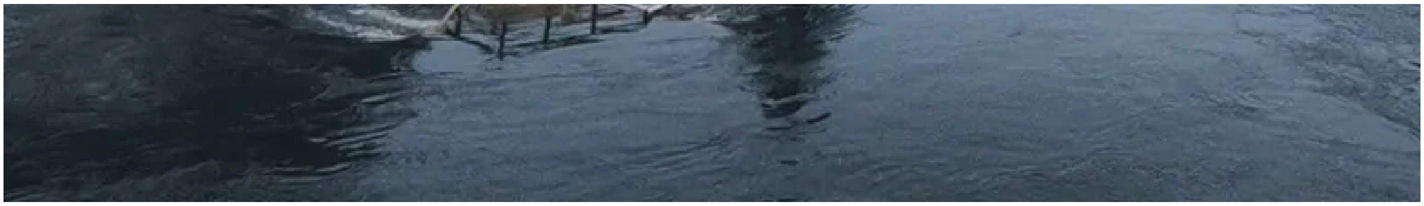
Heavy equipment was called in to keep Jakeman All Grade School in Trout River from sliding into the water. (Submitted by Tina Crocker)

There's not much room for students to walk between Trout River's school and the river itself. (Submitted by Tina Crocker)

Marble Mountain worked quickly to deal with the major damage caused by water and mud. (Twitter/Donnie O'Keefe)

Water and mud made a mess of Marble Mountain Resort last weekend, but some slopes opened Thursday. (Marble Mountain Facebook)

On the weekend, Ethan Brake and his brother were using a rubber dinghy to cross this area in Trout River to get home. On Monday, they were skating on it. (Jeremy Eaton/CBC)



The deck from someone's house or cabin is seen floating in the Humber River near Shellbird Island. Residents living along the Humber reported seeing decks and other items floating down the river Tuesday afternoon and evening. (Brandon Sparkes)

Waters from the swollen Humber River threatened to overtake resident Angie Moss's yard. (Eddy Kennedy/CBC)

Float plane hangers were partially submerged in rising waters of Deer Lake earlier this week. (CBC)

Ice was flowing down the Humber River near the Nicholsville bridge this week, but ice jams became the new concern. (Instagram/@janakendall)

More of the bank slid into the Humber River Thursday, prompting town officials to remind residents to stay alert and be prepared to evacuate if necessary. (John Pike/CBC)

*With files from Colleen Connors*

# Four homes now in jeopardy on Pine Tree Drive in Deer Lake

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 22, 2018 at 11:18 a.m.
**Updated:** Jan 22, 2018 at 11:20 a.m.

The ground beneath this utility pole on Pine Tree Drive in Deer Lake was seriously compromised by the eroding banks of the Humber River this past weekend. - Submitted

The Town of Deer Lake says four homes on Pine Tree Drive are now in jeopardy from the eroding banks of the Humber River.

Late last week, residents of two homes on the road were urged to evacuate because the riverbank near their properties was sliding into the flooded Humber River and getting closer to houses.

During the weekend, more of the sandy earth fell into the water and the town is now confirming four homes are in potential peril.

According to a notice on the town's website, there is now a pole that is falling over because of the erosion. Newfoundland Power was expected to be onsite today to put in new poles on the opposite side of the road.

Town representatives met with residents of Pine Tree Drive Sunday and informed them the town has a volunteer evacuation plan in place.

A public works crew from the town has started putting in a bypass road, using a road reserve to provide residents with an alternative means of getting out of the Pine Tree Drive area.

The town will continue to monitor the situation on a regular basis.

The Canadian Red Cross has been kept up to date and The Emmanuel Pentecostal Church is available in the event an evacuation is ordered.

# Tense times as mild weather set to possibly worsen Humber River erosion issue in Deer Lake

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Jan 23, 2018 at 11 p.m.
**Updated:** Jan 24, 2018 at 9:21 a.m.

Newfoundland Power crews work to connect power lines to a pole that was moved from one side of Pine Tree Drive in Deer Lake to the other after it was compromised due to riverbank erosion. - Photo by Roxanne Ryland

There was a little more erosion of the riverbank along Pine Tree Drive in Deer Lake Tuesday, but the town is really bracing for what might happen today.

Four homes on the street that runs along the Humber River have been on a voluntary evacuation alert this week, with the municipality urging those residents to leave.

The sandy bank began to be eaten away by high water levels and flowing ice after a rain storm that struck western Newfoundland Jan. 13.

**Related stories:**

Homeowners in Deer Lake's volunteer evacuation zone vow to stay until the last minute

Two homes on Pine Tree Drive in Deer Lake urged to evacuate because of riverbank erosion

Mayor Dean Ball says Humber River's eroding banks will continue to be a serious concern for Deer Lake

Riverside homeowners in Deer Lake hope the Humber River recedes before evacuation is ordered

On Tuesday, a crew from Newfoundland Power finished relocating four utility poles from the river side of Pine Tree Drive to the opposite side. One of those poles had been dangling in the foundering sand beneath it.

After Newfoundland Power finished its work, a crew from Aliant was scheduled to move in to relocate its wires to the other side of the road, so the poles on unstable ground could be removed altogether.

Mayor Dean Ball said a little bit more of the riverbank had given way between Monday and Tuesday. He said the town will be dealing with an engineering consultant to assess the situation as it continues to develop.

Today's forecast of mild temperatures and rain could make the situation worse. Ball said he feels further deterioration of the riverbank is inevitable, though it's uncertain when that will be.

The affected residents had still been choosing to remain in their homes, as of deadline Tuesday.

The provincial Department of Municipal Affairs said it has been working with its emergency management partners and the town in preparation for the potential of further erosion.

The department said it will offer assistance where necessary in the event of any emergency situations that might arise.

# Engineers drawing up plan to try and mitigate Deer Lake’s riverbank erosion issues

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Feb 01, 2018 at 8:31 p.m.
**Updated:** Feb 01, 2018 at 9 p.m.

This aerial image taken Jan. 20 shows just how close the cracks in the sandy banks of the Humber River are to the road on Pine Tree Drive in Deer Lake. The stairs and deck to the right of the crack will likely be lost to the river. - Photo courtesy Town of Deer Lake - Submitted

The Humber River has been historically eating away at the banks along Pine Tree Drive for as long as it has been meandering its way through that part of Deer Lake.

The historical erosion is nothing new, really, but the fact a recent rainstorm three weeks ago has caused significant wearing of the banks remains a major cause for concern for the town and the area’s residents.

RELATED:

'Resident relieved riverbank along Pine Tree Drive in Deer Lake survived latest mild spell'

'Tense times as mild weather set to possibly worsen Humber River erosion issue in Deer Lake'

'Homeowners in Deer Lake's volunteer evacuation zone vow to stay until the last minute'

'Two homes on Pine Tree Drive in Deer Lake urged to evacuate because of riverbank erosion'

'Mayor Dean Ball says Humber River's eroding banks will continue to be a serious concern for Deer Lake'

'Riverside homeowners in Deer Lake hope the Humber River recedes before evacuation is ordered'

On Thursday, town officials met with the engineers it has contracted to assess the most recent erosion event, which has put four private homes on the river's edge in jeopardy. Some of those residents have already lost land and some personal property to the river since the Jan. 13 storm.

Mayor Dean Ball said the engineers confirmed the foundering of the sandy riverbank is not going to stop. They will now more closely analyze the situation and produce a report that is expected to suggest ways to possibly slow down the worsening situation.

"It's going to continue and we all knew that, really," said Ball. "All we can do now is continue to monitor it and see what the engineer's report has to say."

The mayor said the possible measures to be taken could include dropping armour stone or sheet pilings in the area along Pine Tree Drive where the bending river flows directly into the banks.

Ball said the situation is truly unfortunate because both private property and municipal infrastructure is at stake. Over time, he said, the river will likely eventually claim the road and inevitably put more properties in the same vicinity at risk.

The latest problems all began when mild temperatures, mixed with heavy rains and significant snowmelt, led to a flooded river that got backed up by an ice jam at the river's mouth further downriver from Pine Tree Drive.

The river often floods in the spring, but this situation during winter is different from any in recent memory.

More mild weather and rain is coming today with temperatures of 5 C and 20 millimetres of rain in the forecast for the Deer Lake area. Around 15 centimetres of snow is expected through the rest of the weekend as temperatures drop back down around -6 or -7 C.

More rain is anticipated Monday when temperatures rise to around 3 C and another 15 millimetres fall before the mercury goes back to below freezing by Tuesday.

Ball said there is not much in the way of preventative measures that can be taken as these mild spells approach.

"We'll be monitoring it, as will the residents," he said. "There's not much else we can do right now."

Residents of the homes considered to be in jeopardy have been urged to voluntarily evacuate, but no one has left their homes just yet.

CBC

# Flooding in Pasadena forces evacuation of 5 residents Saturday

Water levels in Pasadena rose dangerously high Friday night

CBC News · Posted: Feb 03, 2018 1:45 PM NT | Last Updated: February 3, 2018


Pasadena Fire Rescue successfully evacuated five residents of the community Saturday after water levels became dangerously high. (Twitter/Pasadena Fire Rescue)

Five residents of the Maple Place area of Pasadena, on Newfoundland's west coast, were evacuated from their homes Saturday morning due to dangerously high water levels.

Crews with Pasadena Fire Rescue and Newfoundland Power were on the scene early Saturday morning, after heavy rain.

**Pasadena Fire Rescue**
@PasadenaRescue

Avoid Maple Drive, Pasadena. #impassable

2 9:16 AM - Feb 3, 2018

See Pasadena Fire Rescue's other Tweets

By 9:30 a.m., a water rescue team with the volunteer fire department was evacuating five homeowners.

First responders and town employees remained on the scene Saturday afternoon.

# UPDATED: Five residents evacuated safely from flooded Maple Place in Pasadena

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Feb 03, 2018 at 10:23 a.m.
**Updated:** Feb 03, 2018 at 8:42 p.m.


Residents of Maple Place in Pasadena had to be evacuated from their flooded properties by a loader Saturday morning. - Submitted

The cause of the flooding concerns in Pasadena today has been identified as an ice jam in South Brook.

Mayor Gary Bishop and other officials flew over the brook coursing through the heart of the town earlier today to see if they could find out why three homes on Maple Place had to e evacuated Saturday morning.

According to Bishop, an ice jam in a bend in the river has forced the brook to redirect its flow towards Maple Place.

He said a plan is being worked on to break up the jam and get the water flowing back on its regular course towards Deer Lake.

Power has been cut to the three homes because floodwaters are dangerously close to the home's electrical services. With temperatures expected to drop to around -16 C tonight, Bishop hopes the situation can soon be rectified to the point where power can be restored and homes can be warmed up.

He said the town is looking at bringing in generators to pump water out of flooded basements.

The mayor said it will be days before the entire situation is taken care of.

Five residents from the three affected homes Maple Place had to be evacuated in a loader because of the flooding Saturday morning.

The road was inaccessible to regular traffic and Bishop said the current was so strong in the six or seven feet of the floodwater that a boat could not be used for the evacuation.

Bishop said all of the evacuated residents are fine and have found alternate accommodations with family and friends.

A pool of water formed at the lower part of Maple Place was showing no sign of dropping Saturday afternoon.

The flooding on Maple Place has cut through this property at the end of the street.

***********

(Previous story)

Five residents of Maple Place in Pasadena had to be evacuated from their homes because of flooding in the area Saturday morning.

According to social media posts by Pasadena Fire rescue, the evacuation was successful, but first responders and town employees remain on the scene to deal with the situation.

The road, which only has a few houses on it, is near a brook that courses through the middle of town. The brook flooded after Friday's heavy rains and mild temperatures and overflowed onto the road, rendering it impassable by regular traffic.

The town's volunteer fire department deployed its ice water rescue team to conduct the evacuation.

A crew from Newfoundland Power was also on the scene as part of the emergency response.

# Pasadena says it will have to revisit what can be done to prevent future South Brook flooding

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Feb 05, 2018 at 9:48 p.m.
**Updated:** Feb 06, 2018 at 5:13 a.m.

Terry Colson points to a piece of ice stuck to a tree that indicates just how high the floodwaters were on Maple Place in Pasadena this past weekend. - Gary Kean

Terry Colson says something needs to be done about the susceptibility of flooding in South Brook and he might soon get his wish.

Colson is one of the five residents who had to be evacuated from their homes on Maple Place in Pasadena after an ice jam in South Brook redirected water toward the properties.

There are only three homes on Maple Place, a low-lying road situated on the banks of the brook. They were all evacuated, but residents were permitted to return to their homes Sunday after a trench was dug to direct the water back on its normal course toward Deer Lake.

RELATED:

'Pasadena mayor thankful only three homes affected by unexpected flooding'

Colson has lived in the area for about 22 years and has seen flooding there before. He says something should have been done long ago to prevent what happened Saturday.

Debris that had been floating in about five feet of water Saturday sits in the inch or so of water still in Terry Colson's flooded basement Monday morning.

“By rights, it should be dug down and the brook widened out,” Colson said as a generator continued to pump water from his flooded basement Monday morning. “It wouldn't take much to do it, with the machinery they have today.”

The frustration was clear in Colson's voice. Water from the misdirected brook came into his garage early Saturday morning and quickly made its way down a handful of steps and under the door leading to his basement and downstairs rec room.

“When it comes to water, there's not much you can do,” said Colson. “It's going to go where it wants. It's too strong to stop it.”

While there was less than two inches Monday morning, Colson estimated there was around five feet of water in his basement when he and his wife were evacuated Saturday.

The power had to be turned off around 5 a.m. Saturday as the water levels crept toward the house's electrical service. The power was still shut off Monday morning, leaving Colson worried about all the food stored in his freezer.

The couple has been staying with relatives since being displaced.

He said he will have to throw out three chesterfields in his rec room.

“No human being should be going through what we're going through,” he said. “It's hard having to leave your own home. There is nothing worse. No one knows what it's like until you have to go through it.”

Pasadena town manager Brian Hudson said the municipality has contacted all of the affected residents, offering what assistance it can in terms of pumps and generators.

The town held a conference call Monday with officials from the provincial Fire and Emergency Services and water resources divisions of the Department of Municipal Affairs and Environment to discuss water levels and the weather forecast for the coming day or so.

Monday's weather, which was mild with heavy rain and wind, was concerning.

“We are waiting in fear of what might happen today,” Hudson said of the conditions outside.

Heavy equipment was kept stationed close to Maple Place in case it needed to be mobilized again on short notice.

Hudson said there was little that could be done with the several hundred metres of ice damming on South Brook, which extended from the mouth of the brook at Deer Lake back to beyond Maple Place.

He noted the fact the brook is S-shaped as it courses past the Maple Place area makes South Brook susceptible to problematic ice damming.

In terms of the kind of action Colson says should be taken with the brook for a more permanent fix, the town did reinforce the riverbanks about a decade ago with baskets of stone.

Hudson said the town is limited in what it can do because South Brook is considered a licensed salmon river and has some environmental protections because of that.

“The real solution is altering the course of the river,” said Hudson. “That said, the town has applied in the past to do work, but it has been rejected because of environmental concerns.”

Hudson said this latest incident will likely cause the town to have another look at what its options are for addressing South Brook’s flood risk.

“It is something the town will be looking at and following up on in terms of infrastructure plans and the potential for improvements in that area,” he said.

# Woman returns from vacation to property crumbling into Humber River

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Feb 06, 2018 at 8:43 p.m.
**Updated:** Feb 07, 2018 at 6:27 a.m.

Jane Janes surveys the eroding riverbanks in her backyard in Deer lake for the first time Tuesday. - Roxanne Ryland photo

Jane Janes has been back home on Pine Tree Drive since Friday, but she never ventured out to get a good look at the riverbank crumbling around her property until Tuesday.

Janes, whose maiden name is Moss, was born on the Deer Lake street some 76 years ago and has lived there all her life.

Relatives of the Moss family own most of the homes on the street.

RELATED:

'Mayor Dean Ball closely watching erosion issue along Pine Tree Drive in Deer Lake'

'Engineers drawing up plan to try and mitigate Deer Lake's riverbank erosion issues'

Three days before a major rainstorm struck the area Jan. 13 and triggered significant erosion of the banks of the Humber River along Pine Tree Drive, Janes left to visit her daughter's family in Alberta.

While in Alberta, she got daily updates and saw all the photos her daughter, Christine May, was regularly posting on social media. Her level of concern, allayed while being so far removed from it, has been elevated now that she can see what's happening firsthand.

Until Tuesday, she had only peered out at the cracking soil around her property through a window.

So far, the river has claimed two apple trees and her pumpkin patch, along with some windows for her greenhouse. A small decorative lighthouse, frozen stuck in the ground, is precariously close to also being lost.

Stairs leading down to the river are also compromised by the shifting sands.

"I knew land could be reclaimed after a while, but I didn't expect to see all of that," she said after her first venture outside to assess the situation up close.

"It's wicked. It's worse than what I thought it was."

Janes is all too familiar with January thaws. She remembers being awakened in the middle of the night by loud crashes and bangs as sheets of ice clashed with one another on their migration towards Deer Lake during previous mid-winter mild spells.

The chunky pack ice that jammed the mouth of the river last month, causing it to back up and rise so high that the banks began eroding in places, was unlike anything Janes has ever experienced in all her years living on the river.

"This was the worst year yet," she said. "I've never seen it like this before."

Nothing can be done about what's been lost so far. Janes is now concerned about her gazebo and her shed, considering there is a crack between those structures and the edge of the bank.

She doesn't think her house is in jeopardy, but that doesn't mean things won't worsen to the point where an evacuation may be required.

"If the road above us goes, the water and sewer will go too and we will have to evacuate," she acknowledged.

Last week, the erosion was within six or seven feet of municipal infrastructure and Mayor Dean Ball has said further erosion was inevitable.

Monday, another section — this one measuring about six feet wide and nearly 20 feet long — broke off the bank further in the road from where Janes lives.

Ball said the overhang that dropped off wasn't a huge chunk, but was further evidence the erosion activity is continuing and not about to stop any time soon.

The town is waiting to hear back from engineers working on a report about the situation and what can be done to mitigate the progressive faltering of the riverbanks. The options could include dropping armour stone or driving in steel pilings to form a wall to break the impact of the flowing water on the sandy banks.

Janes is hoping nothing else happens until the usual spring thaw and that action can be taken then to provide her neighbourhood with some level of protection from the powerful Humber River's currents.

"It's worrying all right, but I'm not letting it get to me," she said. "We'll wait until the spring and then I might start worrying more than what I'm doing now."

CBC

# Deer Lake embankment disappearing daily after winter flooding

Now that spring is here, more land from the bank on Pine Tree Road has washed into the river.

Colleen Connors · CBC News · Posted: May 03, 2018 3:12 PM NT | Last Updated: May 3, 2018


The embankment has moved another 6 meters or more since the winter months. The bank is washing into the Humber River at an alarming rate. (Colleen Connors/CBC)

January flooding pushed snow and ice along the bank running along the Humber River in Deer Lake, and as spring arrives in the area, more land is quickly being lost.

Several more meters of earth have let go on Pine Tree Road since the winter, and there is a fear so much land will wash away that residents' water and sewer lines will be exposed.

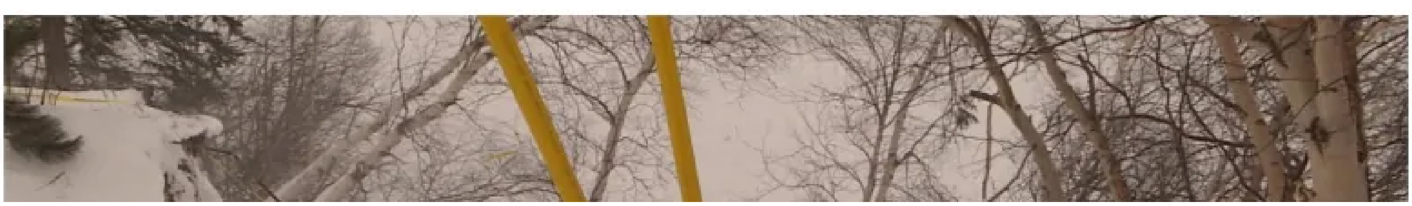

Wade Moss lives on Pine Tree Road and isn't worried his house will fall into the river. He believes the town will find a permanent fix soon. (Colleen Connors/CBC )

Wade Moss and most of his relatives live near the eroding embankment.

## Worse than ever

"We have seen some erosion over the years but not to this extent. It seems because of the flooding we had in January, It's very unusual," Moss said.

"My dad is 82 and he says he's never seen this before."



The Pine Tree Road embankment in January and in May. The bank has washed away another 6 meters. (Colleen Connors/CBC)

Thursday morning, more land cracked and fell into the river behind his father's home, but the river is still about 20 meters from the house. He says people on Pine Tree Road are not worried they will lose their homes.

"The town and the mayor are watching out for us all the time, and we are quite happy with that," he said.

## Millions to fix

Deer Lake Mayor Dean Ball says now that the snow has melted, engineers have looked at the site and fixing the crumbling embankment will cost millions of dollars.

"We want to make sure the money spent is spent well and we are not talking about this again in five or 10 years," Ball said.

"The piece of work has got a lot larger. We were talking four or five hundred feet in February, now we are talking at least triple that."

Mayor Dean Ball is worried the embankment is washing away at a rapid rate and it will cost millions to fix. (Colleen Connors/CBC)

The town has applied for financial help with the province and the federal government. The costlier fix involves steel sheet piling where a large interlocking vertical steel wall will go up along the bank.

Another preventable costly measure would be a large armour stone wall, but that was attempted on parts of Pine Tree Road before and didn't last.

## Permanent, lasting fix

"I'm surprised. This is armour stone that was put in 10 or 15 years ago and this stone, it's big rock and it's 15-20 feet from the river and to see that drop, ya, something underneath there is happening for sure." said Moss.

Water and sewer lines are not yet exposed and still meters underground. But more land is washing into the river daily.

The mayor says the steel sheet wall or armour stone wall will be installed before the fall.

CBC

# Kruger, Deer Lake, province named in flooding class-action suit

CBC News · Posted: May 25, 2015 11:47 AM NT | Last Updated: May 25, 2015

St. John's lawyer Bob Buckingham says the water seepage problem in Deer Lake has been around for almost 100 years. (CBC)

People claiming their properties have been damaged by water seeping from the Deer Lake Power canal are now suing for compensation.

The canal has been feeding water to turbines that generate electricity for Corner Brook Pulp and Paper for decades, but hundreds of people who live near Deer Lake Power say it's also been seeping water into their backyards and basements.

Those affected by the seepage have enlisted the help of lawyer Bob Buckingham to launch a class action suit seeking millions of dollars in damages from Kruger — the company that owns

Corner Brook Pulp and Paper, the town of Deer Lake, and the provincial government.

The Deer Lake Power facility has been providing electricity to Corner Brook Pulp and Paper for over 90 years.

Deer Lake homeowner Richard Dewey has been dealing with the problem for years. In fact, the flooding got so bad he even had to move out and is now renting in nearby Reidville.

"It floods my property 365 days a year, I pretty much have a brook running through my basement," he said.

"I've tried to stop it, but it's an industrial fix that needs to happen here."

Dewey has tried a number of things to stop the water from entering his home, such as digging trenches to attempt to divert the flow — but to no avail.

He has even started to develop allergies he suspects are caused by mould and poor air quality, which eventually led him to move out of his home. After years of trying to get something done, he's decided to seek legal action against the three parties.

"Unfortunately it's come to this," he said. "We couldn't get anything done without Bob [Buckingham] and his team."

"This issue has devastated my life, financially, mentally, it's just been a nightmare."

## Suing all three parties for damages

Meanwhile, Buckingham says decades of neglect on the part of the Town of Deer Lake, Kruger and the province have led to around 350 people being affected by the seepage.

"Rather than sue one, we had to sue them all," he said.

"We had to make sure we had all of the parties at the table in dealing with this."

He said each of the three parties shoulder the blame for the problem, which is why he filed a statement of claim on Monday to seek damages from them.

"Kruger, because they are the cause of the problem; the town, because they've known about it for years and haven't done anything to stop the problem; and finally the province, because they haven't gone out and enforced legislation."

Residents who live near Deer Lake Power say decades of trying to get the seepage problem fixed have been led nowhere. (CBC )

Buckingham said the class action suit, which hasn't been certified yet, will seek tens-of-millions of dollars in damages.

He said he would like to negotiate an out-of-court settlement, but he says he will proceed with litigation if it's necessary.

"Hopefully we will be successful in this, the water will be diverted, the houses will be reclaimed and people won't have to clean out their houses every year," he said.

"People need to have their homes."

# Deer Lake still waiting on cost to address erosion along banks of Humber River

Diane Crocker (diane.crocker@thewesternstar.com)
**Published:** May 29, 2018 at 11:24 p.m.
**Updated:** May 29, 2018 at 11:30 p.m.

Photo by Christine May The Town of Deer Lake continues to wait to find out the costs of work to address erosion along the banks of the Humber River. - Submitted

There’s been little change in the situation along the banks of the Humber River in Deer Lake over the past couple of weeks.

Still, Mayor Dean Ball said Tuesday that the town remains on watch, especially when there is any amount of rain in the forecast.

Ball said he spoke with the engineers the town has enlisted to find a solution for the erosion along riverbank in the area of Pine Tree Drive and Riverbank Road on Monday and their work is still in the qualifying stages.

**Related stories:**

It could be a month before Deer Lake can begin to address erosion along banks of the Humber River

Deer Lake getting better idea of seriousness of Humber River erosion problems

"(They're) getting the numbers put together on the costs associated in repairing Pine Tree and Riverbank."

Ball said they are getting close, "But there's no new news as regards to it's going to be a week or it's going to be 10 weeks, really."

Erosion along the riverbank started to become an issue after a major rainstorm in mid-January.

Chunks of the sandy bank have fallen into the river taking with them large trees, other vegetation and some private property. Cracks in the soil are also close to some of the town's underground infrastructure.

Options being looked at to prevent further erosion include depositing armour stone in the area most susceptible to the force of the river or placing steel pilings into the riverbank to deflect the flowing current.

The final decision will depend on the costs.

While the town has to wait to deal with the issue, it is moving forward with the development of an app that will enable it to inform residents of emergency situations or other events, like water outages and road closures, that may affect them.

"So, we will have direct contact with all our residents in Deer Lake that have cellphones," said Ball.

The app is in response to the situation created by the flooding and is being created by AppAds Promotions in Bay Roberts.

Ball said council approved spending $3,500 for the app at its meeting on Monday night.

The cost includes training.

**Other Deer Lake council news**

The town is ready to go to tender on water, sewer and street upgrades for Fourth Avenue.

Rodney's Contracting has been awarded a tender for just over $11,000 for cleanup of the beach. The contractor will rake the beach and cleanup any brush and debris that's been washed up there during the storms in January and February and from the spring melt.

Upland Planning and Design Studio out of Nova Scotia has been enlisted to produce a business plan for the beach area of the town. The plan will take in the beach, Schwartz Park and area known as Joe Butt's property that the town is in the process of purchasing. The land could be the site of a farmer's market, a location for the town's municipal Christmas tree and overflow parking for the beach. The plan will cost around $10,000.

# Province has provided western Newfoundland with nearly $2 million in assistance for January flooding issues

Gary Kean (gary.kean@thewesternstar.com)
**Published:** Sep 03, 2018 at 11:28 p.m.
**Updated:** Sep 03, 2018 at 11:30 p.m.

Photo by Christine May Eroding riverbanks in Deer Lake is one of the aftereffects of the major flooding in western Newfoundland last January. - Star file photo

There have been many stories through 2018 about the ongoing impacts of the major flooding that affected much of western Newfoundland last January.

There have been stories of public infrastructure, such as highways and municipal roads being washed out, eroding riverbanks threatening both private and municipal property in Deer Lake and flooding and associated damage to private properties.

**Related stories:**

Rocky Harbour's John Grant wants his flooded home back

Rocky Harbour Deputy Mayor Frank Piercey says town not liable for resident John Grant's flooding issues

Corner Brook declares state of emergency because of flooding

Humber Arm South's deputy mayor had to evacuate parents from flooded home

Last week, The Western Star published a story about John Grant of Rocky Harbour and the frustrations he's had getting assistance to repair flood damage to his home. Grant has blamed some of the damages to his property on a failure of municipal infrastructure, though the town has said it isn't liable.

In its budget this past spring, the provincial government allocated $6.55 million for the west coast flood event. According to the Department of Municipal Affairs and Environment, it has received 123 private sector claims and 15 municipal claims requesting assistance pertaining to flood-related damages.

Through the Newfoundland and Labrador-Disaster Financial Assistance Program to date, the provincial government has paid out more than $1.5 million to private sector claimants and roughly $350,000 to municipalities.

Here is a breakdown of funding provided to communities under the Newfoundland and Labrador-Disaster Financial Assistance Program for flooding in western Newfoundland, as of Aug. 31:

- York Harbour: $41,236.72 (Municipal road infrastructure)

- Benoit's Cove: $100,280.96 (Municipal road infrastructure, sewer infrastructure)

- Irishtown-Summerside: $15,845.98 (Municipal road infrastructure)

- Trout River: $5,372.75 (Municipal road infrastructure, water supply infrastructure, community boardwalk)

- Deer Lake: $9,385.74 (Engineering consultant assessment)

- Mount Moriah: $1,554.04 (Municipal road infrastructure)

- Glenburnie-Birchy Head-Shoal Brook: $39,988.47 (Stream dredging/debris removal)

- Lark Harbour: $16,665.32 (Municipal road infrastructure, water supply infrastructure)

- Rocky Harbour: $8,029.51 (Municipal road infrastructure)

- Woody Point: $48,551.23 (Municipal road infrastructure, water supply infrastructure)

- Corner Brook: $66,192.82 (Municipal road infrastructure, storm sewer infrastructure)

**The following communities have claims under the program, but still have work outstanding and no funds have been provided under the program to date:**

- Meadows (water supply infrastructure)

- Stephenville (municipal road infrastructure, water and sewer infrastructure, dredging);

- Reidville (walking trail system)

- Gallants (water supply infrastructure)

*Source: Department of Municipal Affairs and Environment*

# Town of Deer Lake plans to backfill eroded sections of Humber River banks

The Western Star
**Published:** Oct 23, 2018 at 12:03 a.m.
**Updated:** Oct 23, 2018 at 12:05 a.m.

The Town of Deer Lake is taking steps to help stem the erosion of parts of the Humber River bank. - Star file photo

The long-awaited fix to address some of the riverbank erosion issues in Deer Lake should happen soon and it isn't expected to be as expensive as originally thought.

Access to Pine Tree Drive is still restricted to local traffic only. It's been that way since shortly after a major rainstorm and snowmelt event in mid-January caused significant erosion of the sandy banks of the Humber River, along which the road courses.

The Town of Deer Lake had been thinking it would need to carry out repairs that would cost millions of dollars. The most likely option that had been discussed was to drive steel sheet pilings deep into the riverbank to stabilize it and mitigate any further erosion from the flowing river.

**Related stories:**

Deer Lake still waiting on cost to address erosion along banks of Humber River

It could be a month before Deer Lake can begin to address erosion along banks of the Humber River

Engineers drawing up plan to try and mitigate Deer Lake's riverbank erosion issues

Woman returns from vacation to property crumbling into Humber River

Now, according to Mayor Dean Ball, the plan is to place armour stone into the areas where the bank shifted, then backfill and reshape the remediated banks.

"It's still a fairly good chunk of work, but it won't be up in the millions like we were talking before," Ball said Monday.

In fact, this is essentially the same approach taken on Pine Tree Drive during a similar erosion event there nearly two decades ago.

The town had hired an engineering firm to look into the options available to address the issue. On Monday, about half a dozen local contractors were on-site with the engineering firm to walk through the affected areas and to see who was interested in bidding on the work.

Because it is still considered an emergency situation, the town won't have to award the contract for the work at a public meeting. Ball said the contractor will likely be chosen later this week.

The plan is to get the work done as soon as possible this fall.

The erosion along Pine Tree Drive not only ate away at several private properties along the riverbank, but jeopardized some public water and sewer infrastructure below the road.

Ball hopes this fix will protect properties owned by residents and the town.

"You put your faith in those people to do what needs to be done," he said of the engineers and contactors. "We're adamant we want this done and done right."

Pine Tree Drive wasn't the only road in Deer Lake affected by the rising Humber River as a result of the storm in January. Riverbank Road, which saw sections drop after being undermined by the water, is also in need of repairs, but is not included in the contract to be worked out this week.

# Flooding

**Date**: January 11-19, 1983

**Location**: Central, southern, and western Newfoundland

**Easting**:

**Northing**:

**Fatalities**:

**Injuries**: 0

**Source**: Environment Canada. Flood Events in Canada, 1983-1987. Water Planning and Management Branch, Inland Waters Directorate. October, 1988.

Central, southern, and western Newfoundland; January 11 to 19, 1983; due to mild temperatures and excessive rainfall from a major winter storm, homes and highways were damaged along the Exploits and Gander Rivers (central), the Conne River (southern), and in Stephenville (west coast). The flood occurred after 189 mm of rain fell within a 36-hour period, destroying several homes, businesses and other infrastructure worth approximately $4 million; several homes, two railway cars and a local club were washed away; approximately 500 people were evacuated; numerous washouts along many central highways forced travellers to seek refuge; no loss of life or personal injury was reported. Flooding in the Exploits and Gander River basins resulted in partial damage to the dam and power house in Bishop Falls on the Exploits River. Total damages were estimated at $34 million.

Last Updated: November 17, 2010

# Flooding

**Date**: Jan, Aug 1983

**Location**: Stephenville

**Easting**:

**Northing**:

**Latitude**: 48° 33' 00" N

**Longitude**: 58° 35' 00" W

**Fatalities**:

**Injuries**:

**Source**: Stephenville Flood Information map, Department of the Environment, Water Resources Divsion

Two serious floods occurred in the Stephenville area in 1983. In January heavy rains combined with snow melt caused Blanche Brook and Warm Creek to burst their banks.

In August, 3 days of heavy rainfall resulted in flooding described as the worst in the town's history. $100,000 of damage was reported.

Last Updated: November 17, 2010

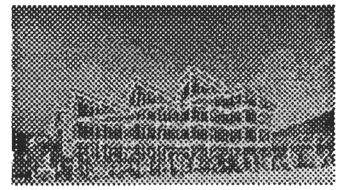
 http://www.theteleg.../et/et.exe/20765-In

**News**

The Telegram

For Tuesday, January 26, 1999

# Records set, facilities damaged as west coast swamped 1/26/99



Marble Mountain

The Western Star-Corner Brook

The rain's gone away and, hopefully, it won't be back for at least 40 more days.

Fortunately, the three outdoor venues to be used for the 1999 Canada Winter Games fared well in the record-setting rainfall that drenched the west coast Sunday. While that's not to say there was no damage done to the venues, precautionary measures taken in anticipation of such drastic weather changes so close to the Feb. 20 opening ceremonies proved very effective.

According to Frank Humber, sport and operations manager with the Games' Host Society, the most damage was sustained at the wide-open shooting range for biathlon, located at the Blow-Me-Down Cross-Country Ski Club, which lost a lot of snow.

The trails that will host the ski portion of biathlon and the cross-country ski event itself survived the rainy deluge in much better shape, although the ski park did close for two days because of weather conditions.

"You're talking pretty high altitudes up there and we don't anticipate any problem getting back to where we need to be," said Humber. "The trails themselves for both biathlon and cross-country are fine because the club is grooming and packing them on a regular basis, but we are going to need Mother Nature's co-operation on the biathlon shooting range."

The most vulnerable venue is the Pasadena Oval, which is scheduled to host a test event for long-track speedskating this coming weekend. After visiting the site Monday morning, Humber said he is confident plans for the only untested sport of the 21 events in the Canada Winter Games still will go ahead this weekend.

"It didn't hit us too bad actually," said Humber of the newly-constructed oval. "Obviously, you don't have two days with 10- to 12-degree temperatures and pouring rain without it doing some damage but, fortunately, the plans the contractor had and the research that he's done in terms of how you build an oval is built in preventative measures to deal with situations like that."

Humber noted the oval is built about three metres wider than it actually needs to be so that, during a mild spell, ice melts from the outside and inside edges.

"We're still well within the limits for long-track," noted Humber. "Our focus is still on hosting a long-track speedskating event this weekend."

The 400-metre oval has somewhere between four and six inches of base ice down and, beginning today, ice-makers hope to make the final inch or so of finish ice with the old Zamboni machine that once resurfaced Humber Gardens in Corner Brook.

Humber added he has received assurance from Marble Mountain operations manager Gary McWaters not to panic with regard to the freestyle and alpine skiing sites at the hill.

"Gary called me (Monday) morning and said there certainly is no reason for worrying," said Humber. "The long-range forecast over the next few days says it's supposed to be really cold, so they'll be whacking the snowguns to the slopes at Marble and he doesn't anticipate any problems.

"You can see the edge of the freestyle area but there's been snow stockpiled there. We can't stand many more hits like this, but the precautions we put in place with respect to making snow, making ice properly and grooming properly help keep what we do have as long as possible."

http://www.theteleg.../et/et.exe/20765-In

Tex Seaborn, vice-chair and V-P Sport with the Host Society, said there are no contingency plans as such in place for the outdoor Games sports. He said there is no reason why, even under the worst circumstances, Marble Mountain and the cross-country ski park wouldn't be viable venues in three weeks time. He added that should mild weather prevail and proper ice cannot be made at the oval, that worst-case scenario could force that event's cancellation. Meanwhile, Sunday's rainy weather contributed to new rainfall and temperature records in Stephenville.

Officials with Environment Canada reported a total of 19.6 millimetres of rain fell on the town, while the temperature soared to a balmy 9.1 C. Those figures beat records for rain, 15.9 mm, and high temperatures, 8.3 C, that were set in 1987 and 1963 respectively.

There was flooding reported in Noel's Pond and the town of Port au Port East as well. A backup of ice at the bridge in Noel's Pond diverted water into fields and across the highway that runs through the community. A Department of Works, Services and Transportation excavator cleared ice from the bridge Monday morning and the road was opened later in the afternoon. There was some damage to the road's shoulder and flooding reported in some area cottages but nothing more serious than that was reported.

Flooding in Port au Port East was not severe enough to disrupt traffic flow.

A whopping 40.4 mm of rain fell on Deer Lake that same day, but officials with Canada's weather watching agency couldn't confirm if that was a new record. Town workers were busy checking for drainage problems and monitoring stream water levels, but there was no serious damage reported. However, Route 430 of the TCH from Deer Lake to Wiltondale wasn't as fortunate.

The Department of Works, Services and Transportation battled blocked culverts and flooded ditches. A portion of the highway shoulder near Bonne Bay Pond had about 30 metres washed away and dropped off by about 10 feet.

Don Matthews, regional engineer, says the department is beginning repairs to the section today.

Both the RCMP and the RNC reported no major accidents because of the downpour, but there were some dangerous spots on western Newfoundland roadways that kept officials with the department busy.

Near the Steady Brook sewage lagoon, a culvert got blocked with debris early Monday morning ,forcing water onto the Trans-Canada Highway. From Deer Lake to Wiltondale the department was warning motorists to be wary of water accumulation on the road, and there was damaged guide rails in the Spruce Hills area, and road shoulders suffered erosion damage near Lomond.

Other parts of the TCH east of Deer Lake to Birchy Narrows also experienced water buildup, however, damage was not as extensive.

# Other Articles:

National News From Canada.Com International News From Canada.Com

Environment Canada Atlantic Region Environnement Canada Région de l'Atlantique

# Current Weather for DEER LAKE

Your Window on the Weather

Weather
Text Only
Canadian Hurricane Centre
Atmospheric Sciences
Climate
N.B. Smog Forecast
Weather Guru
Commercial Services
Who We Are
Aviation Weather

Time of Observation: Tue Jan 26 02:30 PM 1999 NST
Cloud Cover: cloudy
Visibility: 12.0 miles
Weather: snow shower.
Temperature: -6.0 'C
Humidity: 62 %
Wind: W 15 Km/hr
Pressure: 101.14 KPa
Pressure (inches of mercury): 29.86

Yesterday's Maximum Temperature: -6.1 'C
Yesterday's Minimum Temperature: -8.7 'C
24 Hour Precipitation Amount: 5 (mm)

Today's Normal High Temperature: -2.5 'C
Today's Normal Low Temperature: -10.9 'C
Today's High Temperature Record: 14.0 'C
Today's Low Temperature Record: -31.1 'C

Sunrise: 7:57 NST
Sunset: 17:06 NST

Home | What's New | Weather | Climate | Pollution | Wildlife | Conserving Nature | Issues | Links

Search Query: Canada

*Send comments to the Internet Communications Officer.*

Environment Canada Atlantic Region Environnement Canada Région de l'Atlantique

Your Window on the Weather

# Current Weather for GANDER

Weather

Text Only

Canadian Hurricane Centre

Atmospheric Sciences

Climate

N.B. Smog Forecast

Weather Guru

Commercial Services

Who We Are

Aviation Weather

Time of Observation: Tue Jan 26 02:30 PM 1999 NST
Cloud Cover: cloudy
Visibility: 20.0 miles
Weather: none
Temperature: -6.0 'C
Humidity: 58 %
Wind: WNW 31 Km/hr
Pressure: 100.89 KPa
Pressure (inches of mercury): 29.77

Yesterday's Maximum Temperature: -4.6 'C
Yesterday's Minimum Temperature: -6.8 'C
24 Hour Precipitation Amount: < 2 mm

Today's Normal High Temperature: -2.0 'C
Today's Normal Low Temperature: -10.5 'C
Today's High Temperature Record: 10.0 'C
Today's Low Temperature Record: -22.8 'C

Sunrise: 7:45 NST
Sunset: 16:56 NST

Home | What's New | Weather | Climate | Pollution | Wildlife | Conserving Nature | Issues | Links

Search Query: Canada

*Send comments to the Internet Communications Officer.*

Environment Canada Atlantic Region | Environnement Canada Région de l'Atlantique

Your Window on the Weather

# Current Weather for PORT AUX BASQUES

Weather

Text Only

Canadian Hurricane Centre

Atmospheric Sciences

Climate

N.B. Smog Forecast

Weather Guru

Commercial Services

Who We Are

Aviation Weather

Time of Observation: Tue Jan 26 02:40 PM 1999 NST
Weather: snow.
Temperature: -7.0 'C
Humidity: 67 %
Wind: WNW 31 Km/hr
Pressure (inches of mercury): 29.90

Yesterday's Maximum Temperature: -4.9 'C
Yesterday's Minimum Temperature: -7.7 'C
24 Hour Precipitation Amount: 0 (mm)

Today's Normal High Temperature: -2.5 'C
Today's Normal Low Temperature: -9.1 'C
Today's High Temperature Record: 6.1 'C
Today's Low Temperature Record: -22.0 'C

Sunrise: 7:59 NST
Sunset: 17:19 NST

Home | What's New | Weather | Climate | Pollution | Wildlife | Conserving Nature | Issues | Links

Search Query: Canada

*Send comments to the Internet Communications Officer.*

Environment Canada Atlantic Region | Environnement Canada Région de l'Atlantique

Your Window on the Weather

# Current Weather for STEPHENVILLE

Weather

Text Only

Canadian Hurricane Centre

Atmospheric Sciences

Climate

N.B. Smog Forecast

Weather Guru

Commercial Services

Who We Are

Aviation Weather

Time of Observation: Tue Jan 26 02:30 PM 1999 NST
Cloud Cover: overcast
Visibility: 4.0 miles
Weather: snow.
Temperature: -7.0 'C
Humidity: 73 %
Wind: W 22 Km/hr
Pressure: 101.18 KPa
Pressure (inches of mercury): 29.87

Yesterday's Maximum Temperature: -5.9 'C
Yesterday's Minimum Temperature: -7.9 'C
24 Hour Precipitation Amount: 1 (mm)

Today's Normal High Temperature: -1.3 'C
Today's Normal Low Temperature: -8.6 'C
Today's High Temperature Record: 9.1 'C
Today's Low Temperature Record: -22.4 'C

Sunrise: 8:00 NST
Sunset: 17:13 NST

Home | What's New | Weather | Climate | Pollution | Wildlife | Conserving Nature | Issues | Links

Search Query: Canada

*Send comments to the Internet Communications Officer.*

Environment Canada Atlantic Region
Environnement Canada Région de l'Atlantique

Your Window on the Weather

# Current Weather for ST.JOHNS

Weather
Text Only
Canadian Hurricane Centre
Atmospheric Sciences
Climate
N.B. Smog Forecast
Weather Guru
Commercial Services
Who We Are
Aviation Weather

Time of Observation: Tue Jan 26 02:30 PM 1999 NST
Cloud Cover: cloudy
Visibility: 15.0 miles
Weather: none
Temperature: -3.0 'C
Humidity: 58 %
Wind: WNW 20 Km/hr
Pressure: 100.93 KPa
Pressure (inches of mercury): 29.78

Yesterday's Maximum Temperature: -1.8 'C
Yesterday's Minimum Temperature: -3.8 'C
24 Hour Precipitation Amount: 0 (mm)

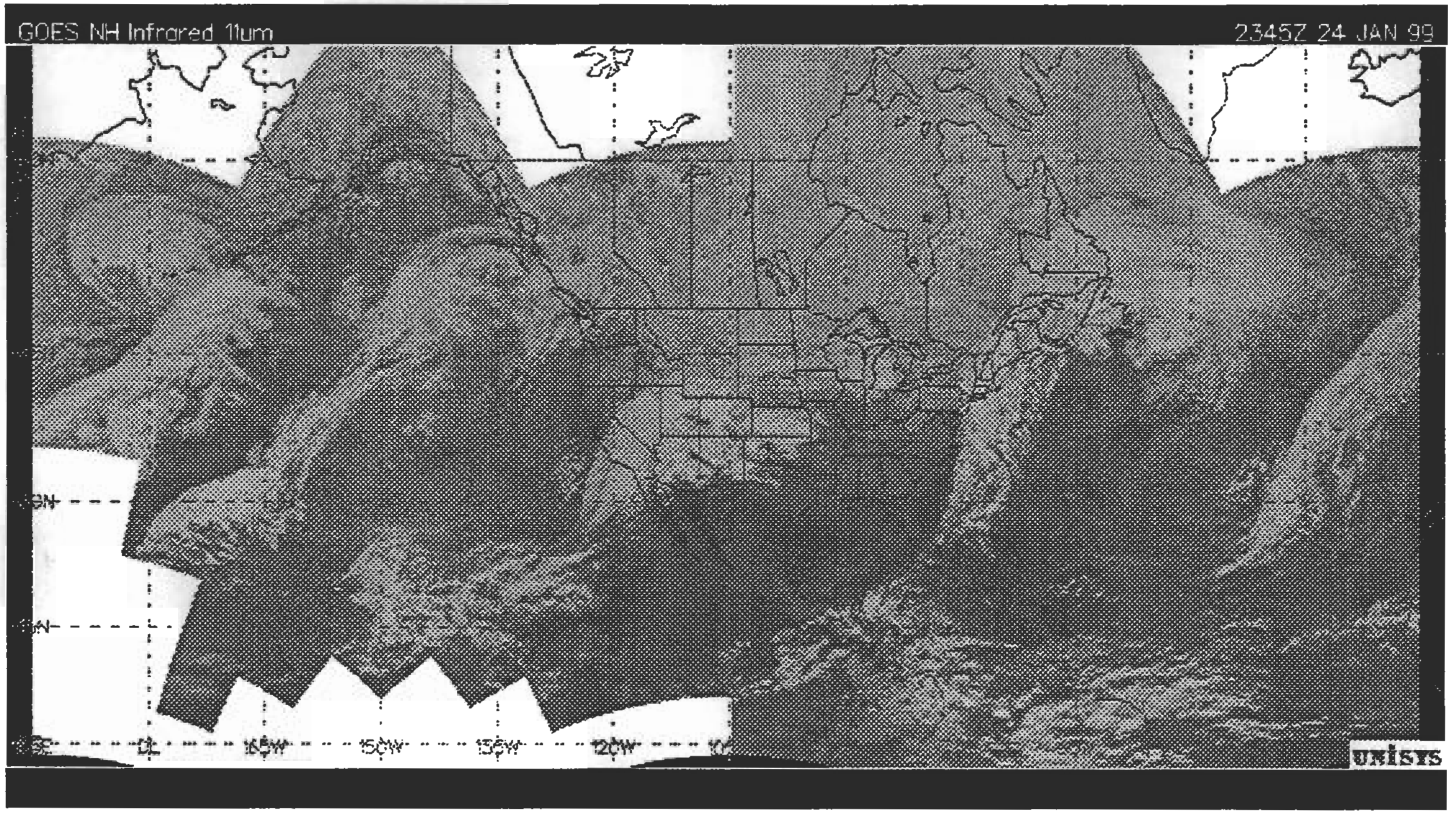
Today's Normal High Temperature: -0.6 'C
Today's Normal Low Temperature: -7.9 'C
Today's High Temperature Record: 13.1 'C
Today's Low Temperature Record: -18.3 'C

Sunrise: 7:34 NST
Sunset: 16:53 NST

Home | What's New | Weather | Climate | Pollution | Wildlife | Conserving Nature | Issues | Links

Search Query: Canada

*Send comments to the Internet Communications Officer.*


GOES NH Infrared 11um
2345Z 24 JAN 99
165W
150W
135W
120W
UNISYS

| | | Maximum | Minimum | Rain | Snow | Snow on ground |
|---|---|---|---|---|---|---|
| 24th Jan. 99 | Stephenville........ | 9.1c | -5.7c | 19.6mm | 0.4cm | 15cm |
| 25th Jan. 99 | " | 6.6c | -6.0c | 16.0mm | 0.4cm | 10cm |
| 26th Jan. 99 | " | -4.6c | -9.4c | nil | 1.2cm | 10cm |
| 24th Jan. 99 | Deer Lake........... | 9.0c | -10.6c | 37.8mm | 5.6cm | 11cm |
| 25th Jan. 99 | " | 9.8c | -6.1c | 4.8mm | 2.0cm | 11cm |
| 26th Jan. 99 | " | -5.9c | -8.7c | nil | 4.2cm | 11cm |
| 24th Jan. 99 | Corner Brook....... | 14.0c | -8.3c | 27.4mm | 6.3cm | n/a |
| 25th Jan. 99 | " | 13.1c | -5.1c | 16.0mm | nil | n/a |
| 26th Jan. 99 | " | -5.0c | -9.1c | nil | 0.7cm | n/a |

Steady Bk ~~sewage lagoon~~ - flooded TCH
culvert blocked
TCH Deer Lake to Birchy Narrows - minor shoulder erosion

27 JAN 99

FLOOD LOCATIONS

| | Damage | Cause |
|---|---|---|
| - Noels Pond @ bridge | | |
| - Port au Port East | - road shoulder flooding cottages. | ice |
| - Route 430 near Bonne Bay Pond (Deer Lake - Wiltondale Hwy) | - 30m shoulder severe erosion | blocked culvert flooded ditch |
| - ~~Steady Bk sewage lagoon~~ | | |
| ~~[illegible]~~ Lomond | road shoulder | ~~blocked culvert~~ ? |

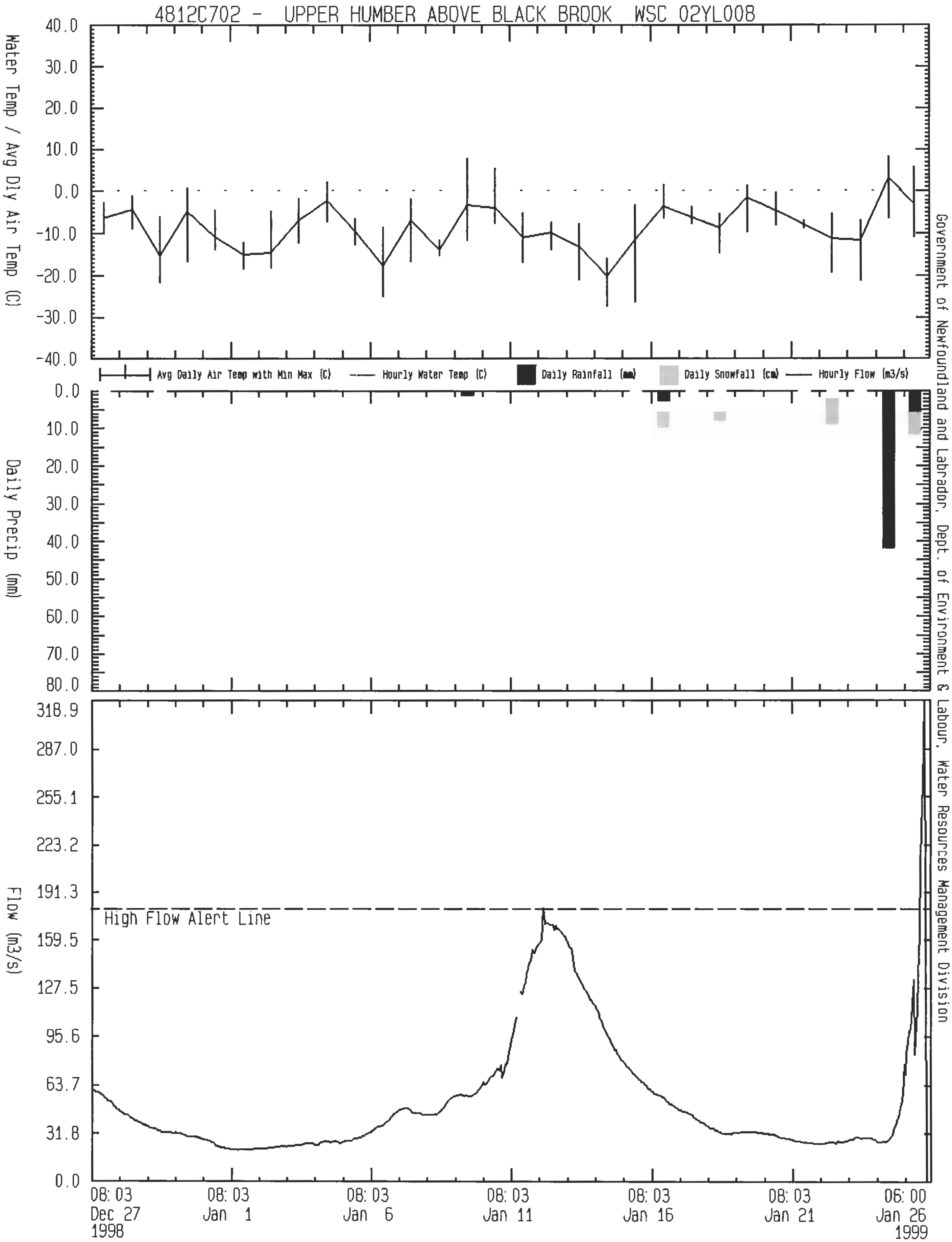
Met Stats

JAN 25/99

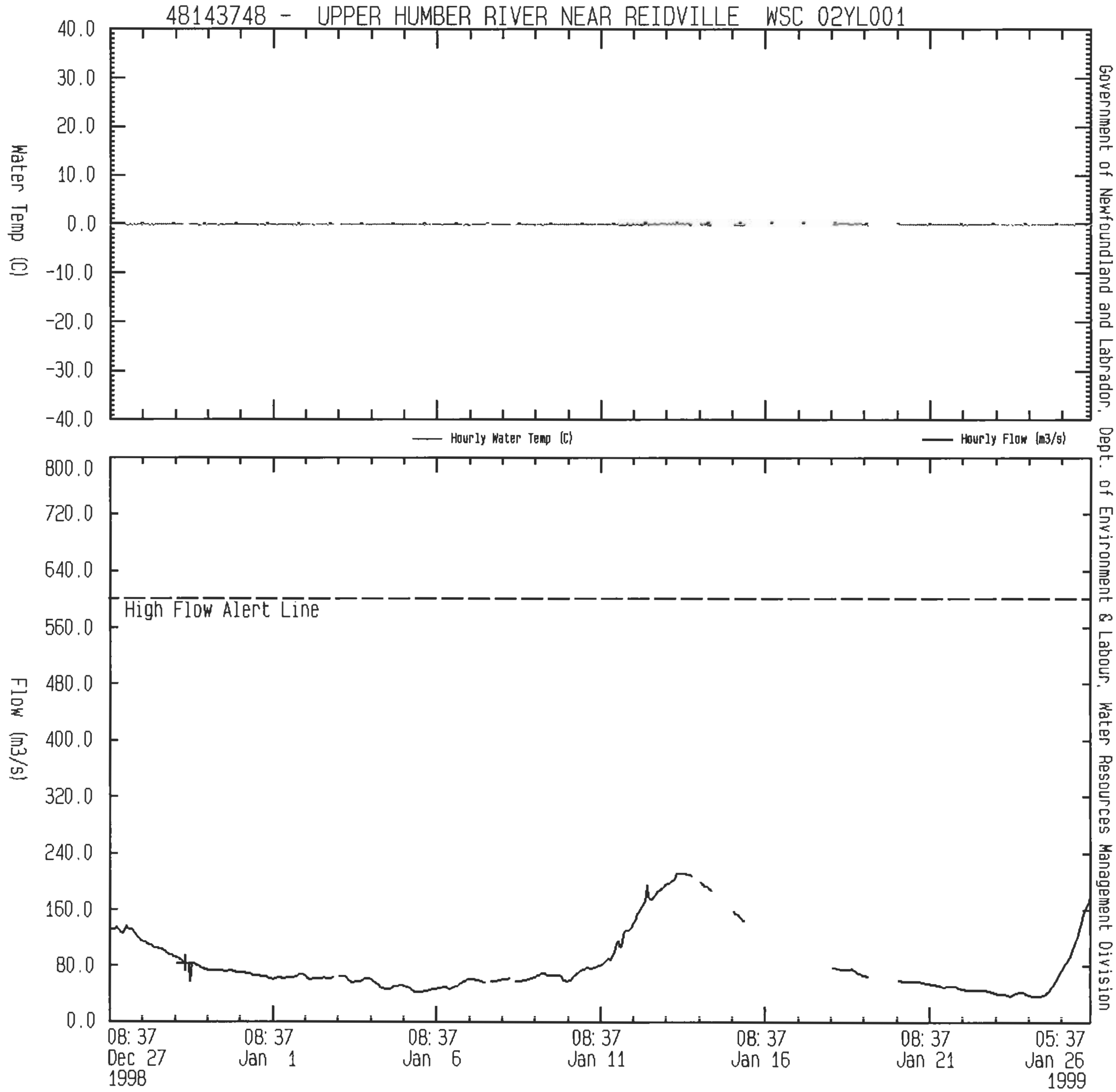
| | |
|---|---|
| Stephenville | 19.6 mm rain<br>9.1°C max temp. |
| Deer Lake | 40.4 mm |

Other

Town Deer Lake ~~[illegible]~~ works staff out & about clearing culverts etc.

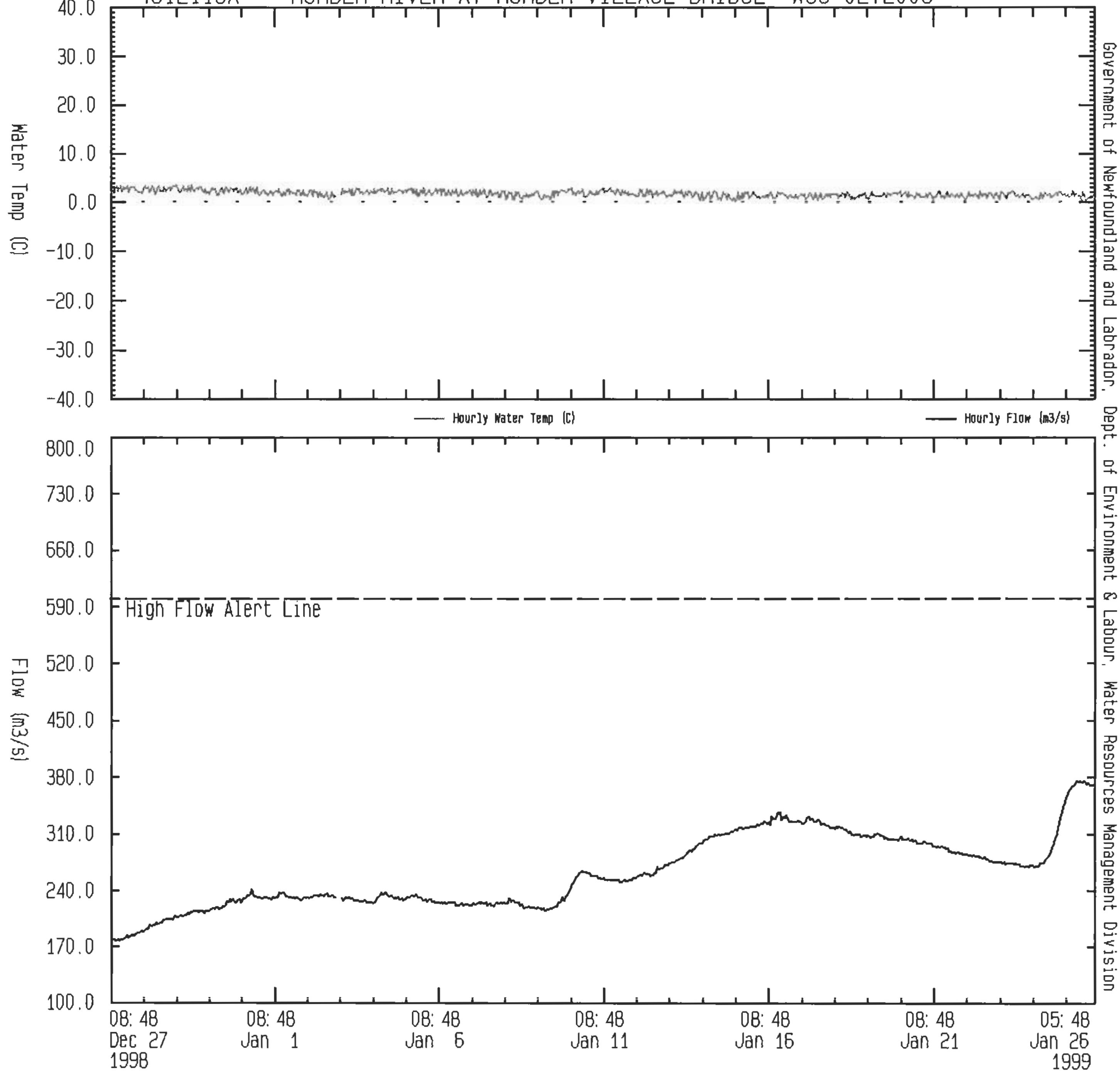


4812C702 - UPPER HUMBER ABOVE BLACK BROOK WSC 02YL008
Water Temp / Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Hourly Water Temp (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Hourly Flow (m3/s)
Daily Precip (mm)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Flow (m3/s)
318.9
287.0
255.1
223.2
191.3
159.5
127.5
95.6
63.7
31.8
0.0
High Flow Alert Line
08:03 Dec 27 1998
08:03 Jan 1
08:03 Jan 6
08:03 Jan 11
08:03 Jan 16
08:03 Jan 21
06:00 Jan 26 1999
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division

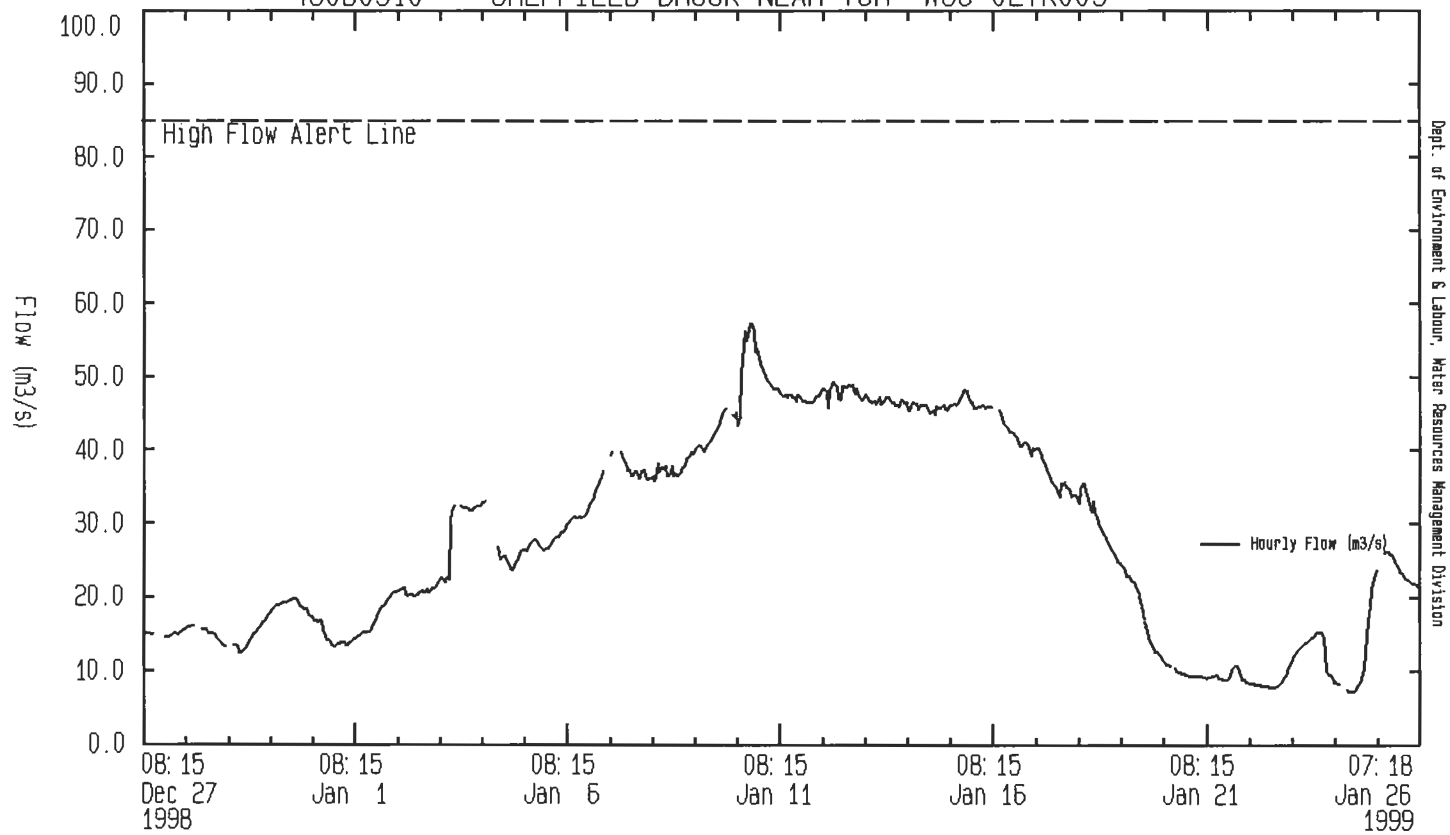


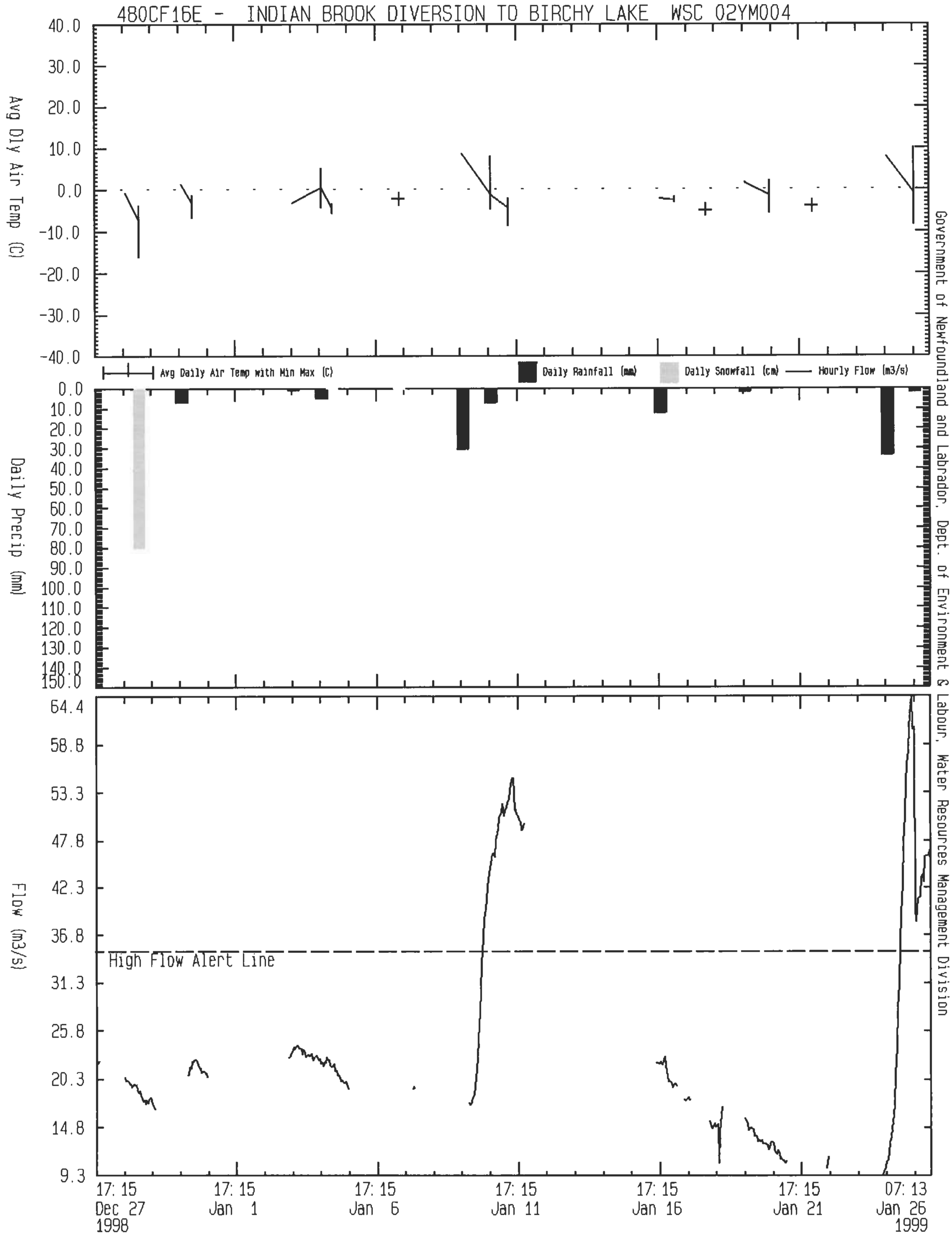
48143748 - UPPER HUMBER RIVER NEAR REIDVILLE WSC 02YL001
Water Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Hourly Water Temp (C)
Hourly Flow (m3/s)
Flow (m3/s)
800.0
720.0
640.0
560.0
480.0
400.0
320.0
240.0
160.0
80.0
0.0
High Flow Alert Line
08:37 Dec 27 1998
08:37 Jan 1
08:37 Jan 6
08:37 Jan 11
08:37 Jan 16
08:37 Jan 21
05:37 Jan 26 1999
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division

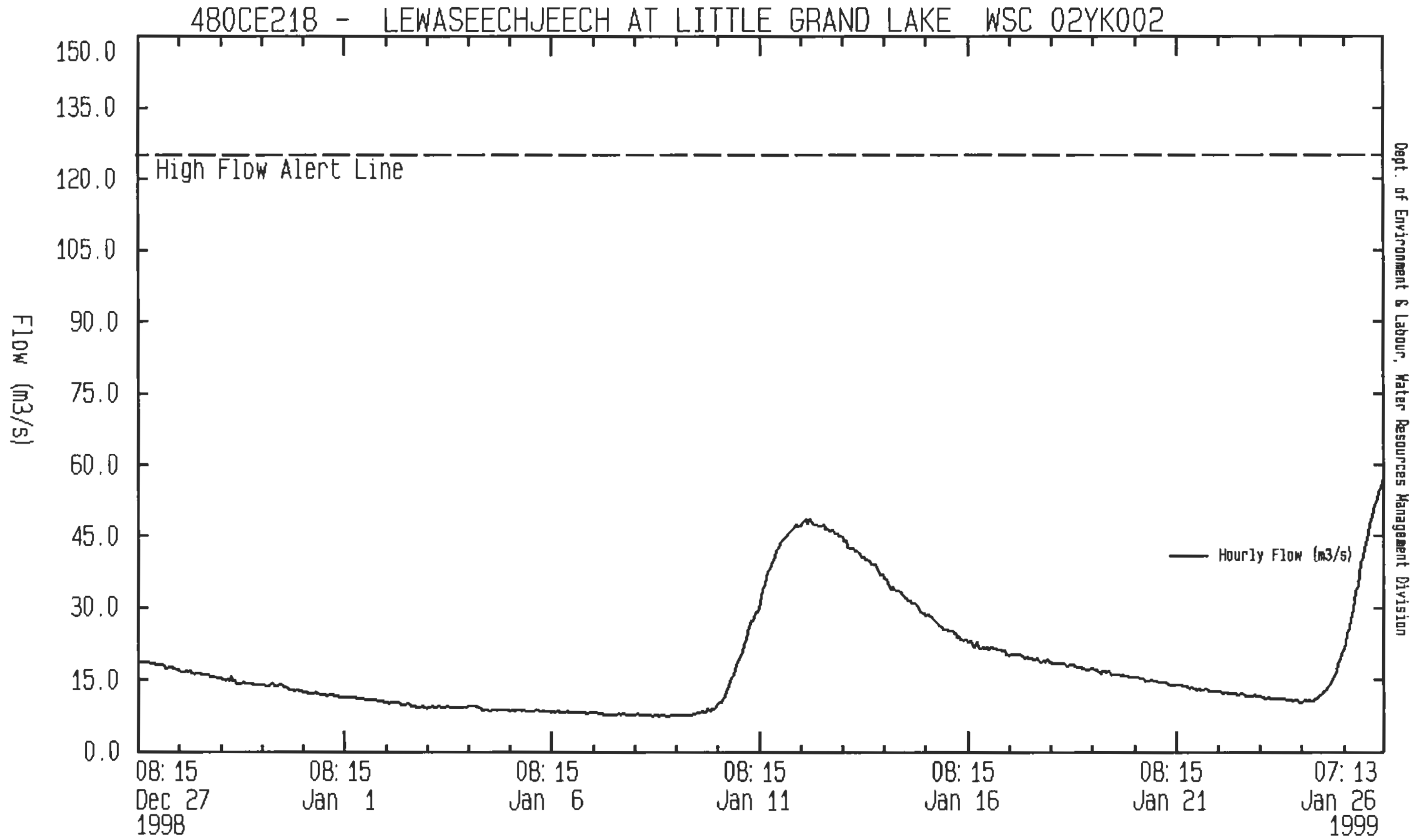
4812116A - HUMBER RIVER AT HUMBER VILLAGE BRIDGE WSC 02YL003

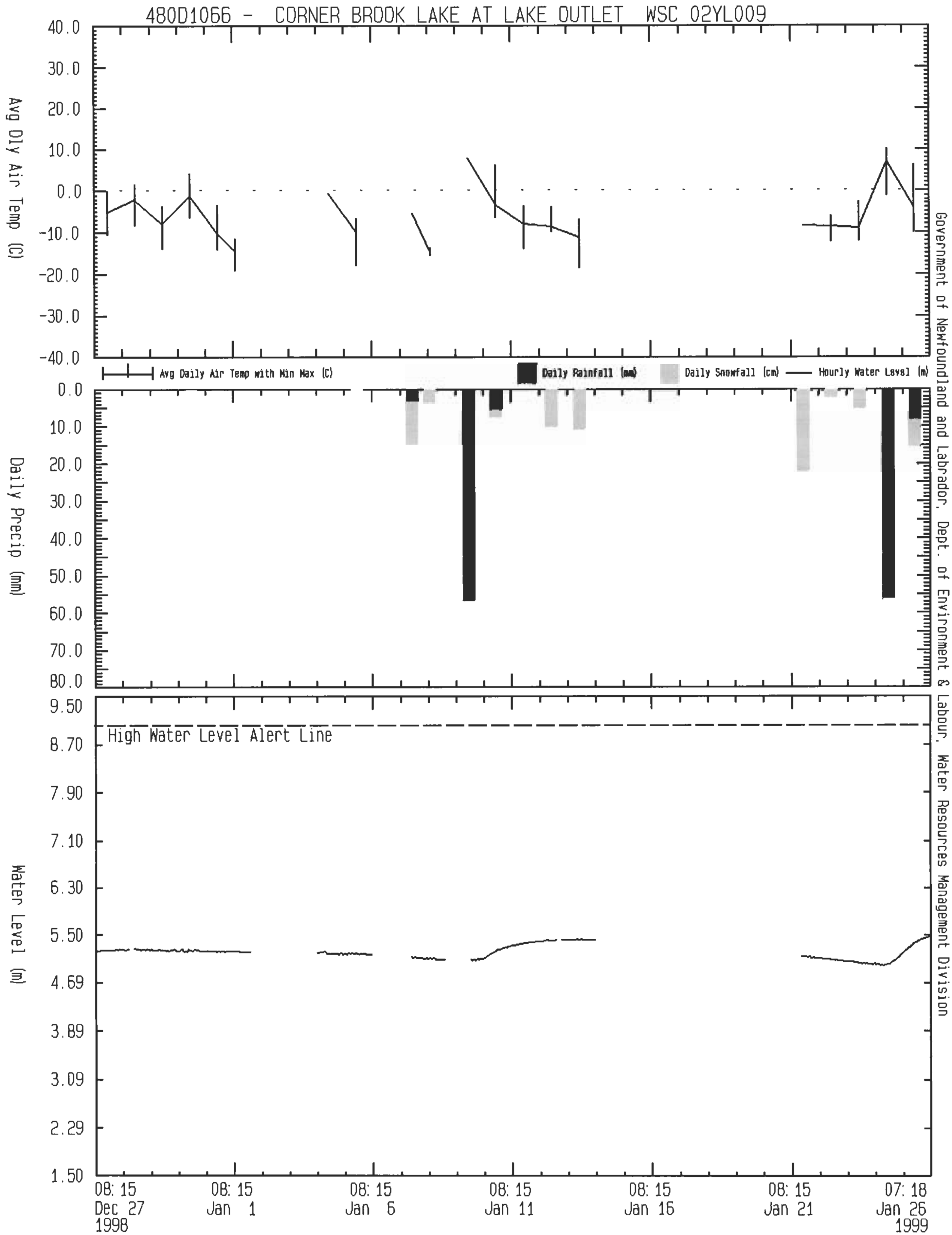


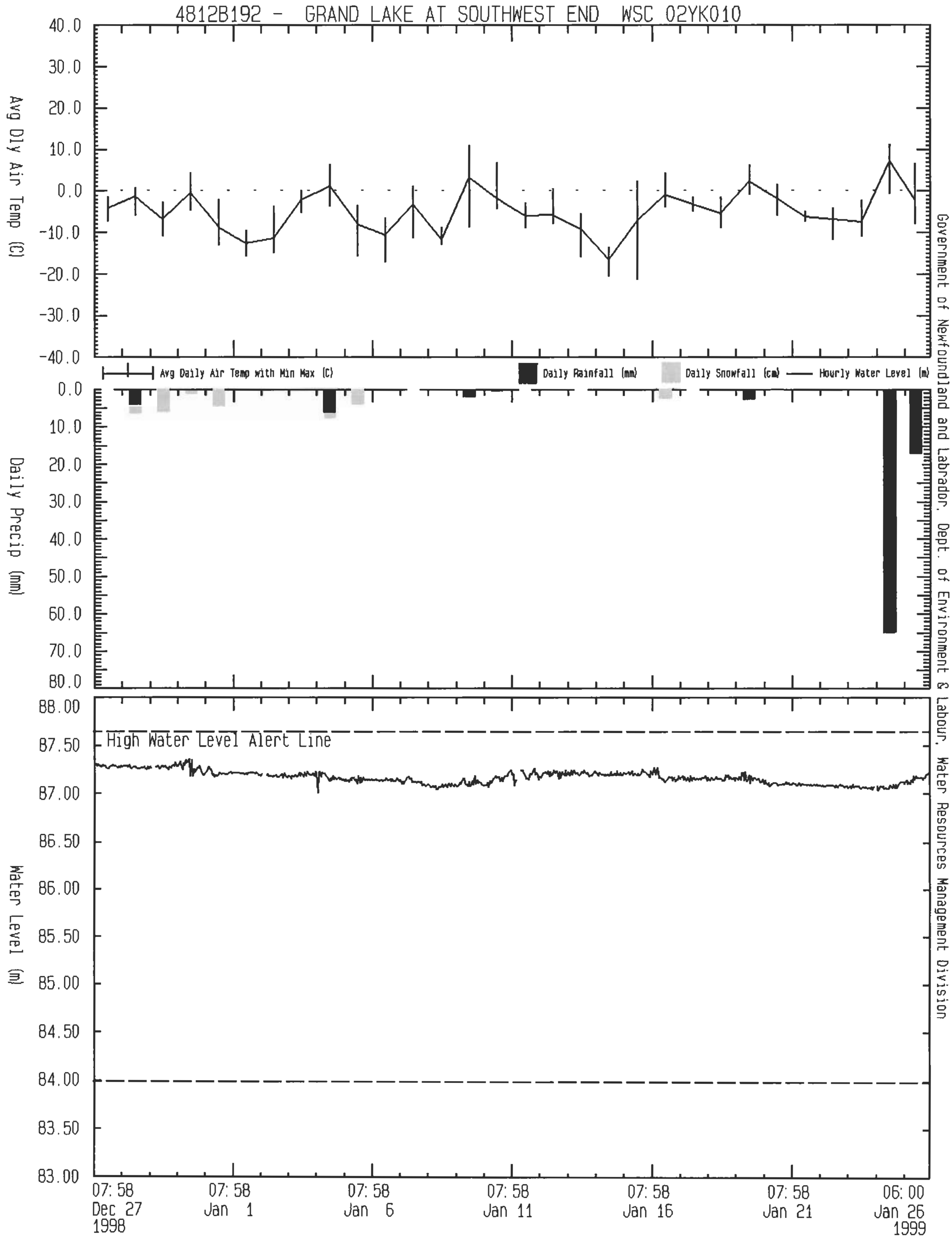
480D0310 - SHEFFIELD BROOK NEAR TCH WSC 02YK005



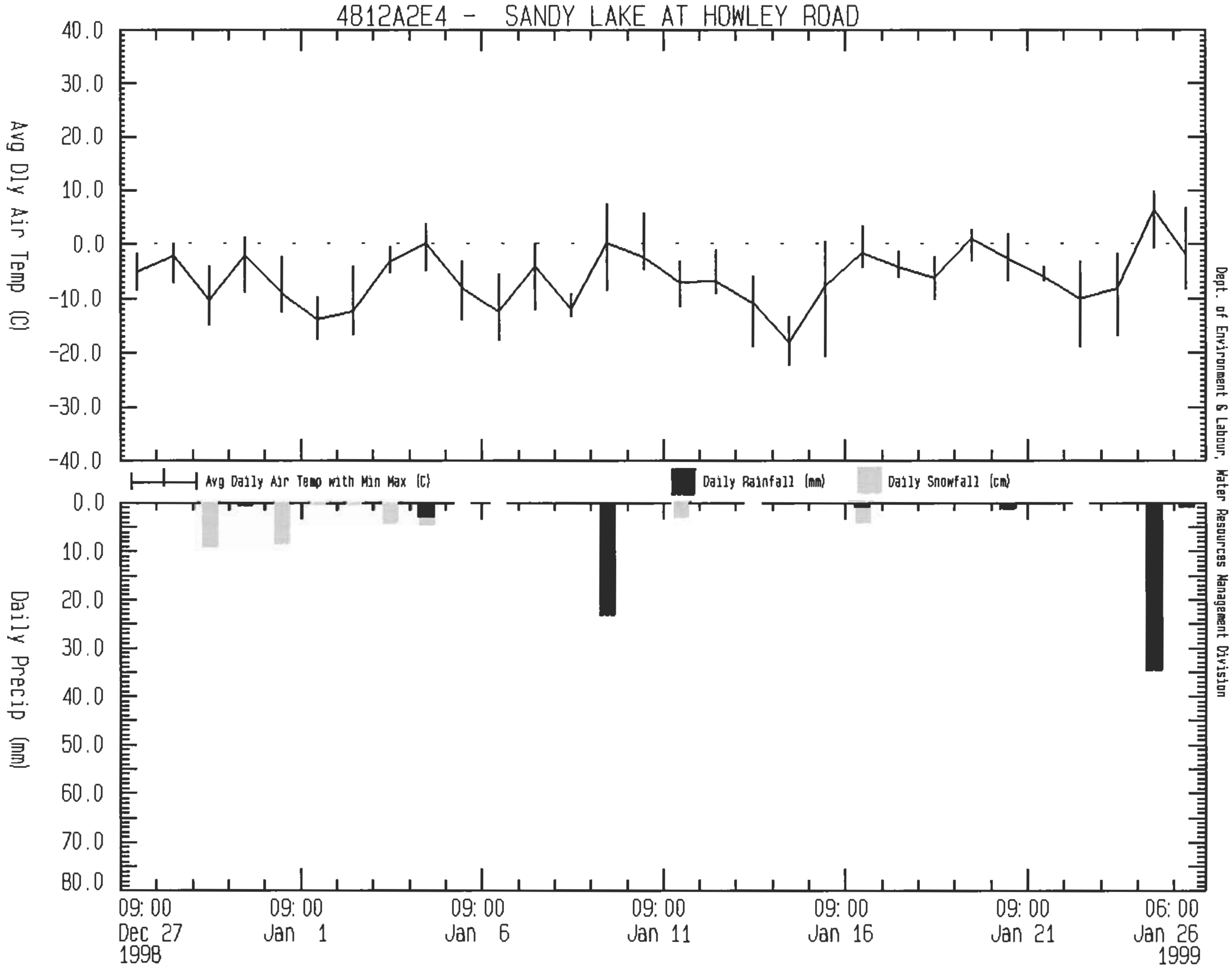

480CF16E - INDIAN BROOK DIVERSION TO BIRCHY LAKE WSC 02YM004
Avg Dly Air Temp (C)
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Hourly Flow (m3/s)
Daily Precip (mm)
Flow (m3/s)
High Flow Alert Line
17:15 Dec 27 1998
17:15 Jan 1
17:15 Jan 6
17:15 Jan 11
17:15 Jan 16
17:15 Jan 21
07:13 Jan 26 1999
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division

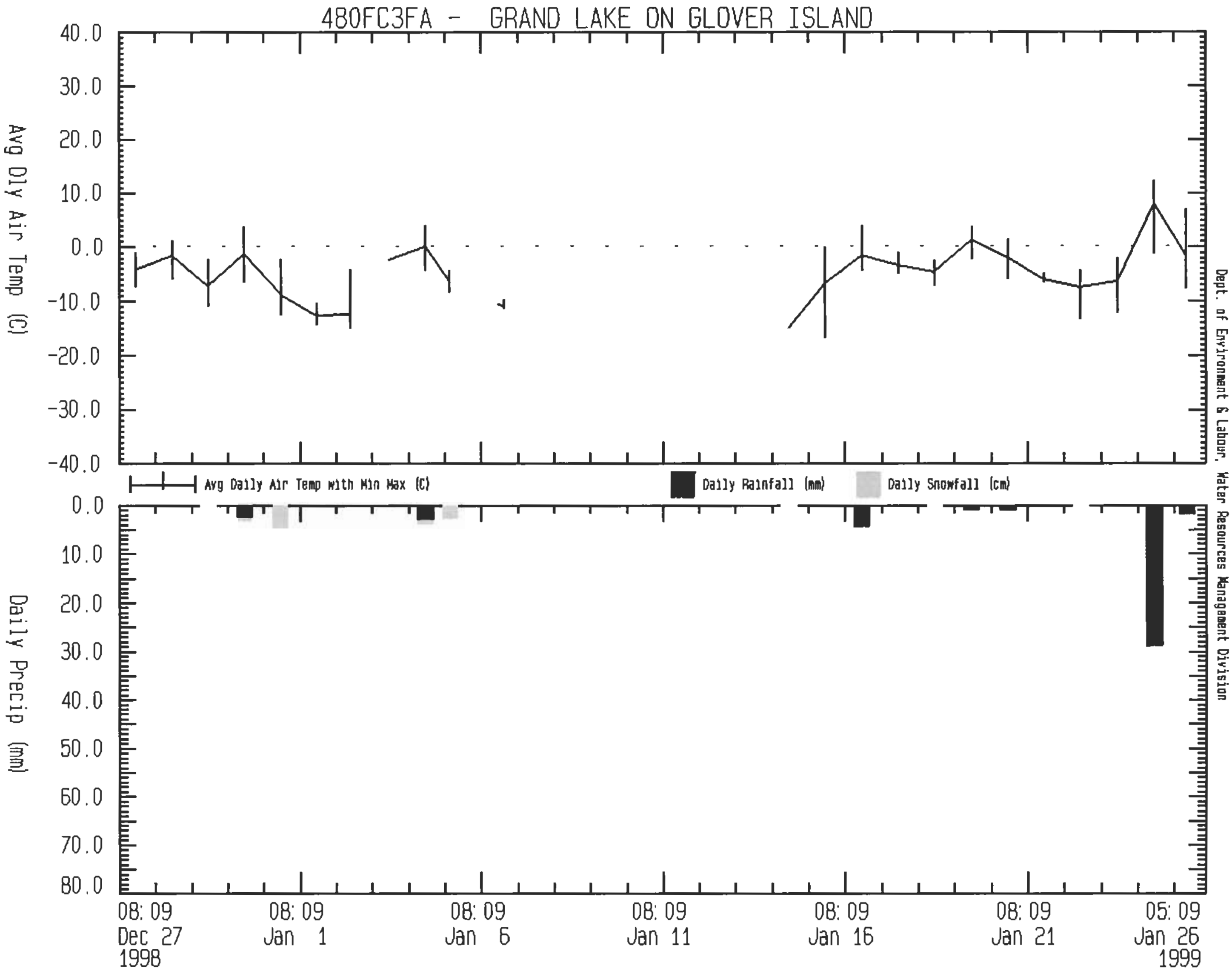

480CE218 - LEWASEECHJEECH AT LITTLE GRAND LAKE WSC 02YK002
150.0
135.0
120.0
105.0
90.0
75.0
60.0
45.0
30.0
15.0
0.0
Flow (m3/s)
High Flow Alert Line
Hourly Flow (m3/s)
Dept. of Environment & Labour, Water Resources Management Division
08:15 Dec 27 1998
08:15 Jan 1
08:15 Jan 6
08:15 Jan 11
08:15 Jan 16
08:15 Jan 21
07:13 Jan 26 1999


480D1066 - CORNER BROOK LAKE AT LAKE OUTLET WSC 02YL009
Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Hourly Water Level (m)
Daily Precip (mm)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Water Level (m)
9.50
8.70
7.90
7.10
6.30
5.50
4.69
3.89
3.09
2.29
1.50
High Water Level Alert Line
08:15 Dec 27 1998
08:15 Jan 1
08:15 Jan 6
08:15 Jan 11
08:15 Jan 16
08:15 Jan 21
07:18 Jan 26 1999
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division

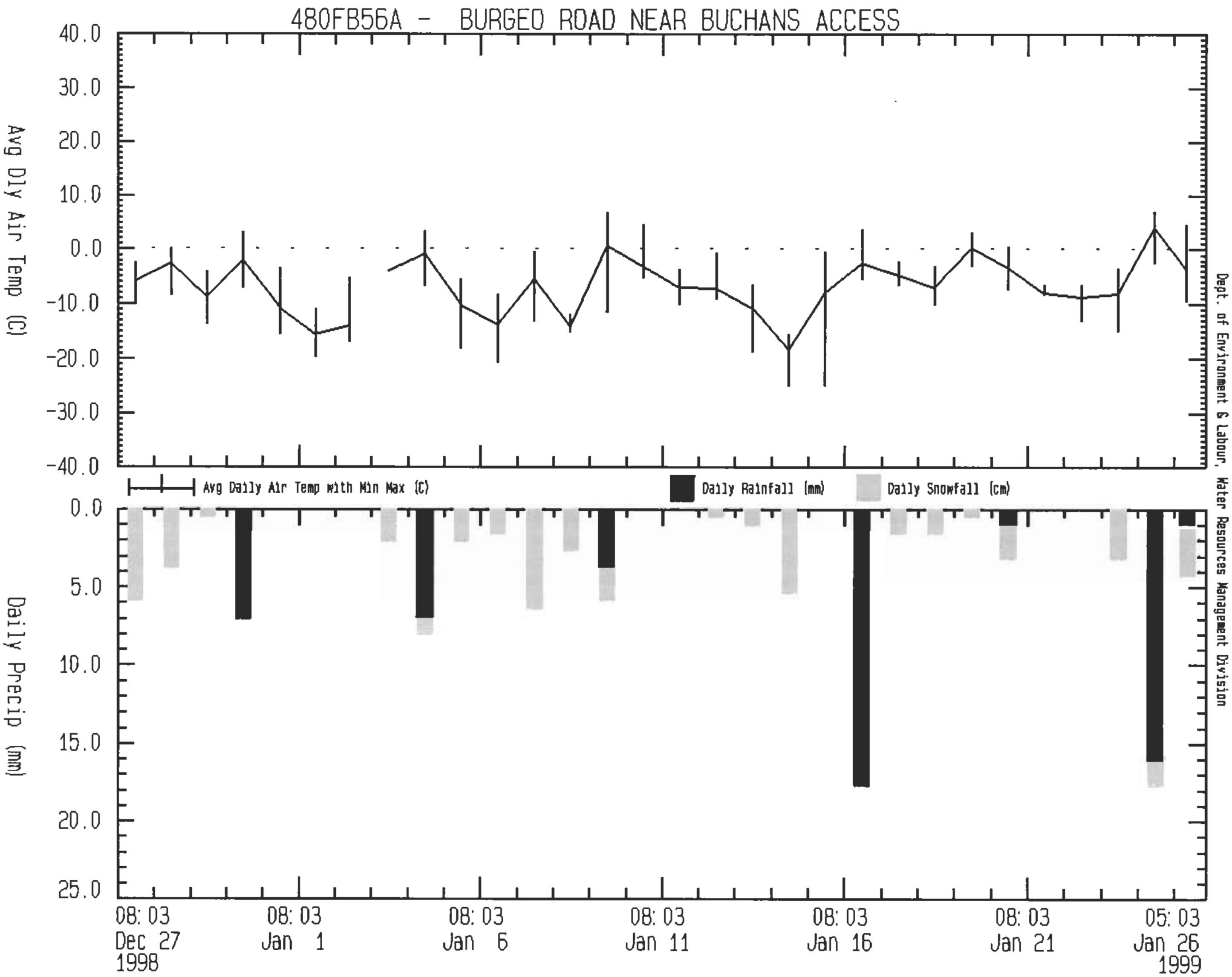


4812B192 - GRAND LAKE AT SOUTHWEST END WSC 02YK010
Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Hourly Water Level (m)
Daily Precip (mm)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
Water Level (m)
88.00
87.50
87.00
86.50
86.00
85.50
85.00
84.50
84.00
83.50
83.00
High Water Level Alert Line
07:58 Dec 27 1998
07:58 Jan 1
07:58 Jan 6
07:58 Jan 11
07:58 Jan 16
07:58 Jan 21
06:00 Jan 26 1999
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division


4812A2E4 - SANDY LAKE AT HOWLEY ROAD
Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Daily Precip (mm)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
09:00 Dec 27 1998
09:00 Jan 1
09:00 Jan 6
09:00 Jan 11
09:00 Jan 16
09:00 Jan 21
06:00 Jan 26 1999
Dept. of Environment & Labour, Water Resources Management Division



480FC3FA - GRAND LAKE ON GLOVER ISLAND
Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Daily Precip (mm)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
08:09 Dec 27 1998
08:09 Jan 1
08:09 Jan 6
08:09 Jan 11
08:09 Jan 16
08:09 Jan 21
05:09 Jan 26 1999
Dept. of Environment & Labour, Water Resources Management Division



480FB56A - BURGEO ROAD NEAR BUCHANS ACCESS
Avg Dly Air Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Daily Precip (mm)
0.0
5.0
10.0
15.0
20.0
25.0
08:03 Dec 27 1998
08:03 Jan 1
08:03 Jan 6
08:03 Jan 11
08:03 Jan 16
08:03 Jan 21
05:03 Jan 26 1999
Dept. of Environment & Labour, Water Resources Management Division

NLIS 5
June 9, 2000
(Works, Services and Transportation)

AB
copy FYI
I'll check later
for cost of
new bridge
KR
June 21/2000

Contract awarded for removal of Little Falls Bridge

A tender was awarded to Western Construction Company Ltd. for the removal of the Little Falls Bridge, on the western side of Sir Richard Squires Park. Rick Woodford, Minister of the Department of Works, Services and Transportation, announced the details of the $143,674.10 contract today.

"The contractor will start removing the bridge as soon as he obtains the necessary permits," said Minister Woodford. "Once the existing bridge is gone, we'll issue tenders for the construction of a new steel structure. My goal is to have this route to the park accessible hopefully within the next several months."

The concrete bridge was closed in late May after it was determined that the force of the Humber River eroded the base of the bridge's middle pier, resulting in a shifting of the pier. Subsequent damage was also done to the deck.

Visitors to the park can temporarily access the park from the Kruger woods road, which connects to the old Trans Canada Highway. This road is now being upgraded to provide suitable access to the park for this year's tourist season.

Media contact: Lynn Evans, Communications, (709) 729-3015.

2000 06 09 1:55 p.m.

FB
IVJ
HR
June 8/00

treaties give Mi'kmaq people the right to fish when and where they choose.

D-F-O is now trying to work out fishing agreements with First Nations, to avoid conflict between Native and non-Native fishing communities.

But the Conne River Mi'kmaq haven't been included in the negotiations, because according to Ottawa, they don't have treaty rights.

Chief Misel Joe says that makes them the only First Nation in Atlantic Canada not at the bargaining table.

JOE CLIP:

<<<<you know, the mentality in nfld is that we were brought by the french, so we couldn't have any traditional hunting or fishing rights in this territory, and i guess what we have to do at this stage is go out and do what we want to do, under a controlled sort of way, and to use the courts where we can to prove otherwise. it's unfortunate because it takes up enormous amounts of money and resources to have to do that. but we're committed to doing that, and if that what it takes, then that's what it takes>>.

So far, 18 of the 34 eligible First Nations have signed interim fishing agreements with D-F-O.

The one-year agreements provide communal fishing licenses and money for training and equipment.

The licenses were purchased by D-F-0 from non-Aboriginal fishermen.

----

Residents of Reidville, near Deer Lake should be back on their regular water supply this weekend.

The town was left without water for about 12-hours last weekend when heavy rains and snow runoff raised the level of the Humber River by about eight feet.

The flooding damaged the town's pumphouse and equipment.

Since then, Reidville's 500 residents have had to use a temporary, and muddy, water supply.

But the town says the pumps are being fixed and should be be back in operation within days.

----

The provincial government has rejected a call by NAPE to hold a public inquiry into the corrections system.

The union's president, Tom Hanlon, says the work environment in correctional institutes is bad. He says that's contributed to a high rate of personal problems, including divorce and suicide attempts, among correctional officers.

The Justice minister, Kelvin Parsons says the government has offered to set up a special committee to review the problems. Parsons says it's too soon to call a public inquiry.

PARSONS CLIP:

<<there are collective bargaining and other processes in place, including the committee that we've agreed to strike to deal with these concerns. There's no need of a public inquiry, the processes

**From:** Ken Rollings
**To:** Timothy Collins
**Date:** 6/6/00 3:03PM
**Subject:** Bridge Washout on Humber River near Cormack

Tim:

It appears the return period of this event was about 20 years.

Streamflows peaked at 871 m^3/s on May 21 (preliminary data).

Based on the analysis of 68 years of data, (RFFA 99)
the 1:20 year flood was 859 m^3/s and
the 1:50 year flood was 948m^3/s.

Our website with near to real time data including
Upper Humber River near Reidville (ID# 02YL001) is located here:

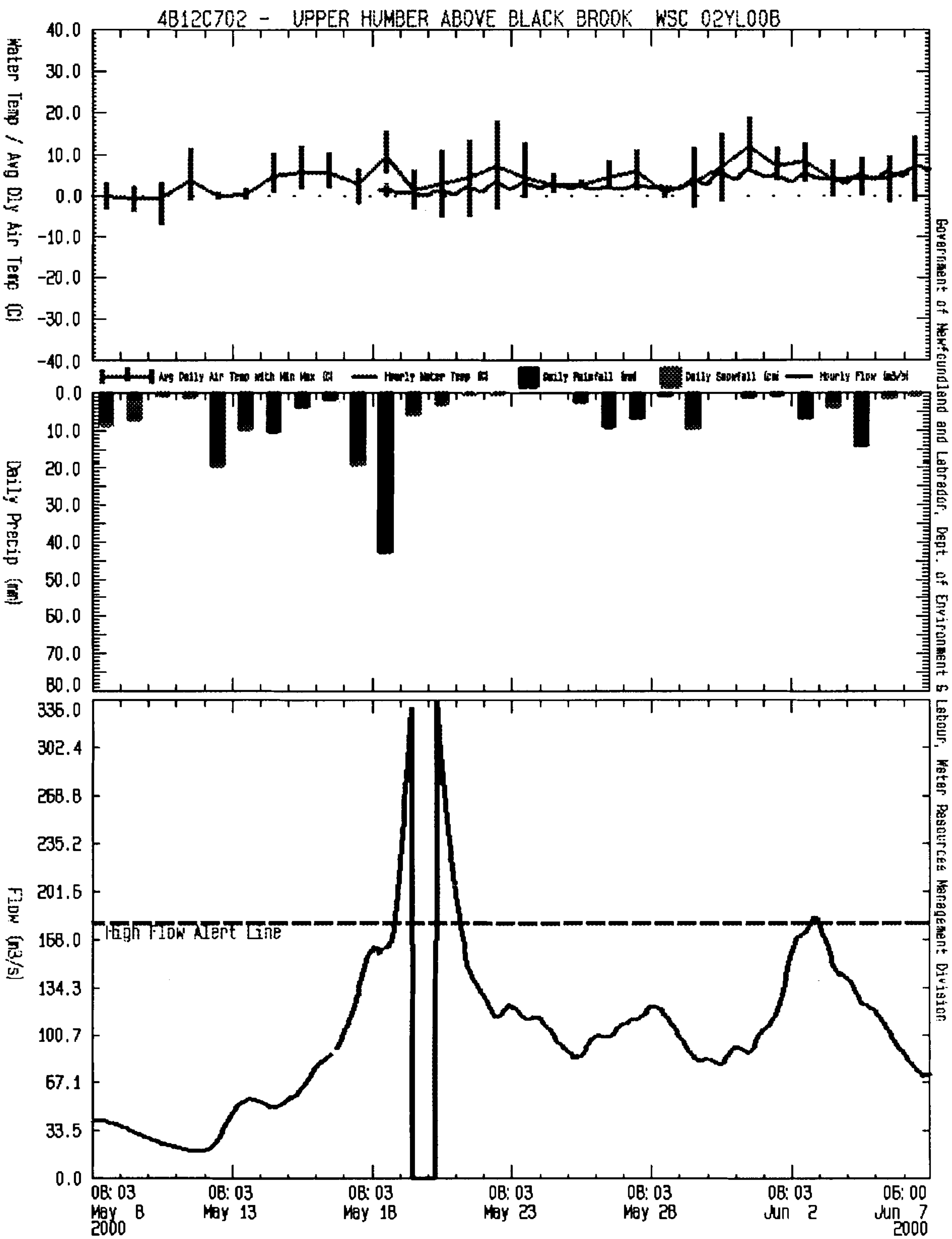
http://www.gov.nf.ca/wrmd/ADRS/30DGRAPH.HTM

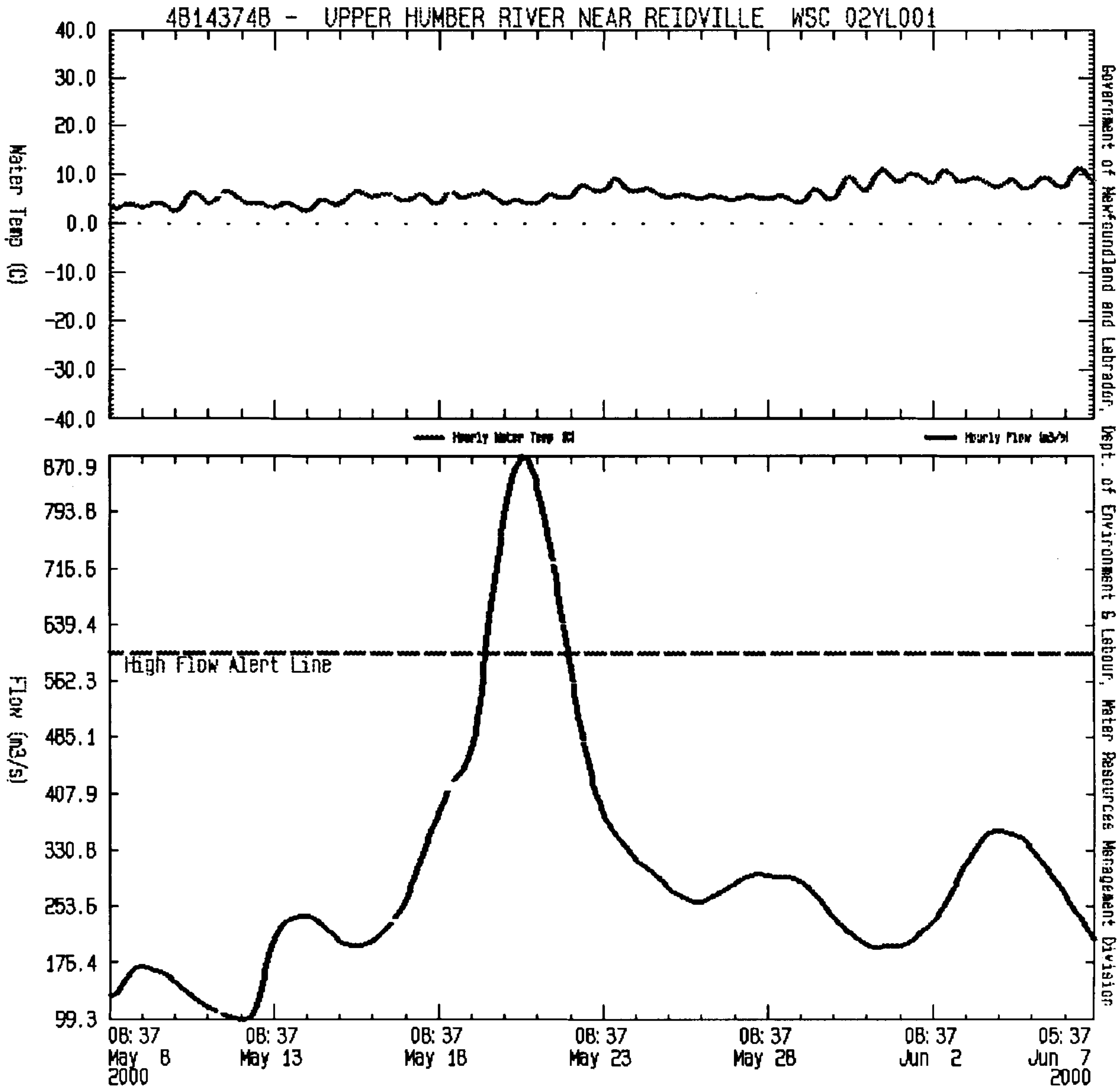
Regards,
KEN

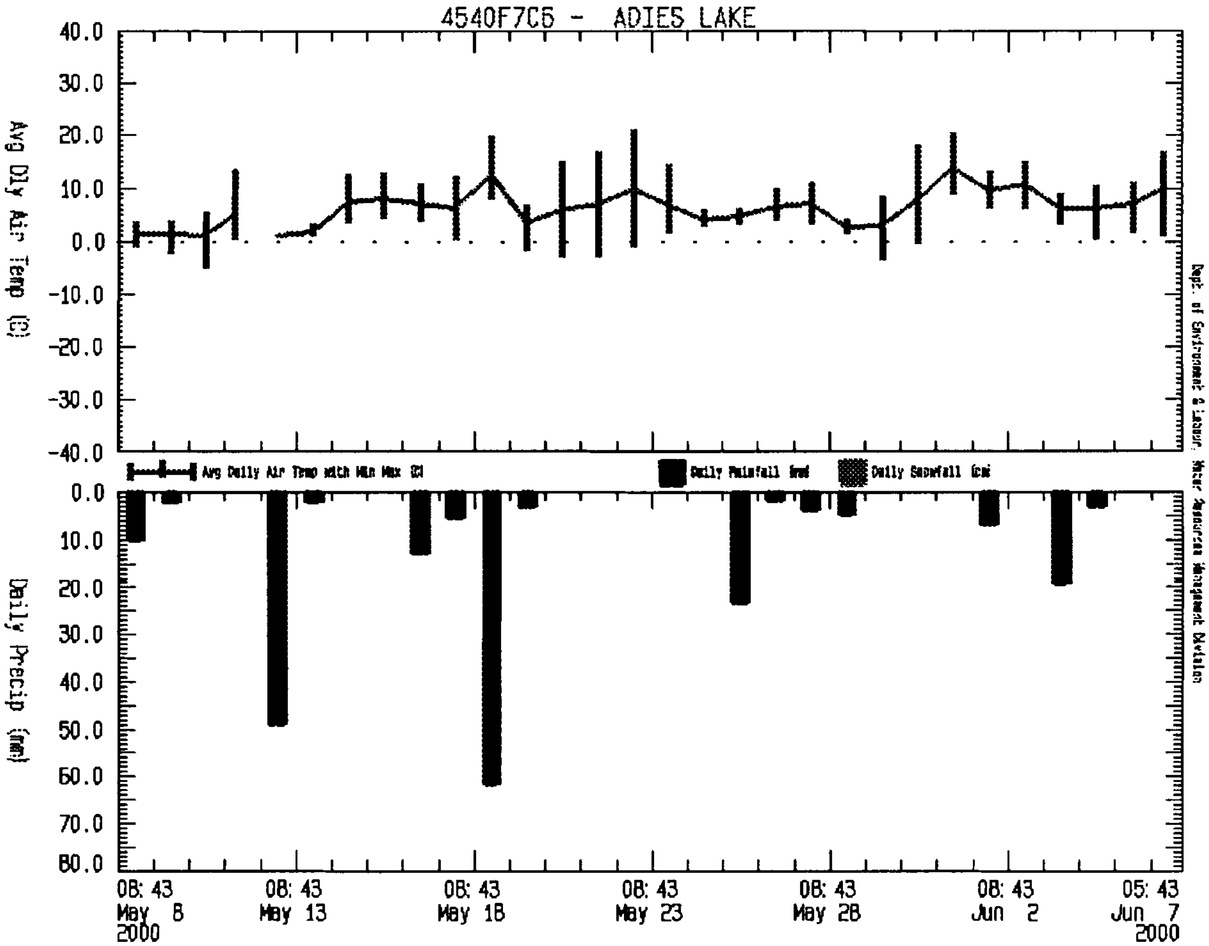
Ken Rollings, P. Eng.
Senior Engineer
Water Resources Management Division
Hydrologic Modelling Section
Department of Environment and Labour
P. O. Box 8700
St. John's, NF
AIB 4J6

Phone: 729 2553
Fax 729 0320
email: krollings@mail.gov.nf.ca
website:http: www.gov.nf.ca/env/Env/water_resources.asp

**CC:** Anil Beersing; Robert Picco


4812C702 - UPPER HUMBER ABOVE BLACK BROOK WSC 02YL008
Water Temp / Avg Dly Air Temp (C)
Avg Daily Air Temp with Min Max (C)
Hourly Water Temp (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Hourly Flow (m3/s)
Daily Precip (mm)
Flow (m3/s)
High Flow Alert Line
08:03 May 8 2000
08:03 May 13
08:03 May 18
08:03 May 23
08:03 May 28
08:03 Jun 2
06:00 Jun 7 2000
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division


48143748 - UPPER HUMBER RIVER NEAR REIDVILLE WSC 02YL001
Water Temp (C)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Hourly Water Temp (C)
Hourly Flow (m3/s)
Government of Newfoundland and Labrador, Dept. of Environment & Labour, Water Resources Management Division
Flow (m3/s)
870.9
793.8
716.6
639.4
562.3
485.1
407.9
330.8
253.6
176.4
99.3
High Flow Alert Line
08:37 May 8 2000
08:37 May 13
08:37 May 18
08:37 May 23
08:37 May 28
08:37 Jun 2
05:37 Jun 7 2000


4540F7C6 - ADIES LAKE
Avg Dly Air Temp (C)
Daily Precip (mm)
Avg Daily Air Temp with Min Max (C)
Daily Rainfall (mm)
Daily Snowfall (cm)
Dept. of Environment & Labour, Water Resources Management Division
08:43 May 8 2000
08:43 May 13
08:43 May 18
08:43 May 23
08:43 May 28
08:43 Jun 2
05:43 Jun 7 2000

AB FYI

KR

June 6/

more info from Ian Bell later

KR

NLIS 5
June 1, 2000
Works, Services and Transportation

Little Falls Bridge to be replaced

Rick Woodford, Minister of Works, Services and Transportation, announced that a decision has been made regarding the bridge leading into Sir Richard Squires Park

The department will call tenders immediately for the removal of Little Falls Bridge, a concrete structure built on the Humber River in 1948. A steel bailey bridge will be put in its place.

"The middle pier supporting the bridge has shifted and as a result, has separated from the deck," said Woodford. "For safety reasons, this access has been closed to all traffic and will not be reopened until the new structure is built."

Bridge inspectors have determined that either the pier, or the rock at the base of the pier, has been partially eroded by the force of the water. Because of the danger of the bridge falling into the river, the department, in consultation with the Department of Fisheries and Oceans, wants the existing structure removed as soon as possible. The new bridge will be constructed after the old structure is removed and as soon as the design and tendering processes permit.

Temporary access to the park will be via the Kruger woods road, which connects to the old Trans Canada Highway. Plans are now under way to upgrade this road to provide suitable access to the park for this year's tourist season.

Media contact: Lynn Evans, Communications, (709) 729-3015.

2000 06 01 3:35 p.m.

# Bridge closure cuts off access to Sir Richard Squires park

By JAMES MATTHEWS
Star Staff Writer

**CORMACK**

The bridge connecting Cormack to Sir Richard Squires provincial park was closed Monday.

Road blocks were erected on both sides of the bridge, located on Route 422, effectively cutting off access to the park commonly known as Big Falls.

One side of the 52-year-old cement bridge has begun to slope toward the Upper Humber River.

A contractor hired by the provincial Department of Works, Services and Transportation is currently clearing an old woods road to be used as an alternate route from the east side of the park near Howley.

Despite the damage to the bridge, the park remains open, according to park warden Bert Hillier.

Hillier doesn't think there's much that can be done in the way of repairing the causeway from Cormack, and said the alternate route will serve to provide adequate access to the park from its east side.

Works, Services and Transportation Minister Rick Woodford said inspectors have been at the site since Monday evening. He expects an evaluation of the damage to be completed by this morning.

He said the damage was incurred as one of the pillars near the bridge's middle started to move with the flow of the river.

The river, which started to rise during the Victoria Day weekend, has also wreaked havoc with municipal water facilities at neighbouring Reidville.

Hillier agrees the increased volume of water roaring along the river is likely to be a factor in causing the damage.

"I've seen the river higher, but with the years of erosion, I guess it finally met its maker," he said.

Divers from the department are unable to survey the base of the weakened pillar because the water is so fast and has risen so high, Woodford said. This will complicate efforts to get a more comprehensive damage report and will affect attempts to estimate the cost of repairs.

"We've got to wait until the water goes down to get a real good feel for what's going on there," Woodford said.

All the province's bridges are inspected on a yearly basis, and there were no signs of trouble at the bridge's last inspection.

Though reports of the damage were received Sunday, the minister said it's difficult to tell exactly when the troubled pillar first started to weaken or how long it has been moving.

"It might have been moving all along, but it didn't affect the top – the superstructure," said Woodford. "It could have started last year, really.

"What they're saying is the pillar is resting on a piece of bedrock and that's being undermined as well. But we can't get down to look at it."

Though it may be difficult to determine the full extent of damage to the bridge, Cormack Mayor Marg Sweet is already predicting a potentially great loss for the local summer tourism industry should the bridge be closed for a lengthy span of time.

She said a number of independent businesses in the town have been providing services to anglers as they passed through on their way to the banks of the Upper Humber River.

The quality and maintenance of the road from the town to the park has been an issue for many years with little attention paid to it by the department. If the road had been given more attention, the closure of the bridge could possibly have been averted.

The detrimental effect on the local tourism economy could be heightened should the bridge be closed indefinitely and the alternate route from east be used on a permanent basis, said Mayor Sweet.

"I don't like the idea that the main entrance to the park is not going to go through Cormack," she said. "I don't want to see anything shut down between Cormack and the park."

Star photo by James Matthews

**This bridge on Route 422 linking Cormack to Sir Richard Squires provincial park was closed Monday, restricting access to the park. One of the pillars near the centre of the bridge has weakened, causing the bridge to slope toward the water of the Upper Humber River.**

Hurricane Gustav Storm Summary

On September 12, 2002 Hurricane Gustav passed over Atlantic Canada. With wind speeds of over 120 km/h, Gustav dumped more than 100 millimetres of rain in portions of Nova Scotia while part of Newfoundland received more than 70 millimetres. To learn more about Hurricane Gustav, read the storm highlights and view the pictures below.

- Tropical storm Gustav was upgraded to a hurricane at 11:50 a.m. ADT on September 11, only hours before moving into southwestern Maritime waters.
- September 12, Hurricane Gustav made landfall along the southern coast of Cape Breton, Nova Scotia at 1:30 a.m. ADT.
- Gustav was upgraded from a tropical storm to a hurricane at 11:50 a.m. ADT on Sept 11, only hours before moving into southwestern Maritime waters.
- Normally (50 year average) the North Atlantic would have had three hurricanes by September 11, however, Gustav was the first of this year, making it the latest date for the Atlantic's first hurricane in 60 years. interesting
- Reports of heavy rain, high winds, and minor flooding from storm surge were received from around Atlantic Canada...events which were all warned of well in advance by the Atlantic region weather centres.
- The highest rainfall amounts officially reported were in Nova Scotia where 102 mm fell in Ashdale (a climate station in West Hants County) and 92 mm at Halifax International Airport. All of Nova Scotia received over 50 mm while the New Brunswick rain amounts ranged from 8 mm (Miscou) to 63 mm (Moncton) and the Newfoundland rainfalls ranged from 40 to 70 mm in the north.

Hurricane Gustav Storm Summary

- Highest wind speed reports varied across the region... ranging from 89 km/h at Miscou, NB, to 109 km/h at East Point, PEI, to 122 km/h at both St. Paul Island and Sable Island, NS. High wind gusts in parts of Newfoundland of over 100 km/h were still being reported days afterward.
- Storm surge conditions throughout the southern Gulf of St. Lawrence coincided (within a few hours) of a run of high astronomical tides, resulting in localized coastal flooding. A noteworthy point for water levels in Charlottetown is that had the highest surge arrived only four to five hours earlier to coincide exactly with the high tide, an additional 70 cm of elevation would have pushed water levels to near record values resulting in definite flooding of portions of downtown Charlottetown.

interest

- Gustav was downgraded to a post-tropical storm as it exited Nova Scotia and entered Newfoundland on September 12 shortly before 6:30 a.m. NDT.

**Image Descriptions:**

Storm photos of Hurricane Gustav as it passes over Cheticamp, Nova Scotia on September 12, 2002.

Related Links:

- Environment Canada: Canadian Hurricane Center web site.
- CNN: Hurricane Gustav heads toward Nova Scotia.
- CTV News: Nfld. hit with heavy rain, Gustav leaves land.
- CBC News: Hurricane Gustav drenches East Coast.

Nfld. hit with heavy rain, Gustav leaves land

CTV News Staff

Updated: Thurs. Sep. 12 2002 5:58 PM ET

Hurricane Gustav may not have been as powerful as predicted. But the storm did bring record rainfall to two Newfoundland communities on Thursday and left a trail of darkness across the Maritimes.

According to Environment Canada's Hurricane Centre, Gustav, which has been downgraded to a tropical storm, is now moving out to the open Atlantic, after two days of record rains and whipping winds across Maritime provinces.

Before leaving land Thursday, Gustav slammed into the south coast of Newfoundland, causing what are expected to be record one-day rainfalls in the towns of Stephenville and Deer Lake.

Deer Lake saw 47 millimetres of rain by Thursday afternoon, breaking the previous record of 41.9 millimetres set in 1974. In Stephenville, Gustav unleashed 18 millimetres by late Thursday, beating 14.7 millimetres also set in 1974. 18 mm?

The rains caused the RCMP to close one lane of the Trans-Canada Highway at Birchy Lake, about 50 kilometres west of Deer Lake.

Torrential rains also hit Nova Scotia, Prince Edward Island, southern New Brunswick and the Iles de la Madeleine on Wednesday and Thursday.

Gustav also brought winds that reached up to 100 kilometres and hour, which knocked out power lines on P.E.I., Cape Breton and N.S. However, despite warnings of hurricane-force winds, there have been no reports of significant damage.

In Halifax, close to 4,000 customers in metro lost power early Thursday morning until about 6 a.m. Falling trees also downed power lines between Stellarton and the New Brunswick border.

Ted McIldoon, a meteorologist at Environment Canada's Hurricane Centre, said some parts of Nova Scotia have been hit with more than 60 millimetres of rain.

"It's hard to draw the balance between making people wary and being too blase about it," McIldoon said. "Our winter storms are as bad as hurricanes anyway."

In Charlottetown, P.E.I., wind gusts ripped into the town's century-old elm trees.

On the island's north short, storm-surging surf battered breakwaters and filled beaches with sea foam. And a dozen communities were left without power.

**CBC.CA News - Full Story:**

Hurricane Gustav drenches East Coast
*Last Updated Thu Sep 12 21:26:43 2002*

*HALIFAX*-- Hurricane Gustav brought heavy rains, high winds and minor flooding to the East Coast Thursday.

But after battering the Maritimes, Gustav was downgraded to a sub-tropical storm, brushing Newfoundland before heading out into the Atlantic .

While there were downed trees and plenty of rain, it could have been worse. No lives were lost and property damage was relatively light.

Work crews in Corner Brook were cleaning up debris and trees branches. Power was been knocked out in a section of the city. ← NL

Mainland Nova Scotia's eastern tip experienced rain and winds of more than 100 kilometres an hour.

Parts of that Nova Scotia, Prince Edward Island and New Brunswick had to deal with up to 80 millimetres of torrential rains overnight.

In northern P.E.I. and Charlottetown, residents experienced minor flooding.

Written by CBC News Online staff

FLOODS

Print Cancel

The Telegram (St. John's)
Provincial, Friday, August 10, 2007, p. A4

Environment
More floods for Deer Lake

Michael Rigler; Cory Hurley
Transcontinental Media; The Western Star

Deer lake - It was a rerun nobody wanted to see in Deer Lake. The late summer storm that whipped most of the island's west coast and Northern Peninsula Thursday dumped more rain on the town that had significant flooding earlier this week, causing hundreds of thousands of dollars worth of damage to private properties and businesses.

In fact, the town was still cleaning up from Sunday's torrential downpour.

Home Hardware owner Dean Ball was busy with a team of workers trying to clean out the basement stock room of his Deer Lake store when rainwater started pouring back into his business late Thursday afternoon.

"It's hard to believe, but we're flooding again," Ball told The Western Star. "Town workers are here trying to reinforce the temporary curbs and barriers they put up, but what they had put in place just isn't holding back the water.

"I've already got 12 men in here trying to clean up the damage caused by the weekend's storms. We were estimating that we'd be more than two weeks cleaning up, now I don't know. I'm just praying for a bit of sunshine."

This latest storm didn't have the same intensity as the one that caused the flash flooding, but the heavy rain kept town workers hustling around Deer Lake checking the repairs and temporary water diversions they'd built this past weekend.

Ironically, the heaviest rainfall Thursday started a few hours after Environment Canada lifted the warning issued for the area.

Meanwhile in Corner Brook, the city continued to avoid any major problems with the recent downpours. Late Thursday afternoon Brandon MacDonald, assistant director of operational services, said everything was holding up.

Since the disaster flooding of 2005, city workers have been proactive in preparing for any possible trouble.

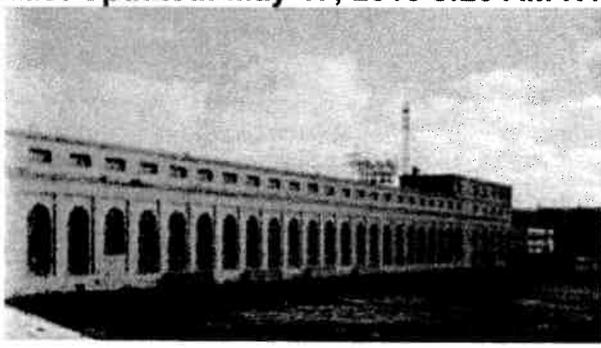
"The guys actually started yesterday (Wednesday) making sure the drainage channels and culverts were clean," MacDonald said.

"We know where the trouble areas are to generally."

# Flooding warning issued in Deer Lake

300

CBC News
**Posted: May 17, 2013 8:22 AM NT**
**Last Updated: May 17, 2013 8:20 AM NT**



*Deer Lake Power is releasing water from three of the gates at its main dam to deal with high water levels. (Town of Deer Lake)*

The Town of Deer Lake is preparing for damage from the highest water levels in the western Newfoundland area in three decades.

Deer Lake Power is scheduled to open three gates at its overflowing reservoir around 10 a.m., to deal with enormous rainfalls that have swollen waterways.

Mayor Dean Ball told CBC News that the levels on the Humber River are the highest he has seen in many years, largely due to melting snow and rain over the last few weeks. He said Friday morning the heavy rain had continued overnight.

Ball said while it is necessary for Deer Lake Power to release water at its dam, there may be consequences for homes in low-lying areas.

"You have sheds and garages that are in backyards that will be affected," he said.

On Thursday, town staff went door-to-door to notify about 85 homeowners of flooding risks.

"Our true concerns are with our residents now, that everybody will be safe. If they're notified, at least people are aware now to watch and keep a close eye on their property and the water level."

Ball said the while people should keep a close eye on levels in the immediate hours after Deer Lake Power opens the gates Friday, they should be aware the gates could be open for as long as five to seven days.

He said if the move does not solve the problem, more gates at the power station's reservoir may have to be opened.

FLOODS

CBC Newfoundland and Labrador (web site)
Newfoundland & Labrador, Thursday, November 28, 2013

## Flooding in pockets of western Newfoundland Part of Trans-Canada Highway impassable because of washouts, water buildup

**CBC News**

Electricity has been restored for the majority of Newfoundland's west coast -- although rising waters were causing flooding concerns in several communities on Thursday.

A portion of the Trans-Canada Highway in the area of South Branch was impassable, RCMP said, because of water buildup and washouts.

In Corner Brook, heavy equipment was brought in to deal with pockets of flooding caused by rainfall on top of a buildup of snow. Nine backhoes were busy clearing debris from overflowing storm sewers.

City officials said Petries Street has closed, and there were reports of localized flooding on several streets, including Georgetown Road, Wheelers' Road and Pike's Avenue. The city has warned that due to very high water levels, the bridge on Main St. could close at any time.

Thousands of people on the west coast and Northern Peninsula woke up in darkness on Thursday morning, although power was restored to most within hours.

Newfoundland Power was still reporting outages in the Humber Valley, including parts of Pasadena, Humber Village and Steady Brook, as of 9:30 Thursday morning.

Newfoundland and Labrador Hydro, which reported outages stretching from Cow Head to St. Anthony, was able to put 2,400 customers back on power through diesel. Repairs were made later for other communities.

Fierce winds, associated with a storm that already has battered the Maritimes, have been sweeping into Newfoundland, with a peak gust of 142 km/h already reported at the notoriously windy Wreckhouse area on the island's southwest coast.

The Newfoundland and Labrador government issued a warning to residents to be cautious near coastal areas, where pounding waves could pose safety issues.

Western and northern Labrador can expect heavy snow during the storm.



Back to table of contents

TABLE 2.1

Historical Summary of Flooding in the Humber River Basin

| Date | Cause | Description/Location |
| --- | --- | --- |
| Sept. 14-16, 1944 | Heavy rain (2.92 in. (74.2 mm) of rain at | Railway reported to have taken precautions to prevent washouts from Grate's Point to Humbermouth. |
| Nov. 16, 1944 | Autumn gale | Grand Lake reported to be high and waves created by gale resulted in a railway washout at Sandy Pond dump. |
| Nov. 4-5, 1945 | Heavy rain | Storm weekend with heavy rain caused three minor washouts on railway line at South Brook, Harry's Brook, and Humbermouth. |
| May 18-19, 1948 | Heavy rain, snowmelt | Rivers and brooks on West Coast reported to be in flood. Railway washout at East Humbermouth |
| May 21-30, 1969 | Rain, melting snow | Several homes along Humber River from Corner Brook to Nicholsville were inundated. Highways were blocked for a period of time. |
| Aug. 1-4, 1973 | 3-day heavy rainfall | Corner Brook Stream and Bell's Brook overflowed resulting in some inundation. South Brook near Pasadena in flood and problems also occurred at Blue Gulch Brook. |
| Jan. 27-28, 1976 | Rain, melting snow and ice jams | In Corner Brook, several road washouts reported. Homes in Frenchman's Cove, Benoits' Cove and Lark Harbour damaged by flood waters. Steady Brook reported to be clogged with ice causing inundation of 4 homes and threatening another 10. |

FLOOD OF JULY 15, 1945*

Cause: Heavy rainfall

Description:

A local resident living beside Winter House Brook (South Arm, Bonne Bay) reported that on July 15, 1945, the family was forced to evacuate their home during the night.

Magnitude:

A rainfall of 1.87 inches (47.5 mm) was reported at Deer Lake on the 15th.

Damages:

Several buildings were flooded and some cultivated land was reported to have sustained severe damage. The highway bridge was also said to have been lost.

FLOOD OF NOVEMBER 4 - 5, 1945

Cause: Heavy rain

Description:

On the West Coast, a stormy weekend with heavy rain caused three minor washouts on the railway line at South Brook, Harry's Brook, and Humbermouth.

Magnitude:

A total rainfall of 1.88 inches (47.8 mm) was recorded at Deer Lake on the 5th and 2.44 inches (62.0 mm) was recorded at Corner Brook.

Damages: No estimates of the damage were available.

* Hydrological Inventory of Gros Morne National Park, Newfoundland, W. O'Sullivan, Halifax, July, 1976.

FLOODS

THE WESTERN STAR, P. 01 OCT. 4, 2005

Star Photo by Frank Gale

**Rev. Hubert Coombs, left, of Stephenville, waits to put his lawn trimmer aboard his truck while Eric Lomond loads some other items as he packs up to bring them to a rented house. The Coombs were among 152 families that were evacuated from their homes as of Monday after inspectors deemed the area a health and safety risk.**

# Residents told to evacuate homes in flood-ravaged Stephenville

**By FRANK GALE**
**Star Staff Writer**

STEPHENVILLE

Residents living in or near the flood zone hit last Tuesday received some bad news on Monday as 152 homes had to be evacuated. And even more evacuations are possible in the coming days.

Following inspections by the Department of Health over the weekend, everyone whose sewer was connected to the flood zone were told to evacuate. According to residents, they were ordered by health inspectors to leave their homes and to only take items that were not damaged.

Each resident was given a list of apartments that are for rent. Those living with family or friends were given $400 to pay for costs, while those who found apartments were given $650 for rent.

Don White of 34 White's Ave., whose home hadn't sustained any damage at all, said he was surprised when he received the notice to evacuate, but later understood the reasoning after meeting with officials at the town hall.

His only complaint was that the information was not trickling down from the Emergency Operations Centre to the people who are affected in the area. He said he was also a little annoyed by rumour that led people to believe they only had a few hours to get out of their homes.

However, White and his wife Myra were impressed with the services provided by the Stephenville-Kippens-Port au Port Search and Rescue team, the RCMP and the Salvation Army and the Red Cross.

"We even had strangers from other parts of town offer a helping hand," he said. "The people at Human Resources Labour and Employment were very helpful when we had to go and register."

While he was bothered by the evacuation, it was also troublesome not being officially told to leave other than by an unsigned notice in the mailbox.

The Whites are moving in with family members.

Retired Anglican Church Reverend Hubert Coombs, who was cleaning out personal effects from his 4 Mill Pl. home and garage on Monday afternoon, said he wasn't too alarmed by the evacuation since he feels his house will be a write-off due to the amount of water in the basement.

Rev. Coombs said he first purchased the house in 1973 and, while he had water in his basement before, it wasn't anything that couldn't be handled by sump pumps. He said this is the worst ever and the house is just not fit to be in anymore.

Like White, Rev. Coombs had plenty of praise for the services provided by the different departments and noted that there has been all kinds of offers of help. He is now renting on the former air force base.

Barry Coates, co-ordinator of the Emergency Operations Centre in the town office, said the evacuation became necessary for health and safety reasons. He said the devastation came quickly and the town really have had no timetables to work with, and was unable to estimate how long the people will be displaced.

He noted teams of engineers will do infrastructure inspections in town to see what can and cannot be repaired, as well as devise a long-term plan for reconstruction. He said Brook Street was open with a one-lane bridge on Monday. The bridges on Missouri Drive and Carolina Avenue have now been cleared and open to commercial traffic.

Coates said the Centre is providing drinking water approved by the Department of Health at Stephenville Dome, with a number of taps located at the back of the building for those who want to fill their own containers.

This is part of a re-treated water line which has a feed for the Dome and Sir Thomas Roddick Hospital only.

# Evacuation

## Flood waters drive hundreds from Stephenville homes

By FRANK GALE
Star Staff Writer

STEPHENVILLE

While Stephenville has experienced flooding in the past, residents say the high waters that resulted in officials calling a state of emergency Tuesday was the worse ever in the town.

"I've been living here since 1965 and while I had water in my house before, it was never anywhere close to this," said Rodney Gale of 8 Brookside Drive.

Down the street, Mary White of 2 Brookside Drive, said never in a million years did she expect the flooding would reach her house. She had about a foot and a half of water in the lower level of her split level house and reported water in the crawl space as well.

However, White felt things could have been worse, saying her heart goes out to an elderly neighbour, Angus Loder, whose house was pushed off its moorings by the flood and ended up partially on the street.

Hundreds of people were evacuated from their homes as rain-filled rivers flooded downtown Stephenville. More than 110 millimetres of rain fell on the region by mid-morning.

The crisis started early in the day when it became clear that two rivers running through town were going to breach their banks. After the state of emergency was declared, officials began a door-to-door evacuation of low-lying areas at 7:30 a.m.

A payloader was used to rescue several people by taking them in the bucket to dry land. Some scurried to beat the waters while others waded through water up to their waist to get away.

The Department of Human Resources, Labour and Employment set up a reception centre and shelter in the Armory, and co-ordinated temporary accommodations and other assistance. The department also assisted the Red Cross with the registration of evacuees.

Although the three bridges in Stephenville were intact, the roadways leading to the bridges had washed away. Severe damage was also reported in the neighbouring communities of Noel's Pond and Black Duck Siding. Several roadways in and out of small communities surrounding Stephenville were flooded, including the Trans-Canada Highway.

Photo by Mitch Bennett

**Several vehicles parked in the back of Auctions Plus scrapyard on the Hansen Highway in Stephenville were washed away in Tuesday's flood. A witness said the strong water currents tore away the ground right from under the vehicles.**

The Sir Thomas Roddick Hospital cancelled scheduled services and was only providing emergency and essential services on Tuesday.

People checking out the flooding along a number of small streets that run into the lower lying land near Blanche Brook shook their heads in disgust and general disbelief as they saw logs, vehicles, picnic tables, bags of garbage and other debris being carried along in the swollen current across roads and fields.

The same scenario took place at Gaudon's Brook, which forms the border between Stephenville and Kippens. The fast and swollen stream, which at most times is only a trickle, chewed away at land and even took out a section of Millbrook Lane in Kippens.

At the bridge on Kin Court, which survived many floods since it was constructed in 1956, the road washed out next to the bridge and its moorings on that side dropped. At the bridge on Hansen Highway where it crosses Blanche Brook, there was fear of losing that bridge as well, so large rocks were trucked in and dropped into the river to save it from impending damages.

Overall, it's estimated damages will be high as hundreds of homes were flooded in the town and in the area. Schools were closed shortly after they began and later in the day a boil order was put into effect.

The town's municipal election was cancelled due to the state of emergency and will be held within the next seven days.

Many roads were closed and people in areas that were not accessible at times throughout the day were advised that if emergency medical attention was needed a helicopter would be provided. One man, trapped behind a bridge that had washed out, had to have the gates at the airport opened for him to be escorted down the taxiway for planes to avoid the high water.

After meeting with the town council and the local emergency response group, Municipal and Provincial Affairs Minister Jack Byrne told **The Western Star** that he was proud to see how everyone quickly pulled together Tuesday morning.

"When you have some 140 mm of rain to deal with, it presents a pretty serious situation and it's hard to look at all the homes here in the water," said Byrne. "We (the provincial government) have been in contact with the federal government, who say they are prepared to assist."

Byrne said the level of destruction gives you some feeling, on a smaller scale, of what went on in New Orleans with hurricane Katrina. He said the section of his department that deals with emergencies will be there to work with all the groups and individuals to listen to concerns and alleviate problems that will come up due to the flooding.

He said he couldn't even estimate the cost of damages and said they will get a better picture when the water resides. He said the province is certainly concerned about getting the roads and bridges back to where they are safe.

Byrne said they will be looking to the federal government Disaster Financial Assistance Program to assist them in that regard. He said that program usually provides assistance to return infrastructure back to what it was prior to the flooding.

Joan Burke, legislature member for St. George's-Stephenville East, said she was shocked to see the devastation caused by the flooding. She said it's a serious situation and is pleased to see the province has acted quickly.

"We will see what we need to do as the clean up progresses and move forward from there," said Burke.

Today's weather forecast calls for clouds with sunny periods and a 40 per cent chance of showers in the morning.

**(See more coverage on Pages 2 and 3)**

Western Star. p.01 Sept. 28, 2005.

FL005

FLOODS

# FLOOD ZONE

Many homes in the flooded area have been gutted of possessions. Countless homes have garbage piled up outside of their homes including this one on Willowdale Drive.

## *Still waiting for word on damaged homes*

**By GLENDA McCARTHY**
*the Georgian*

**Replacing bridges, pavement, and infrastructure are just some of the things that representatives of the Town of Stephenville have been making decisions on since the flood on Sept. 27.**

**Stephenville Mayor Tom O'Brien says the town is still dealing with the aftermath of the flood, and the work needed to restore it to pre-flood conditions will not be finished for some time.**

"The engineer report we have right now relates to the Town's infrastructure in the flooded area," says Mayor O'Brien.

"The town's infrastructure is the water and sewer lines, roadways, pavement and that type of thing. In addition to that, it also includes the necessary work on the brook, and the raising and reinforcing of the banks on Blanche Brook."

Mayor O'Brien announced at a recent town council meeting that the estimate for this type of work is $3.3 million.

"That report is part of the process we have to work through to determine what it would cost to repair the damaged areas in preparation for everyone moving back into that area."

The same report identifies the cost of reclaiming the area as green space and doing the necessary work on Blanche Brook. It is estimated that the cost would be in the vicinity of $2 million.

"If you reclaim it as a green space area then the houses have to be removed, the town's infrastructure, although damaged, would have to be removed from the ground and the necessary work would have to be done on the brook. The engineering reports, and assessments we're waiting on now, would estimate the costs of repairing the damaged homes as well as estimating the cost of relocating the families affected."

But Mayor O'Brien says people's safety comes first.

"As one could appreciate, the cost of relocating the families will be considerably higher than returning them to the flooded area. The single most important consideration to be taken into account when making decisions to return people to the area or relocating the people has to be their safety. With that said, it is the town's preference to relocate."

While people may have noticed fewer pieces of heavy equipment working around the town, more work will soon be tendered out.

"Although there was a lot of emergency work done on Blanche Brook and Warm Brook there is still a lot of work to be done on both which will go out on tender. The work done to date is covered under EMO. The additional work remaining to be done will be covered to a degree by EMO."

The EMO has stated the town will be restored to pre-flood conditions.

"To date no work has been carried out on Gaudon's Brook as there were private land issues and because of this, we had to wait for the engineering work to be completed. This report is now gone to government for the appropriate approvals to get the necessary work completed this year."

While the mayor doesn't expect all of the work will be done this year, he expects a lot of it to be completed this year.

Meanwhile there is still a lot of garbage to be cleaned up from people cleaning out their homes in the flooded area.

"The tender for the cleanup of garbage will hopefully be done this week coming. It needs to be cleaned up but we couldn't do anything until the insurance adjusters were finished doing their jobs."

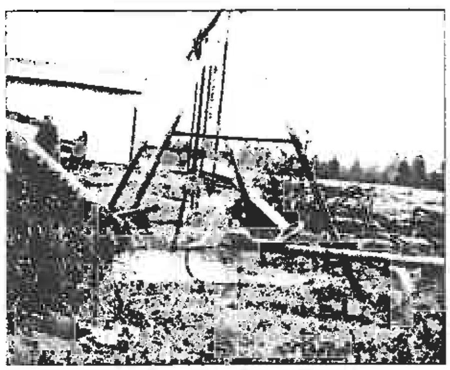
He says engineering reports have been submitted to government for approval of the following: installing a temporary (Bailey) bridge to replace the Kin Court bridge, necessary paving on Minnesota Drive, Brook Street and other areas, the lowering of Ned's Pond and the removal of Ned Pond's dam and the permanent water line repairs along Hanson Highway. The mayor says they are hoping to get started in the next week or two.

However, the one-lane bridge on Brook Street and a permanent bridge to replace the Kin Court bridge are two of the projects which will have to wait until next spring.

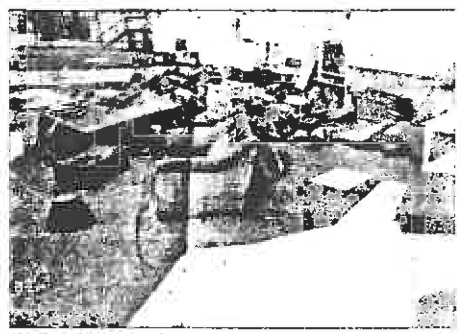
But Mayor O'Brien says the people affected by this disaster have been tremendous.

"They've been more than patient while we work through this process but again the most common, single concern expressed by individuals affected by the flood is their safety," he says.

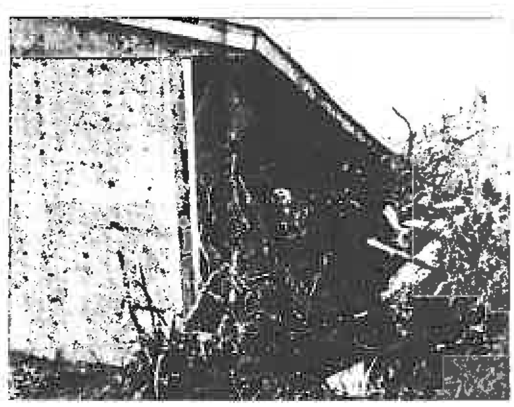
"When it comes to the safety issue, there is no question in my mind whether the brook will overflow its banks again - it's just a matter of when. Therefore the safety concern is very legitimate and that is why we as a town want to see the people relocated."



This swing set still stands on Blanch Street, however the fence is full of branches from trees. The area that was once grass is covered with debris, rocks and mud.



Endless bags, couch sets, mattresses and other furniture can be found outside some of the homes affected by the flooding on Sept. 27 such as this one on White's Avenue. The Town of Stephenville will award the contract to remove garbage from the area in the next week.



FLOODS

# Stephenville ravaged by flood waters

By JOHN HANRATTY
Transcontinental Community Newspapers

'Images of Louisiana flashed before residents' eyes in some parts of Stephenville when they looked out their windows Tuesday morning.

Heavy overnight rains had caused Blanche Brook to overflow its banks in the central part of town, threatening houses on a number of streets running off Queen Street toward the brook. At least 50 households were evacuated there and in the Noel's Pond area after a State of Emergency was declared at 9 a.m.

Municipal and school board elections were cancelled, schools and stores closed and a number of bridges in Stephenville and neighbouring Kippens were closed to traffic.

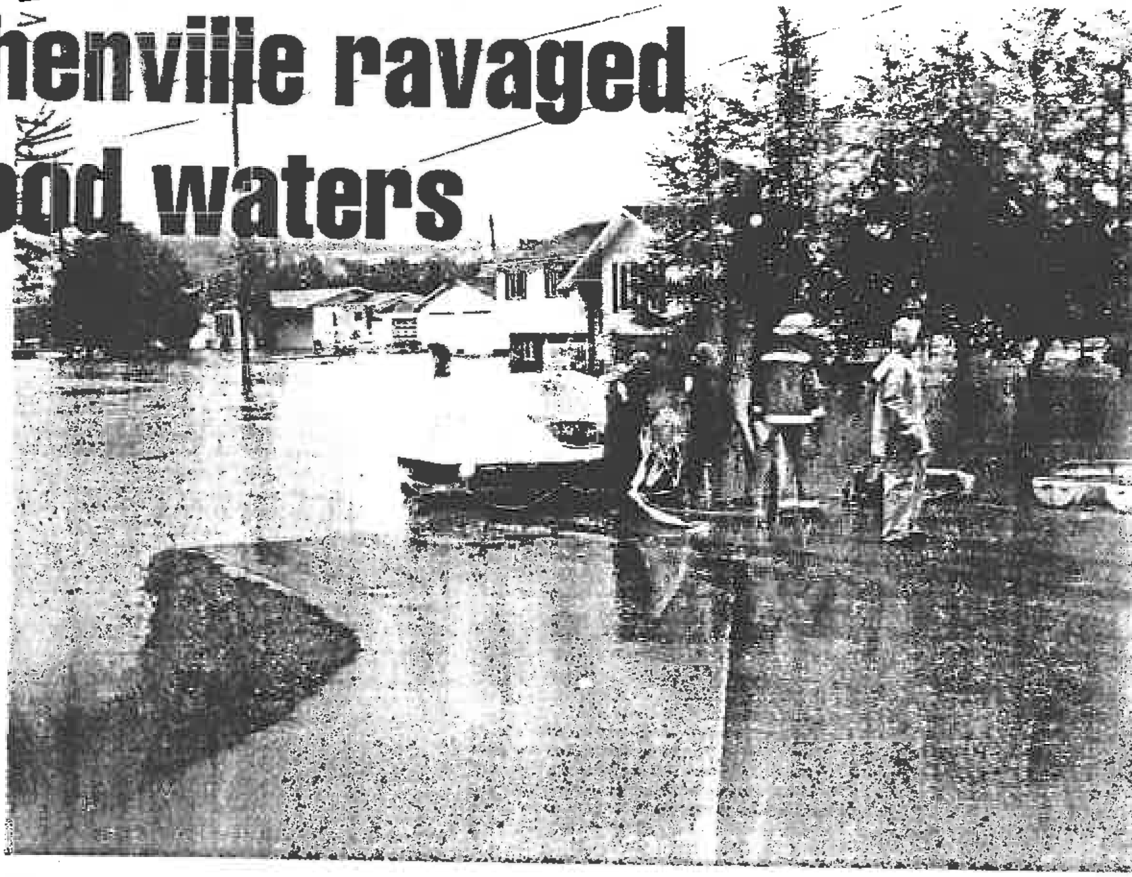
The heavy rains continued throughout Tuesday, with over 125 millimetres falling on Stephenville.

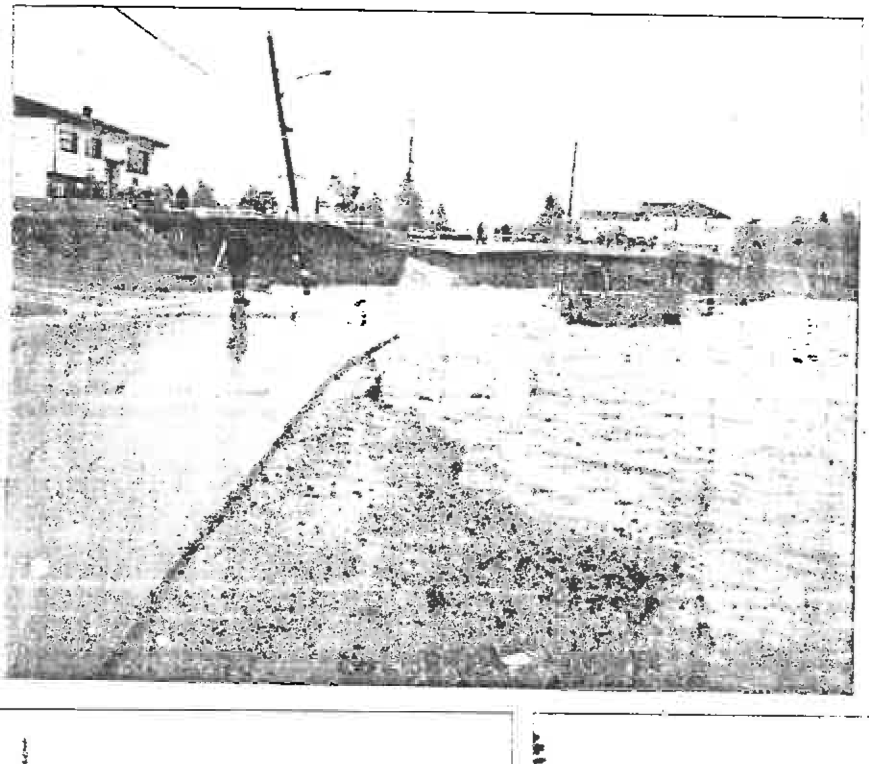
Mill Brook Lane in Kippens was washed out completely, isolating approximately a dozen houses.

Route 460 was closed in three places, including Kippens and Noel's Pond. The Trans-Canada Highway was reduced to one lane about five kilometres east of the turnoff to Gallants.

The election in the town of Stephenville will be rescheduled within seven days, and Education Minister Tom Hedderson will decide when the election in the Appalachia zone of the Western School District will be held.

*The Georgian*





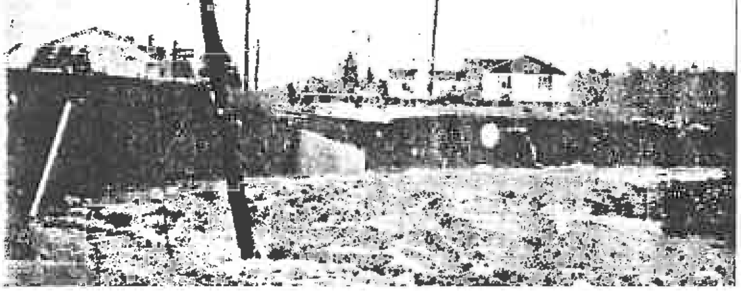
**ABOVE:** More than 200 homes were evacuated in Stephenville on Tuesday during heavy flooding. These houses are located between Queen Street and Blanche Brook, which overflowed.

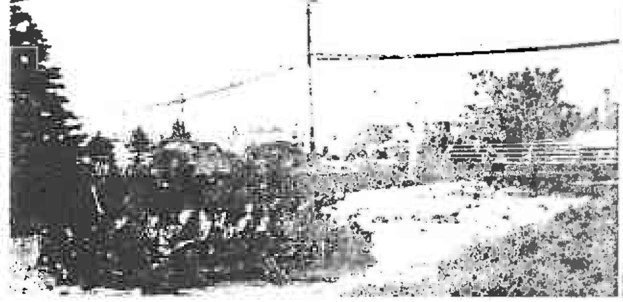
**BELOW:** The only bridge linking Stephenville with Kippens (and the Port au Port Peninsula) was built in 1994 after previous flooding, but it was in trouble again this week. Intensive efforts continued Tuesday and Wednesday to save the bridge and keep it open to one lane of traffic. Another bridge in town at the Kincourt washed out, two other bridges were closed, and two others were reduced to one lane.

**BELOW LEFT:** Municipal and school board elections were postponed, schools and businesses closed and health services reduced to emergency levels in Stephenville Tuesday. Twenty-four hours after a State of Emergency was declared, the town was still in rough shape as most houses were without water, and there was a boil water order in effect for the town.

*D. Hanratty photo*

**RIGHT:** MillBrook Lane in Kippens was washed out completely in Tuesday's flooding, isolating a number of residents.

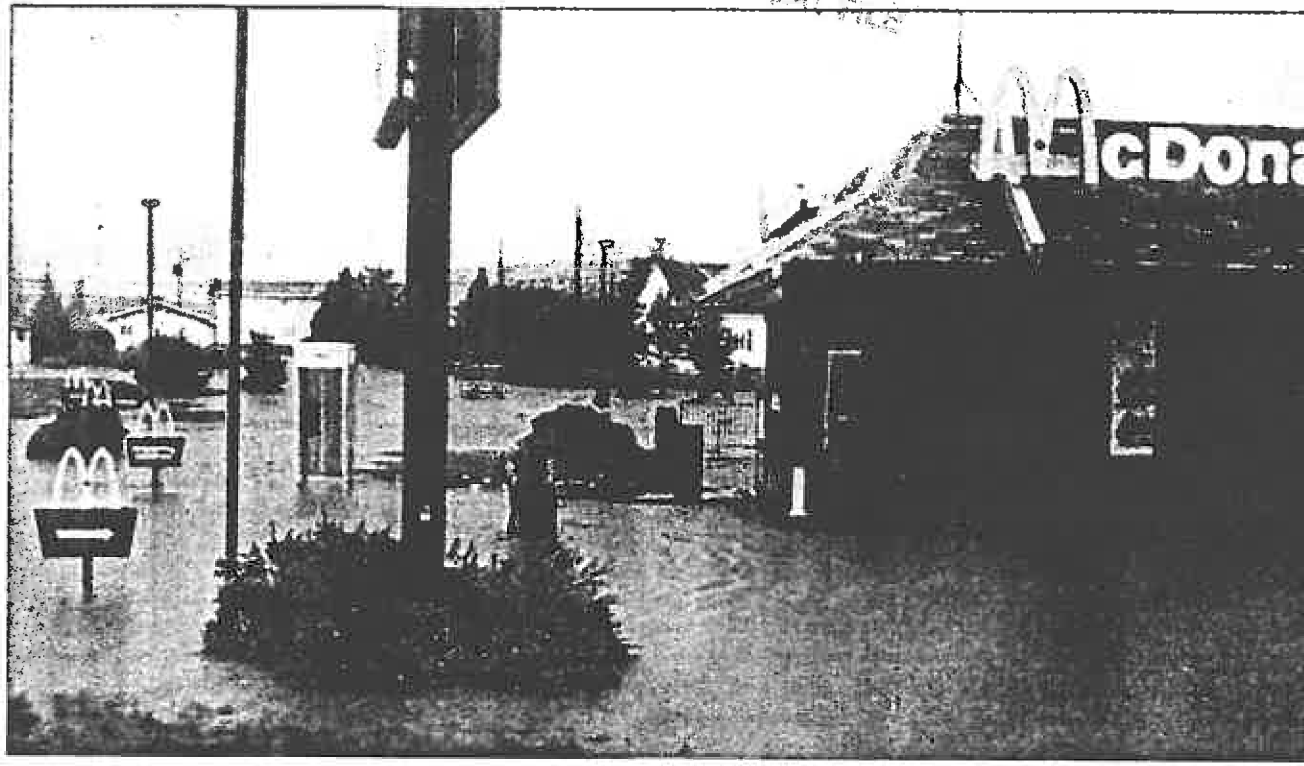


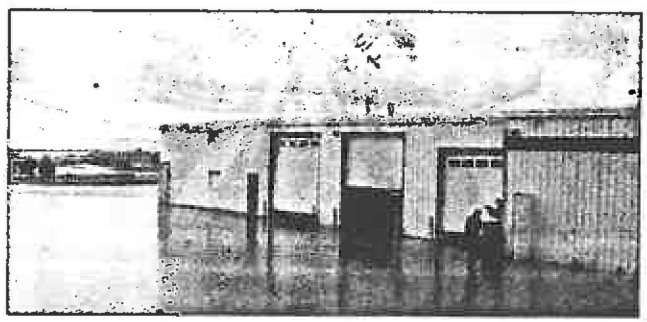


FLOODS

# STATE OF EMERGENCY





**Stephenville declared a state of emergency this week after 140 mm of rain fell over a 24-hour period. An estimated 200 of the town's 8,000 residents were evacuated from their homes.**

*Allison Furlong/For The Independent*

Independent p.7 v.3 #40 Oct. 21 2005

# Flood devastation worse than originally thought

V. 35 # 41 Oct. 11/2005

By JOHN HANRATTY
*the Georgian* p. 1

The Sept. 27 flood was bad, but the aftermath was even worse for many people living in the Stephenville flood zone.

When the waters receded after the flooding of Blanche Brook, a whole new set of nasty problems began to emerge. Sewage and water lines in the area were severely damaged, with back-ups resulting. There was also oil pollution from damaged oil tanks. Mould quickly began growing in some homes.

After a few days of assessing the situation, the authorities rendered their verdict. On Saturday, Oct. 1, the Emergency Command Centre issued an Isolation and Evacuation Order. In all, 156 homes were essentially declared unlivable, at least temporarily. It is expected to be permanent in many cases.

Residents were told to move into alternate accommodation as soon as possible. The weekend of Oct. 1-2 saw a mass exodus as an entire neighbourhood rushed to move out. Residents tried to salvage whatever furniture, appliances and possessions they could get out of the buildings.

The new evacuation order cited "health and environmental concerns related to the massive destruction of the water and sewer distribution system."

Some residents were confused and alarmed by what was happening, yet many apparently feel they do not want to move back into the stricken neighbourhood in any case.

The Town organized a closed-door meeting Oct. 5 for the residents, with spokespersons from a number of government departments, agencies and the town.

One resident preferring to remain nameless said they were told that decisions about individual homes could take many months. However, an Emergency Measures Organization spokesman described what happened in Badger after their serious flood a couple of years ago.

In that case, homeowners were basically provided with new homes. If they had mortgages on their old homes, these were transferred to the new residences. If they were mortgage-free, they received their new homes mortgage-free as well.

Landlords did not receive new buildings, as the program was just for the replacement of one's primary residence, not rental properties.

Of course, all this took many months to accomplish.

The provincial government is holding an additional information session for flood-impacted residents of Stephenville, the Port au Port Peninsula and the Bay St. George area. It is open to all members of the public but is primarily intended for residents who did not attend the Oct. 5 meeting.

This session will be held on Tuesday, Oct. 11 at Stephenville Elementary School at 7 p.m., and various government officials will be present.

## Rainfall broke two records

The Sept. 27 rain that caused all the havoc in Western Newfoundland did break some local records.

The information comes from Herb Thoms, Weather Preparedness Meteorologist for Environment Canada in Gander. He explains that first of all, his agency measures daily records beginning not at midnight but at 3:30 a.m. and running for 24 hours till 3:30 the next morning.

On this basis, 75 millimetres (mm) of rain fell in Stephenville on Sept. 26 and another 76.4 mm fell on Sept. 27. That was the most rainfall that ever fell on a Sept. 27 in the local area.

More significantly, it was also the highest two-day rainfall ever in Stephenville, at 151.4 mm.

By comparison, Rocky Harbour received over 100 mm and Deer Lake 86.6 from this same 'event' or two-day period.

Stephenville's rainfall did not set any provincial records that Mr. Thoms is aware of. There have been greater two-day rainfalls. For instance, last March, Burin received 160 mm in two days.

There have been unofficial counts of 200 mm in some localities. But the record seems to be held at Baie d'Espoir with 238 mm in 1983. The highest count for St. John's for two days is apparently 131 mm.

FL0005

ENVIRONMENT

# Hundreds evacuated

## *Torrential rain floods Stephenville area*

The Canadian Press
**AND MICHAEL RIGLER, FRANK GALE AND CORY HURLEY**
Transcontinental Media—Corner Brook

Hundreds of people in western Newfoundland were evacuated from their homes and a state of emergency declared as rain-filled rivers flooded downtown Stephenville Tuesday.

Town officials watched anxiously after more than 110 millimetres of rain fell on the region by mid-morning.

Mayor Cec Stein said the crisis started early in the morning when it became clear that two rivers running through town were going to breach their banks.

The town declared a state of emergency and officials began a door-to-door evacuation of low-lying areas at 7:30 a.m. as the flooding began.

"(Residents) were watching it and most of them left (on their own)," Stein said. "We had to rescue a few people with a front-end loader ... and a couple more with a Zodiac."

About 80 homes flooded, some with water up to the kitchen windows.

While Stephenville has experienced flooding in the past, residents say Tuesday's high waters were the worse ever in the town.

"I've been living here since 1965 and while I had water in my house before, it was never anywhere close to this," said Rodney Gale of Brookside Drive.

**See PREMIER, page A2**

# Premier, MHAs tour stricken areas

Continued from page A1

Down the street, Mary White said never in a million years did she expect the flooding would reach her house. She had 18 inches of water in the lower level of her split level house.

However, White felt things could have been worse, saying her heart goes out to an elderly neighbour, Angus Loder, whose house was pushed off its moorings by the flood and ended up partially on the street.

Up to 200 of the town's 8,000 residents had to leave their homes and several dozen vehicles were submerged, Stein said.

Another 20 to 30 millimetres of rain were forecast for Tuesday but the mayor said the low-lying areas had already flooded and other areas of town were not at risk, regardless of any additional rainfall.

Stein said he expected flood waters could recede in as quickly as 24 hours.

The province and the Canadian Red Cross had set up a reception centre in the provincial armoury but Stein said most evacuees had taken refuge with family members and friends whose homes were above the flood area.

Although the three bridges in Stephenville were intact, the roadways leading to the bridges had washed away, Stein said.

Severe damage was also reported in nearby Noels Pond and Black Duck Siding.

In Kippens, one bridge was closed and a major road washed away. Several roadways in and out of small communities surrounding Stephenville were flooded, including the Trans-Canada Highway.

Police closed several roads and were advising motorists to stay off those that remained open.

Traffic on the TCH between Pasadena and Deer Lake came to a standstill shortly after 3 p.m. Tuesday when the road was closed at Pynn's Brook due to a washout at the bridge.

The highway was eroded to the centre line about 20 metres from each side of the bridge, leaving workers scrambling to fill and restore that section. One lane was re-opened later in the evening and Gerry Antle, the regional director for Transportation and Works on the west coast, said traffic would likely be disrupted into the morning.

"We are making headway now because the rain has stopped and water conditions are receding somewhat," Antle told The Western Star from the town office of Stephenville, where the Emergency Measures Organization had set up.

"It is starting to stabilize, in that the water is receding, so the ground conditions at the road is stabilized. We are just putting fill on both sides now, so we don't think it is that serious to this point. We don't think we are going to lose a bridge."

The local hospital in Stephenville cancelled scheduled services and was only providing emergency and essential services Tuesday.

The Western Regional Integrated Health Authority asked people living east of Pynn's Brook to contact the emergency department at Western Memorial Regional Hospital in Corner Brook in case of medical emergency.

The Deer Lake area was hit with over 75 millimetres of rain throughout the day and the RCMP detachment was busy patrolling the roads. Police said at times during the day water was pouring off the Route 430 overpass and onto the TCH below, making driving conditions all the more hazardous.

FRANK GALE/THE WESTERN STAR

**Using inflatable rafts, members of the Marine Institute safety emergency response training program visit homes in Stephenville to search for people in the need of rescue Tuesday.**

The torrential rains forced municipal election polls to close early in the communities of Deer Lake, Reidville and Cormack.

Deer Lake returning officer Maxine Hayden said she closed the polling station down at 5 p.m.

"I phoned Municipal Affairs and the RCMP and based on the information I was given at the time, the decision was made to close the polls until the road was open again," Hayden told The Western Star. "When I spoke with the RCMP, I was told there was no chance of the road being opened until late Tuesday or early today.

"With the road open now, we're going to go ahead and open the polls from 5 p.m. until 8 p.m. (tonight). It's not a call you want to have to make, but based on the information I had and the low turnout we were seeing, it seemed to be the only thing to do."

Municipal Affairs Minister Jack Byrne and Joan Burke, the area's representative in the provincial legislature, arrived in the area Tuesday afternoon. Premier Danny Williams also toured the flooded area.

He said he has been in touch with Prime Minister Paul Martin, and has heard that Ottawa is going to assist in the situation.

"He is concerned and we have the attention and assistance of the federal government," he said.

"That's why I'm on my way to try and get a handle of things on the ground."

The heavy rainfall was not directly related to hurricane Rita, which pummelled the American east coast last week.

It was the result of a regular low pressure system that brought heavy rainfall throughout much of Atlantic Canada, according to Environment Canada.

*The Western Star*

Environment Canada Environnement Canada

## Station Results

14 locations match your customized search. Confirm the Data Interval and Date for one of the locations l display the data.

| Station | Prov | Data Interval | Day | Month | |
|---|---|---|---|---|---|
| BLACK DUCK | NFLD | Daily | 29 | Feb | 2004 |
| CARTYVILLE | NFLD | Daily | 29 | Feb | 2004 |
| GALLANTS | NFLD | Daily | 29 | Feb | 2004 |
| HEATHERTON | NFLD | Daily | 30 | Nov | 1956 |
| JEFFREY'S | NFLD | Daily | 31 | Jul | 1995 |
| LOCKLEVEN | NFLD | Daily | 30 | Jun | 1997 |
| LOOKOUT BROOK | NFLD | Daily | 31 | Aug | 1956 |
| LOURDES | NFLD | Daily | 29 | Feb | 2004 |
| PICCADILLY | NFLD | Daily | 30 | Jun | 1989 |
| SANDY POINT | NFLD | Daily | 31 | Mar | 1912 |
| ST GEORGES | NFLD | Daily | 31 | May | 1945 |
| ST GEORGES | NFLD | Daily | 30 | Sep | 1993 |
| STEPHENVILLE A | NFLD | Hourly | 30 | Oct | 2005 |
| STEPHENVILLE CROSSING | NFLD | Daily | 30 | Nov | 1967 |

Important Notices

Created : 2002-06-21
Modified : 2004-05-13
Reviewed : 2004-05-13
Url of this page : http://www.climate.weatheroffice.ec.gc.ca/advanceSearch/searchHistoricDataStations_e.html

The Green Lane™,
Environment Canada's World Wide Web Site.

Canada

up to 1990

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

TABLE 2 STEPHENVILLE AIRPORT NFLD 8403800

LATITUDE 4832 LONGITUDE 5833 ELEVATION/ALTITUDE 24 M

RETURN PERIOD RAINFALL AMOUNTS (MM)
PERIODE DE RETOUR QUANTITIES DE PLUIE (MM)

| DURATION DUREE | 2 YR/ANS | 5 YR/ANS | 10 YR/ANS | 25 YR/ANS | 50 YR/ANS | 100 YR/ANS | # YEARS ANNEES |
|---|---|---|---|---|---|---|---|
| 5 MIN | 4.0 | 5.4 | 6.3 | 7.5 | 8.4 | 9.2 | 23 |
| 10 MIN | 6.4 | 9.3 | 11.2 | 13.6 | 15.4 | 17.1 | 23 |
| 15 MIN | 7.9 | 11.5 | 13.8 | 16.8 | 19.0 | 21.1 | 23 |
| 30 MIN | 10.8 | 15.9 | 19.4 | 23.7 | 26.9 | 30.1 | 23 |
| 1 H | 15.3 | 21.3 | 25.3 | 30.3 | 34.0 | 37.6 | 23 |
| 2 H | 20.9 | 28.2 | 33.0 | 39.1 | 43.6 | 48.1 | 23 |
| 6 H | 35.8 | 46.8 | 54.1 | 63.3 | 70.2 | 77.0 | 23 |
| 12 H | 44.2 | 55.4 | 62.8 | 72.1 | 79.1 | 85.9 | 23 |
| 24 H | 57.1 | 73.9 | 85.1 | 99.2 | 109.7 | 120.1 | 23 |

RETURN PERIOD RAINFALL RATES (MM/HR)-95% CONFIDENCE' LIMITS
INTENSITE DE LA PLUIE PAR PERIODE DE RETOUR (MM/H)-LIMITES DE CONFIANCE DE 9

| DURATION DUREE | 2 YR/ANS | 5 YR/ANS | 10 YR/ANS | 25 YR/ANS | 50 YR/ANS | 100 YR/ANS |
|---|---|---|---|---|---|---|
| 5 MIN | 48.1 | 64.9 | 76.1 | 90.1 | 100.5 | 110.9 |
| | +/- 7.1 | +/- 12.0 | +/- 16.2 | +/- 21.9 | +/- 26.2 | +/- 30.5 |
| 10 MIN | 38.7 | 55.8 | 67.2 | 81.5 | 92.2 | 102.8 |
| | +/- 7.3 | +/- 12.3 | +/- 16.6 | +/- 22.3 | +/- 26.7 | +/- 31.1 |
| 15 MIN | 31.8 | 45.9 | 55.2 | 67.1 | 75.8 | 84.5 |
| | +/- 6.0 | +/- 10.1 | +/- 13.6 | +/- 18.4 | +/- 22.0 | +/- 25.6 |
| 30 MIN | 21.6 | 31.9 | 38.7 | 47.4 | 53.8 | 60.1 |
| | +/- 4.4 | +/- 7.4 | +/- 10.0 | +/- 13.4 | +/- 16.1 | +/- 18.7 |
| 1 H | 15.3 | 21.3 | 25.3 | 30.3 | 34.0 | 37.6 |
| | +/- 2.5 | +/- 4.3 | +/- 5.8 | +/- 7.8 | +/- 9.3 | +/- 10.8 |
| 2 H | 10.5 | 14.1 | 16.5 | 19.5 | 21.8 | 24.0 |
| | +/- 1.5 | +/- 2.6 | +/- 3.5 | +/- 4.7 | +/- 5.7 | +/- 6.6 |
| 6 H | 6.0 | 7.8 | 9.0 | 10.6 | 11.7 | 12.8 |
| | +/- 0.8 | +/- 1.3 | +/- 1.8 | +/- 2.4 | +/- 2.9 | +/- 3.3 |
| 12 H | 3.7 | 4.6 | 5.2 | 6.0 | 6.6 | 7.2 |
| | +/- 0.4 | +/- 0.7 | +/- 0.9 | +/- 1.2 | +/- 1.5 | +/- 1.7 |
| 24 H | 2.4 | 3.1 | 3.5 | 4.1 | 4.6 | 5.0 |
| | +/- 0.3 | +/- 0.5 | +/- 0.7 | +/- 0.9 | +/- 1.1 | +/- 1.3 |

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

*********************************************************************************

TABLE 3 STEPHENVILLE AIRPORT NFLD 8403800

LATITUDE 4832 LONGITUDE 5833 ELEVATION/ALTITUDE 24 M

*********************************************************************************

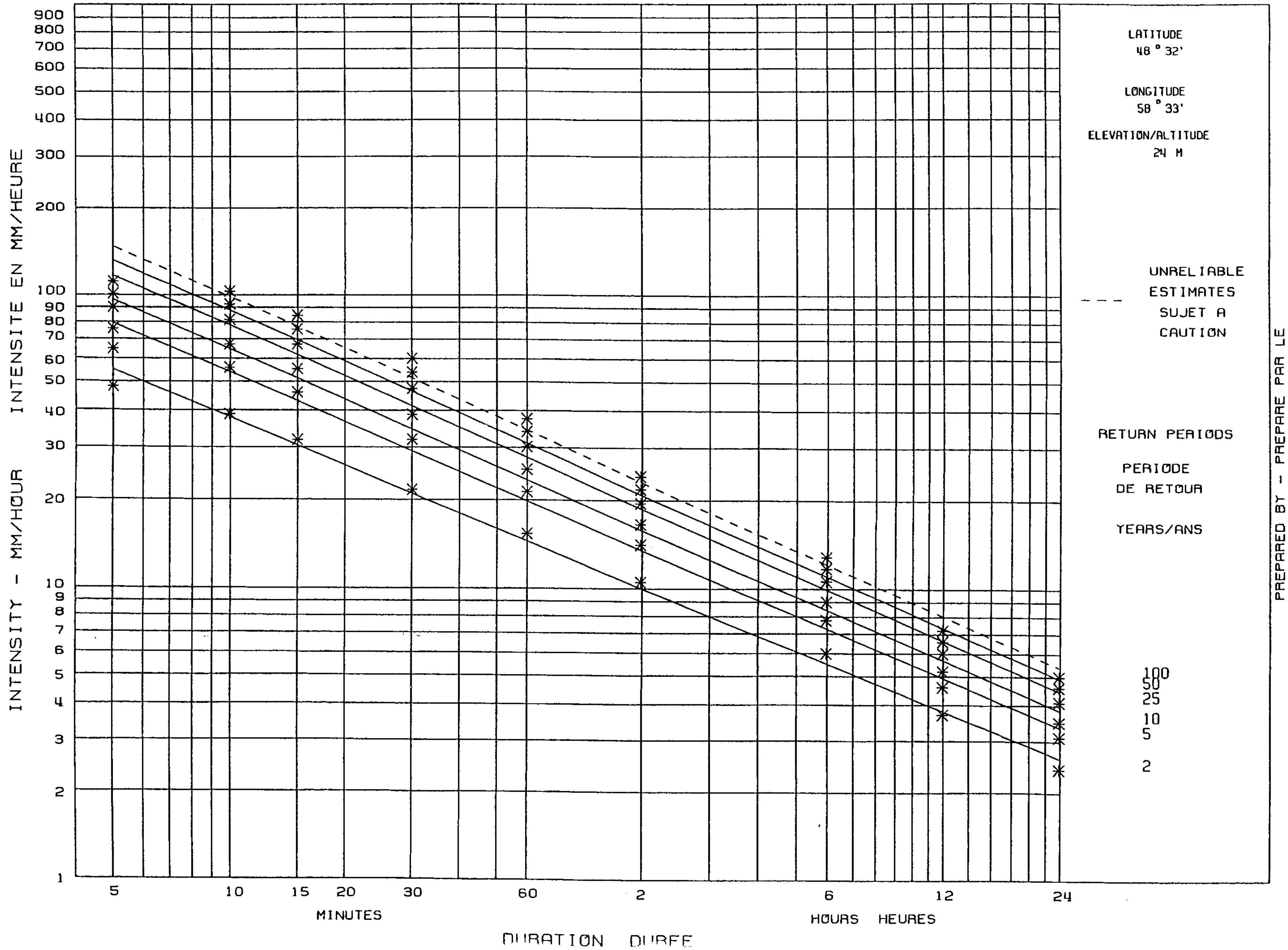
INTERPOLATION EQUATION / EQUATION D"INTERPOLATION: R = A * T ** B
R = RAINFALL RATE / INTENSITE DE LA PLUIE (MM /HR)
T = TIME IN HOURS / TEMPS EN HEURES

| STATISTICS<br>STATISTIQUES | 2 YR<br>ANS | 5 YR<br>ANS | 10 YR<br>ANS | 25 YR<br>ANS | 50 YR<br>ANS | 100 YR<br>ANS |
|---|---|---|---|---|---|---|
| MEAN OF R<br>MOYENNE DE R | 19.7 | 27.7 | 32.9 | 39.6 | 44.5 | 49.4 |
| STD. DEV. R<br>ECART-TYPE | 16.4 | 23.1 | 27.6 | 33.2 | 37.4 | 41.6 |
| STD. ERROR<br>ERREUR STANDARD | 2.7 | 5.8 | 7.9 | 10.5 | 12.5 | 14.4 |
| COEFF. (A)<br>COEFFICIENT (A) | 14.4 | 19.8 | 23.4 | 27.8 | 31.1 | 34.4 |
| EXPONENT (B)<br>EXPOSANT (B) | -0.537 | -0.559 | -0.568 | -0.576 | -0.580 | -0.584 |
| MEAN % ERROR<br>% D'ERREUR | 6.0 | 8.2 | 9.1 | 10.0 | 10.5 | 10.9 |

SHORT DURATION RAINFALL INTENSITY-DURATION FREQUENCY DATA FOR-
DONNEES SUR L'INTENSITE, LA DUREE ET LA FREQUENCE DES CHUTES DE PLUIE DE COURTE DUREE A STEPHENVILLE AIRPORT NFLD

GUMBEL-METHOD OF MOMENTS
METHODE DES MOMENTS

BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD-
BASEES SUR LES DONNEES DU PLUVIOGRAPHES POUR LA PERIOD 1967 - 1990 23 YEARS/AN




ATMOSPHERIC ENVIRONMENT SERVICE - ENVIRONMENT CANADA
SERVICE DE L'ENVIRONNEMENT ATMOSPHERIQUE - ENVIRONNEMENT CANADA

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

DATA INTEGRATION DIVISION
LA DIVISION DU TRAITEMENT DES DONNEES

GUMBEL - METHOD OF MOMENTS/METHODE DES MOMENTS - 1990

*******************************************************************************

TABLE 1 STEPHENVILLE AIRPORT NFLD 8403800

LATITUDE 4832 LONGITUDE 5833 ELEVATION/ALTITUDE 24 M

*******************************************************************************

| YEAR ANNEE | 5 MIN | 10 MIN | 15 MIN | 30 MIN | 1 H | 2 H | 6 H | 12 H | 24 H |
|---|---|---|---|---|---|---|---|---|---|
| 1967 | 4.3 | 7.9 | 8.9 | 14.0 | 18.0 | 18.5 | 25.4 | 38.6 | 51.8 |
| 1968 | 4.1 | 6.9 | 8.1 | 8.6 | 14.0 | 17.0 | 36.6 | 52.8 | 70.6 |
| 1969 | 2.3 | 3.3 | 4.1 | 5.8 | 7.6 | 14.5 | 29.7 | 48.3 | 58.4 |
| 1970 | 4.8 | 8.6 | 8.6 | 9.1 | 14.0 | 21.6 | 39.6 | 41.4 | 54.9 |
| 1971 | 3.8 | 5.6 | 7.9 | 11.2 | 16.8 | 21.6 | 37.6 | 47.5 | 57.4 |
| 1972 | 6.1 | 7.4 | 9.1 | 12.7 | 15.7 | 25.1 | 40.9 | 43.4 | 48.8 |
| 1973 | 2.8 | 5.3 | 7.1 | 10.7 | 20.6 | 37.6 | 49.0 | 52.8 | 89.7 |
| 1974 | 3.3 | 4.3 | 6.6 | 11.4 | 18.5 | 25.7 | 47.0 | 60.5 | 63.0 |
| 1975 | 5.6 | 8.6 | 9.4 | 9.9 | 14.5 | 16.3 | 32.8 | 36.3 | 41.1 |
| 1976 | 3.0 | 5.3 | 6.6 | 7.9 | 10.4 | 13.5 | 22.9 | 33.8 | 36.6 |
| 1978 | 2.3 | 3.3 | 4.6 | 7.9 | 11.2 | 17.3 | 23.5 | 34.3 | 42.0 |
| 1979 | 5.1 | 10.1 | 13.6 | 16.7 | 22.6 | 33.5 | 74.4 | 87.5 | 98.0 |
| 1980 | 4.6 | 6.4 | 7.8 | 11.4 | 18.0 | 19.6 | 36.3 | 44.4 | 59.4 |
| 1981 | 3.1 | 5.0 | 5.5 | 7.3 | 10.4 | 16.0 | 31.1 | 34.0 | 52.1 |
| 1982 | 3.3 | 4.0 | 5.4 | 6.6 | 11.1 | 14.2 | 30.0 | 35.7 | 44.8 |
| 1983 | 3.8 | 6.0 | 7.4 | 10.0 | 14.6 | 20.9 | 45.3 | 52.2 | 82.4 |
| 1984 | 4.5 | 5.5 | 6.8 | 10.2 | 13.8 | 18.2 | 28.1 | 41.1 | 63.2 |
| 1985 | 2.9 | 5.5 | 6.4 | 8.0 | 9.9 | 13.3 | 23.0 | 31.8 | 32.6 |
| 1986 | 3.6 | 6.2 | 7.3 | 10.4 | 16.8 | 22.3 | 23.7 | 33.8 | 46.1 |
| 1987 | 4.6 | 7.8 | 9.4 | 14.0 | 18.0 | 27.4 | 41.0 | 44.0 | 49.9 |
| 1988 | 6.5 | 10.8 | 14.2 | 21.7 | 22.2 | 22.4 | 53.1 | 56.0 | 56.0 |
| 1989 | 4.4 | 7.9 | 9.7 | 11.5 | 17.7 | 29.6 | 47.1 | 59.5 | 97.5 |
| 1990 | 9.4 | 18.7 | 23.2 | 33.2 | 41.5 | 46.3 | 51.5 | 54.6 | 88.9 |

NOTE:-99.9 INDICATES MSG DATA
DONNEES MANQUANTES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| # YRS. ANNEES | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| MEAN MOYENNE | 4.3 | 7.0 | 8.6 | 11.7 | 16.4 | 22.3 | 37.8 | 46.3 | 60.2 |
| STD. DEV. ECART-TYPE | 1.6 | 3.2 | 4.0 | 5.8 | 6.8 | 8.2 | 12.5 | 12.6 | 19.1 |
| SKEW DISSYMETRIE | 1.61 | 2.26 | 2.47 | 2.59 | 2.34 | 1.45 | 1.07 | 1.58 | 0.78 |
| KURTOSIS KURTOSIS | 7.06 | 10.32 | 10.79 | 11.12 | 11.22 | 5.41 | 5.04 | 7.03 | 2.99 |

WARNING / AVERTISSEMENT
YEAR 1979 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1979 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS

DATA/LA VALEUR = 87.5 100 YEAR/ANNEE = 85.9

WARNING / AVERTISSEMENT
YEAR 1990 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1990 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS
DATA/LA VALEUR = 9.4 100 YEAR/ANNEE = 9.2

WARNING / AVERTISSEMENT
YEAR 1990 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1990 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS
DATA/LA VALEUR = 18.7 100 YEAR/ANNEE = 17.1

WARNING / AVERTISSEMENT
YEAR 1990 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1990 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS
DATA/LA VALEUR = 23.2 100 YEAR/ANNEE = 21.1

WARNING / AVERTISSEMENT
YEAR 1990 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1990 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS
DATA/LA VALEUR = 33.2 100 YEAR/ANNEE = 30.1

WARNING / AVERTISSEMENT
YEAR 1990 HAD VALUE GREATER THAN 100 YEAR STORM.
EN 1990 L"INTENSITE DE LA PLUIE A DE PASSE
CELLE POUR UNE PERIODE DE RETOUR DE 100 ANS
DATA/LA VALEUR = 41.5 100 YEAR/ANNEE = 37.6

NOTE: -99.9 INDICATES LESS THAN 10 YEARS OF DATA AVAILABLE
INDIQUE MOINS DE 10 ANNEES DE DONNEES DISPONIBLES

# Blanche Brook Watershed

Environment Canada Environnement Canada

# Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

*NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.*

## STEPHENVILLE A *
## NEWFOUNDLAND

**Latitude**: 48° 31' N **Longitude**: 58° 33' W **Elevation**: 25.60 m

**Climate ID**: 8403800 **WMO ID**: 71815 **TC ID**: YJT

*** This station meets WMO standards for temperature and precipitation.**

| Temperature: | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily Average (°C) | -6.2 | -7.5 | -3.6 | 2.3 | 7.4 | 12 | 16.1 | 16.2 | 12.2 | 6.9 | |
| Standard Deviation | 1.7 | 2.8 | 2.6 | 1.9 | 1.6 | 1 | 1.2 | 0.8 | 1.1 | 1 | |
| Daily Maximum (°C) | -2.5 | -3.2 | 0.7 | 6 | 11.6 | 16.3 | 19.9 | 20.1 | 16.1 | 10.3 | |
| Daily Minimum (°C) | -9.9 | -11.8 | -7.9 | -1.5 | 3 | 7.6 | 12.2 | 12.3 | 8.3 | 3.5 | |
| Extreme Maximum (°C) | 12.4 | 12.7 | 19.7 | 23.8 | 27.2 | 30 | 30.6 | 29.9 | 29.1 | 22.2 | |
| Date (yyyy/dd) | 1986/28 | 1996/17 | 1999/29 | 1986/26 | 1950/26 | 1954/27 | 1949/31+ | 2001/01 | 1989/10 | 1946/01+ | 1 |
| Extreme Minimum (°C) | -26.1 | **-29.5** | -29.2 | -15.6 | -7.1 | -1.1 | 3.9 | 2.2 | -0.7 | -5.6 | |
| Date (yyyy/dd) | 1957/29 | 1990/05 | 1990/08 | 1994/02 | 1993/11 | 1943/01+ | 1974/07 | 1975/25+ | 1986/21 | 1969/31 | 1 |
| **Precipitation:** | | | | | | | | | | | |
| Rainfall (mm) | 34.8 | 28.8 | 37.5 | 55.4 | 93.7 | 102.3 | 117.4 | 122.8 | 127.9 | 126.6 | |
| Snowfall (cm) | 114.6 | 82.2 | 60.5 | 20.9 | 4.2 | 0 | 0 | 0 | 0.1 | 3.7 | |
| Precipitation (mm) | 134.5 | 102.1 | 93.7 | 75.6 | 98.1 | 102.3 | 117.4 | 122.8 | 128 | 130.2 | |
| Average Snow Depth (cm) | 43 | 58 | 43 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Median Snow Depth (cm) | 43 | 58 | 42 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Snow Depth at Month-end (cm) | 51 | 61 | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Extreme Daily Rainfall (mm) | 52.8 | 83.8 | 50.8 | 68.8 | 53.6 | **130.7** | 84.1 | 96 | 72.1 | 50.2 | |
| Date (yyyy/dd) | 1979/08 | 1946/22 | 1968/20 | 1994/07 | 1993/14 | **1995/08** | 1979/17 | 1989/05 | 1943/25 | 2000/10 | 1 |
| Extreme Daily Snowfall (cm) | **56.1** | 41.7 | 34 | 21.1 | 14 | 2.5 | 0 | 0 | 2.4 | 12.7 | |
| Date (yyyy/dd) | **1973/31** | 1964/17 | 1993/14 | 1964/02 | 1963/10 | 1946/01 | 1942/01+ | 1942/01+ | 1989/27 | 1969/23 | 1 |
| Extreme Daily Precipitation (mm) | 58.8 | 94 | 50.8 | 68.8 | 58.9 | **130.7** | 84.1 | 96 | 81 | 50.2 | |
| Date (yyyy/dd) | 1979/08 | 1946/22 | 1968/20 | 1994/07 | 1954/22 | **1995/08** | 1979/17 | 1989/05 | 1955/21 | 2000/10 | 1 |
| Extreme Snow Depth (cm) | 151 | 169 | **183** | 97 | 9 | 0 | 0 | 0 | 0 | 10 | |
| Date (yyyy/dd) | 1982/19 | 2001/25 | **1967/19+** | 1997/03+ | 1997/01 | 1954/01+ | 1954/01+ | 1954/01+ | 1954/01+ | 1969/23 | 1 |
| **Days with Maximum Temperature:** | | | | | | | | | | | |
| <=0 °C | 21.5 | 20.4 | 13.5 | 2.1 | 0.07 | 0 | 0 | 0 | 0 | 0 | |
| > 0 °C | 9.5 | 7.9 | 17.5 | 27.9 | 30.9 | 30 | 31 | 31 | 30 | 31 | |
| > 10 °C | 0.2 | 0.33 | 0.9 | 5.3 | 19.5 | 28.3 | 31 | 31 | 29 | 15.5 | |
| > 20 °C | 0 | 0 | 0 | 0.1 | 0.97 | 5.2 | 14.3 | 14.8 | 2.9 | 0.21 | |
| > 30 °C | 0 | 0 | 0 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0 | |
| > 35 °C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| **Days with Minimum Temperature:** | | | | | | | | | | | |
| > 0 °C | 0.83 | 0.73 | 2.9 | 10.1 | 25.3 | 29.9 | 31 | 31 | 29.9 | 26.5 | |
| <= 2 °C | 30.6 | 27.9 | 29.8 | 25.9 | 12.6 | 1.3 | 0 | 0 | 1 | 11.1 | |
| <= 0 °C | 30.2 | 27.5 | 28.1 | 19.9 | 5.7 | 0.1 | 0 | 0 | 0.1 | 4.5 | |
| < -2 °C | 28.7 | 26.2 | 24.2 | 12.4 | 1.6 | 0 | 0 | 0 | 0 | 0.93 | |
| < -10 °C | 15.2 | 17.2 | 11.1 | 0.67 | 0 | 0 | 0 | 0 | 0 | 0 | |
| < -20 °C | 0.4 | 2.5 | 1.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| < -30 °C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| **Days with Rainfall:** | | | | | | | | | | | |
| >= 0.2 mm | 5.5 | 4.5 | 6.9 | 9.7 | 13.9 | 14.2 | 15.3 | 14.9 | 16.1 | 18.4 | |
| >= 5 mm | 2.2 | 1.8 | 2.7 | 3.7 | 5.6 | 6.2 | 6.9 | 6.9 | 7.4 | 7.8 | |
| >= 10 mm | 1.1 | 0.93 | 1.1 | 1.7 | 3.3 | 3.3 | 4.2 | 4.1 | 4.7 | 4.4 | |
| >= 25 mm | 0.2 | 0.17 | 0.13 | 0.27 | 0.63 | 0.63 | 0.77 | 1.1 | 0.93 | 0.89 | |
| **Days With Snowfall:** | | | | | | | | | | | |
| >= 0.2 cm | 25 | 19.9 | 15 | 7.9 | 1.6 | 0 | 0 | 0 | 0.13 | 1.8 | |
| >= 5 cm | 7.9 | 5.2 | 3.9 | 1.1 | 0.2 | 0 | 0 | 0 | 0 | 0.18 | |

Environment Canada Environnement Canada

# Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a code for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

*NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.*

## STEPHENVILLE A *
## NEWFOUNDLAND

Latitude: 48° 31' N Longitude: 58° 33' W Elevation: 25.60 m
Climate ID: 8403800 WMO ID: 71815 TC ID: YJT

*** This station meets WMO standards for temperature and precipitation.**

| Temperature: | Jan | Feb | Mar | Apr | May |
|---|---|---|---|---|---|
| Daily Average (°C) | -6.2 | -7.5 | -3.6 | 2.3 | 7.4 |
| Standard Deviation | 1.7 | 2.8 | 2.6 | 1.9 | 1.6 |
| Daily Maximum (°C) | -2.5 | -3.2 | 0.7 | 6 | 11.6 |
| Daily Minimum (°C) | -9.9 | -11.8 | -7.9 | -1.5 | 3 |
| Extreme Maximum (°C) | 12.4 | 12.7 | 19.7 | 23.8 | 27.2 |
| Date (yyyy/dd) | 1986/28 | 1996/17 | 1999/29 | 1986/26 | 1950/26 |
| Extreme Minimum (°C) | -26.1 | **-29.5** | -29.2 | -15.6 | -7.1 |
| Date (yyyy/dd) | 1957/29 | **1990/05** | 1990/08 | 1994/02 | 1993/11 |
| Precipitation: | | | | | |
| Rainfall (mm) | 34.8 | 28.8 | 37.5 | 55.4 | 93.7 |
| Snowfall (cm) | 114.6 | 82.2 | 60.5 | 20.9 | 4.2 |
| Precipitation (mm) | 134.5 | 102.1 | 93.7 | 75.6 | 98.1 |
| Average Snow Depth (cm) | 43 | 58 | 43 | 9 | 0 |
| Median Snow Depth (cm) | 43 | 58 | 42 | 7 | 0 |
| Snow Depth at Month-end (cm) | 51 | 61 | 22 | 1 | 0 |
| Extreme Daily Rainfall (mm) | 52.8 | 83.8 | 50.8 | 68.8 | 53.6 |
| Date (yyyy/dd) | 1979/08 | 1946/22 | 1968/20 | 1994/07 | 1993/14 |
| Extreme Daily Snowfall (cm) | **56.1** | 41.7 | 34 | 21.1 | 14 |
| Date (yyyy/dd) | **1973/31** | 1964/17 | 1993/14 | 1964/02 | 1963/10 |
| Extreme Daily Precipitation (mm) | 58.8 | 94 | 50.8 | 68.8 | 58.9 |
| Date (yyyy/dd) | 1979/08 | 1946/22 | 1968/20 | 1994/07 | 1954/22 |
| Extreme Snow Depth (cm) | 151 | 169 | **183** | 97 | 9 |
| Date (yyyy/dd) | 1982/19 | 2001/25 | **1967/19+** | 1997/03+ | 1997/01 |
| Days with Maximum Temperature: | | | | | |
| <= 0 °C | 21.5 | 20.4 | 13.5 | 2.1 | 0.07 |
| > 0 °C | 9.5 | 7.9 | 17.5 | 27.9 | 30.9 |
| > 10 °C | 0.2 | 0.33 | 0.9 | 5.3 | 19.5 |
| > 20 °C | 0 | 0 | 0 | 0.1 | 0.97 |
| > 30 °C | 0 | 0 | 0 | 0 | 0 |
| > 35 °C | 0 | 0 | 0 | 0 | 0 |
| Days with Minimum Temperature: | | | | | |
| > 0 °C | 0.83 | 0.73 | 2.9 | 10.1 | 25.3 |
| <= 2 °C | 30.6 | 27.9 | 29.8 | 25.9 | 12.6 |
| <= 0 °C | 30.2 | 27.5 | 28.1 | 19.9 | 5.7 |
| < -2 °C | 28.7 | 26.2 | 24.2 | 12.4 | 1.6 |
| < -10 °C | 15.2 | 17.2 | 11.1 | 0.67 | 0 |
| < -20 °C | 0.4 | 2.5 | 1.4 | 0 | 0 |
| < -30 °C | 0 | 0 | 0 | 0 | 0 |
| Days with Rainfall: | | | | | |
| >= 0.2 mm | 5.5 | 4.5 | 6.9 | 9.7 | 13.9 |

Environment Canada Environnement Canada

# Daily Data Report for September 2005

*Notes on Data Quality.*

## STEPHENVILLE A
## NEWFOUNDLAND

**Latitude**: 48° 31' N **Longitude**: 58° 33' W **Elevation**: 25.60 m
**Climate ID**: 8403800 **WMO ID**: 71815 **TC ID**: YJT

Daily Data Report for September 2005

| 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 o I |
|---|---|---|---|---|---|---|---|---|---|---|
| 01† | 26.6 | 18.3 | 22.5 | 0.0 | 4.5 | 7.0 | 0.0 | 7.0 | | |
| 02† | 21.8 | 15.8 | 18.8 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | | |
| 03† | 22.8 | 14.4 | 18.6 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | | |
| 04† | 18.3 | 9.3 | 13.8 | 4.2 | 0.0 | T | 0.0 | T | | |
| 05† | 17.2 | 8.6 | 12.9 | 5.1 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 06† | 18.9 | 9.1 | 14.0 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 07† | 20.3 | 13.4 | 16.9 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 08† | 21.5 | 13.1 | 17.3 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 09† | 18.2 | 9.7 | 14.0 | 4.0 | 0.0 | 1.8 | 0.0 | 1.8 | | |
| 10† | 17.5 | 8.2 | 12.9 | 5.1 | 0.0 | 0.2 | 0.0 | 0.2 | | |
| 11† | 14.2 | 5.6 | 9.9 | 8.1 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 12† | 12.4 | 6.4 | 9.4 | 8.6 | 0.0 | 16.8 | 0.0 | 16.8 | | |
| 13† | 15.1 | 4.2 | 9.7 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 14† | 18.9 | 6.6 | 12.8 | 5.2 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 15† | 20.5 | 15.2 | 17.9 | 0.1 | 0.0 | 0.8 | 0.0 | 0.8 | | |
| 16† | 15.8 | 10.6 | 13.2 | 4.8 | 0.0 | 2.4 | 0.0 | 2.4 | | |
| 17† | 14.9 | 9.7 | 12.3 | 5.7 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 18† | 17.9 | 11.0 | 14.5 | 3.5 | 0.0 | 28.2 | 0.0 | 28.2 | | |
| 19† | 14.7 | 10.7 | 12.7 | 5.3 | 0.0 | 1.8 | 0.0 | 1.8 | | |
| 20† | 13.9 | 7.2 | 10.6 | 7.4 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 21† | 16.1 | 7.9 | 12.0 | 6.0 | 0.0 | 42.8 | 0.0 | 42.8 | | |
| 22† | 12.8 | 9.0 | 10.9 | 7.1 | 0.0 | 0.8 | 0.0 | 0.8 | | |
| 23† | 14.6 | 9.4 | 12.0 | 6.0 | 0.0 | 16.2 | 0.0 | 16.2 | | |
| 24† | 13.6 | 5.2 | 9.4 | 8.6 | 0.0 | T | 0.0 | T | | |
| 25† | 13.7 | 3.8 | 8.8 | 9.2 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 26† | 14.5 | 10.7 | 12.6 | 5.4 | 0.0 | 75.0 | 0.0 | 75.0 | | |
| 27† | 16.1 | 8.1 | 12.1 | 5.9 | 0.0 | 76.4 | 0.0 | 76.4 | | |
| 28† | 12.2 | 4.0 | 8.1 | 9.9 | 0.0 | 0.2 | 0.0 | 0.2 | | |
| 29† | 16.1 | 4.5 | 10.3 | 7.7 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 30 | | | | | | | | | | |
| Sum | | | | 147.0* | 5.9* | 270.4* | 0.0* | 270.4* | | |
| Avg | 16.9 | 9.3 | 13.1 | | | | | | | |
| Xtrm | 26.6 | 3.8 | | | | | | | | |

### Legend

[empty] = No data available
M = Missing
E = Estimated
A = Accumulated
C = Precipitation occurred, amount uncertain
L = Precipitation may or may not have occurred
F = Accumulated and estimated
N = Temperature missing but known to be > 0
Y = Temperature missing but known to be < 0
S = More than one occurence
T = Trace
* = The value displayed is based on incomplete data

### Navigation Options

Canada Map
Newfoundland Map
Customized Search
Nearby Stations with Data
1971-2000 Climate Normals
Customizable Chart
Monthly Data (2005)
Bulk Data (2005) [CSV] [XML]

Environment Canada Environnement Canada

# Hourly Data Report for September 26, 2005

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

*Notes on Data Quality.*

## STEPHENVILLE A NEWFOUNDLAND

Latitude: 48° 31' N Longitude: 58° 33' W Elevation: 25.60 m

Climate ID: 8403800 WMO ID: 71815 TC ID: YJT

Hourly Data Report for September 26, 2005

| Time | Temp °C | Dew Point Temp °C | Rel Hum % | Wind Dir 10's deg | Wind Spd km/h | Visibility km | Stn Press kPa | Hmdx | Wind Chill |
|---|---|---|---|---|---|---|---|---|---|
| 00:30 | 12.4 | 8.0 | 75 | 18 | 20 | 19.3 | 101.43 | | |
| 01:30 | 12.8 | 8.1 | 73 | 18 | 19 | 22.5 | 101.32 | | |
| 02:30 | 12.5 | 8.1 | 75 | 19 | 26 | 24.1 | 101.22 | | |
| 03:30 | 12.1 | 8.6 | 79 | 20 | 28 | 24.1 | 101.17 | | |
| 04:30 | 11.8 | 8.9 | 82 | 21 | 26 | 19.3 | 101.16 | | |
| 05:30 | 11.3 | 8.3 | 82 | 21 | 24 | 16.1 | 101.12 | | |
| 06:30 | 11.0 | 8.5 | 85 | 20 | 26 | 6.4 | 101.05 | | |
| 07:30 | 10.9 | 8.6 | 86 | 22 | 28 | 12.9 | 101.06 | | |
| 08:30 | 11.6 | 9.4 | 86 | 23 | 33 | 6.4 | 101.01 | | |
| 09:30 | 11.8 | 10.6 | 92 | 23 | 28 | 6.4 | 100.97 | | |
| 10:30 | 12.0 | 10.8 | 92 | 24 | 32 | 3.2 | 100.95 | | |
| 11:30 | 12.2 | 11.6 | 96 | 24 | 33 | 2.4 | 100.89 | | |
| 12:30 | 12.3 | 11.5 | 95 | 24 | 28 | 8.0 | 100.86 | | |
| 13:30 | 12.3 | 11.6 | 95 | 25 | 24 | 6.4 | 100.78 | | |
| 14:30 | 12.2 | 11.7 | 97 | 25 | 15 | 6.4 | 100.75 | | |
| 15:30 | 12.2 | 11.7 | 97 | 27 | 13 | 4.8 | 100.73 | | |
| 16:30 | 12.0 | 11.5 | 97 | | 0 | 3.2 | 100.68 | | |
| 17:30 | 12.2 | 11.6 | 96 | | 0 | 4.8 | 100.63 | | |
| 18:30 | 12.3 | 10.6 | 89 | | 0 | 6.4 | 100.56 | | |
| 19:30 | 12.4 | 10.7 | 89 | 8 | 13 | 9.7 | 100.40 | | |
| 20:30 | 12.7 | 11.1 | 90 | 4 | 13 | 12.9 | 100.36 | | |
| 21:30 | 13.1 | 11.4 | 89 | 9 | 7 | 12.9 | 100.24 | | |
| 22:30 | 14.4 | 12.8 | 90 | 17 | 15 | 6.4 | 100.14 | | |
| 23:30 | 14.3 | 8.0 | 66 | 19 | 22 | 9.7 | 100.08 | | |

**Legend**

M = Missing
E = Estimated
NA = Not Available

**Navigation Options**

- Canada Map
- Newfoundland Map
- Customized Search
- Nearby Stations with Data
- 1971-2000 Climate Normals
- Almanac Page (September 26)
- Daily Data (September 2005)
- Monthly Data (2005)
- Bulk Data (September 2005) [CSV] [XML]

Important Notices

Created : 2002-06-21
Modified : 2004-01-21
Reviewed : 2004-01-21
Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climateData/hourlydata_e.html

Environment Canada Environnement Canada

# Hourly Data Report for September 27, 2005

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

*Notes on Data Quality.*

## STEPHENVILLE A NEWFOUNDLAND

Latitude: 48° 31' N Longitude: 58° 33' W Elevation: 25.60 m

Climate ID: 8403800 WMO ID: 71815 TC ID: YJT

Hourly Data Report for September 27, 2005

| Time | Temp °C | Dew Point Temp °C | Rel Hum % | Wind Dir 10's deg | Wind Spd km/h | Visibility km | Stn Press kPa | Hmdx | Wind Chill |
|---|---|---|---|---|---|---|---|---|---|
| 00:30 | 13.8 | 7.5 | 66 | 18 | 19 | 4.8 | 99.95 | | |
| 01:30 | 14.2 | 7.8 | 65 | 21 | 28 | 4.8 | 99.88 | | |
| 02:30 | 13.8 | 11.5 | 86 | 21 | 28 | 4.8 | 99.80 | | |
| 03:30 | 14.0 | 12.3 | 89 | 21 | 24 | 9.7 | 99.74 | | |
| 04:30 | 15.0 | 13.2 | 89 | 21 | 35 | 9.7 | 99.67 | | |
| 05:30 | 15.2 | 13.6 | 90 | 18 | 22 | 12.9 | 99.60 | | |
| 06:30 | 15.3 | 14.2 | 93 | 20 | 24 | 4.8 | 99.48 | | |
| 07:30 | 15.6 | 14.9 | 96 | 20 | 33 | 2.4 | 99.41 | | |
| 08:30 | 15.5 | 14.9 | 96 | 21 | 32 | 2.4 | 99.41 | | |
| 09:30 | 15.8 | 14.4 | 91 | 19 | 33 | 6.4 | 99.38 | | |
| 10:30 | 16.0 | 14.8 | 93 | 19 | 32 | 4.8 | 99.26 | | |
| 11:30 | 15.6 | 14.7 | 94 | 22 | 26 | 4.8 | 99.23 | | |
| 12:30 | 14.7 | 13.3 | 91 | 24 | 32 | 4.8 | 99.19 | | |
| 13:30 | 14.0 | 13.2 | 95 | 25 | 33 | 2.4 | 99.15 | | |
| 14:30 | 13.3 | 11.9 | 91 | 28 | 9 | 4.0 | 99.10 | | |
| 15:30 | 13.3 | 11.6 | 89 | 27 | 28 | 11.3 | 99.21 | | |
| 16:30 | 12.1 | 10.3 | 89 | 26 | 28 | 11.3 | 99.34 | | |
| 17:30 | 11.0 | 9.3 | 89 | 27 | 22 | 11.3 | 99.47 | | |
| 18:30 | 10.4 | 8.6 | 89 | 29 | 28 | 11.3 | 99.56 | | |
| 19:30 | 9.6 | 7.5 | 87 | 30 | 30 | 12.9 | 99.68 | | |
| 20:30 | 9.0 | 6.6 | 85 | 30 | 30 | 12.9 | 99.80 | | |
| 21:30 | 8.8 | 5.5 | 80 | 31 | 33 | 16.1 | 99.93 | | |
| 22:30 | 8.8 | 5.2 | 78 | 32 | 30 | 24.1 | 100.04 | | |
| 23:30 | 8.5 | 4.4 | 75 | 32 | 28 | 19.3 | 100.12 | | |

**Legend**

M = Missing
E = Estimated
NA = Not Available

**Navigation Options**

Canada Map
Newfoundland Map
Customized Search
Nearby Stations with Data
1971-2000 Climate Normals
Almanac Page (September 27)
Daily Data (September 2005)
Monthly Data (2005)
Bulk Data (September 2005) [CSV] [XML]

Important Notices

Created : 2002-06-21
Modified : 2004-01-21
Reviewed : 2004-01-21
Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climateData/hourlydata_e.html

Environment Canada Environnement Canada

Canada

CLEANair ONLINE

# Stephenville

## Currently

Observed at: Stephenville Airport 28 September 2005 8:30 AM NDT

**Mostly Cloudy**

| | |
|---|---|
| Temperature | 8 °C |
| Pressure/ Tendency | 101.2 kPa ↑ |
| Visibility | 24 km |
| Humidity | 65 % |
| Dewpoint | 2 °C |
| Wind | NW 18 km/h |

**Yesterday**

| | |
|---|---|
| Max Temp. | 16.1 °C |
| Min Temp. | 8.1 °C |
| Precip Total | 76.4 mm |

**Regional Normals**

| | |
|---|---|
| Max Temp. | 13 °C |
| Min Temp. | 3 °C |

Record Values

**Today**

| | |
|---|---|
| Sunrise | 7:19 |
| Sunset | 19:11 |
| Moonrise | 1:44 |
| Moonset | 17:50 |

## 5 Day Forecast from Environment Canada

| Wednesday | Wednesday night | Thursday |
|---|---|---|
| High 12 °C POP 60% | Low 6 °C | High 14 °C |
| Chance of showers | Clear | Sunny with cloudy periods |

| Friday | Saturday | Sunday |
|---|---|---|
| High 17 °C Low 11 °C | High 14 °C Low 10 °C | High 14 °C Low 7 °C POP 30% |
| Showers | Showers | Chance of showers |

These icons are a summary. See complete text below

## Text Forecast from Environment Canada

Stephenville: Issued 5.30 AM NDT Wednesday 28 September 2005

| | |
|---|---|
| *Today* | Cloudy with sunny periods. 60 percent chance of showers early this morning. Wind northwest 20 km/h gusting to 40. High 12. UV index 3 or moderate. |
| *Tonight* | Clear. Low 6. |
| *Thursday* | Sunny with cloudy periods. Wind becoming south 20 km/h in the morning then increasing to 30 gusting to 50 except 50 gusting to 80 over the Wreckhouse area late in the day. High 14. |
| *Friday* | Showers. Windy. Low 11. High 17. |
| *Saturday* | Showers. Low 10. High 14. |
| *Sunday* | Cloudy with 30 percent chance of showers. Low 7. High 14. |

[ Graphics off ] [ Format for Print ] Important Notices and Disclaimers

Created : 2002-12-31
Modified : 2004-07-13
Reviewed : 2002-12-31
URL of this page : http://weatheroffice.ec.gc.ca/city/pages/nf-27_metric_e.html

The Green Lane™,
Environment Canada's World Wide Web Site.

Canada

**From:** Sonia Glover
**To:** Caul, Brenda; Coffey, Tina; Dominie, Ken; Goebel, Martin; Osborne, Tom; Picco, Robert; Rollings, Ken
**Date:** 9/28/2005 6:59:24 PM
**Subject:** VOCM

**West Coast Flooding**
**September 28, 2005**
**VOCM - 5:30 pm**
The situation is starting to improve on the west coast following massive flooding, but there is still much more work left to be done. In the hard hit town of Stephenville, evacuees were allowed back into their homes this afternoon. Approximately 80 homes were evacuated yesterday leaving more than 250 people looking for other accommodations. 18 people stayed in a shelter overnight, while others stayed with relatives and friends. RCMP say while people are allowed back to survey the damage, some homes are still surrounded by water and are not accessible. Several homes actually left their foundations in the floodwaters, resulting in significant damage Constable Mike Dawson says some bridges and roads are still closed.

Work is continuing today to re-connect the town of stephenville's water supply. Millbrook Lane in Kippens is washed out and remains closed. There are reports of flooding in the community and property damage there. The road in Reidville is not open to foot traffic yet, but may be later tonight if all goes well. Temporary repairs are under way, but a boil order remains in effect. Flooding also affected the community of Rocky Harbour.

Minister Jack Byrne says now that the water has dropped in the Stephenville area, the true damage is visable. Byrne, along with Ministers Joan Burke and Tom Rideout toured the hardest hit areas of Stephenville, Reidville, Pynn's Brook and Gallants today. Byrne says government and Emergency Measures are now setting up ways to assess the damage caused by the flood waters. The minister says EMO officials will be on the west coast tomorrow to distribute Damage Assistance applications.

Red Cross Workers are on the ground in Stephenville helping residents who were forced to leave their homes due to the flooding. More than 250 people have registered with the Red Cross and some escaped so quickly they didn't have a chance to put shoes on. Most evacuees are staying with friends and family, but the Red Cross says there will be a need for clothing, food, and drinking water. All people who were evacuated are urged to register with the Red Cross whether they need assistance or not so officials can determine how many people are affected.

Premier Danny Williams has given full marks to Mayor Cec Stein, his Council and staff for their handling of the flooding situation in Stephenville. Williams says they set up an emergency control centre in the Town Hall at the height of the flooding. Williams also told Bill Rowe on VOCM's Open Line he was impressed at the organization on the ground and the massive effort that was made by a lot of people. Williams says a lot of homes and a lot of grief were saved by people taking control and doing the right thing. He says the team would be a great model for disaster relief anywhere in the world. Williams says the water has dropped dramatically but it will take a while for people to get back into their homes. He gave the assurance that the situation is very much under control.

Kippens Mayor Wayne Ruth says they're received an outpouring of support from towns across the province, but he says things are under control and they enter clean-up mode. Ruth told VOCM Open Line with Bill Rowe the Kippens Bridge is reopened to one-lane traffic and road reconstruction is underway. Ruth says there are examples of people going above and beyond to fight the raging river.

Sonia B. Glover
Director of Communications
Department of Environment and Conservation

Return to News

## Stephenville Declares State of Emergency

**September 27, 2005**

**The town of Stephenville is under a state of emergency with heavy rains and severe flooding. Municipal Affairs Minister told VOCM Open Line with Bill Rowe the Emergency Measures Organization is on the way, forty to fifty homes have been evacuated so far, and a reception centre has been set up in the Armoury. Byrne says more than 110 mm of rain has fallen in the region since yesterday evening and another 20 to 30 mm is in the forecast for today.**

**The state of emergency was declared at 9 o'clock this morning. Blanche Brook has overflowed and this has forced an evacuation. Residents from Mill Place, Alexander Avenue, and all streets between Blanche Brook and Queen Street have been evacuated. RCMP say there are plenty of problems in the Stephenville area and motorists are advised not to drive and stay home at this time. Route 460, the Hansen Highway is closed in three places including Kippens and Noel's Pond.**

**The Kippens Bridge is closed and Millbrook road in Kippens has been washed away. The main highway leading into Cold Brook is heavily flooded. Prince Rupert Road in Stephenville is closed to high water levels from the adjacent Blanche River. Ditches are overflowing on the Trans Canada Highway about five kilometres east of the Gallants area. Traffic is reduced to one lane.**

**And the election in the town of Stephenville has been called off. Voters will go to the polls within the next seven days**

Environment Canada Environnement Canada

Canada

| | | | | |
|---|---|---|---|---|
| Français | Contact | Help/About | Search | Canada Site |
| What's New About Us | Topics | Information/ Publications | Weather | Environment Canada |
| Home | Disclaimer | Partners | Links | WSC |

Station Navigation

Text Search Map Search

Customization

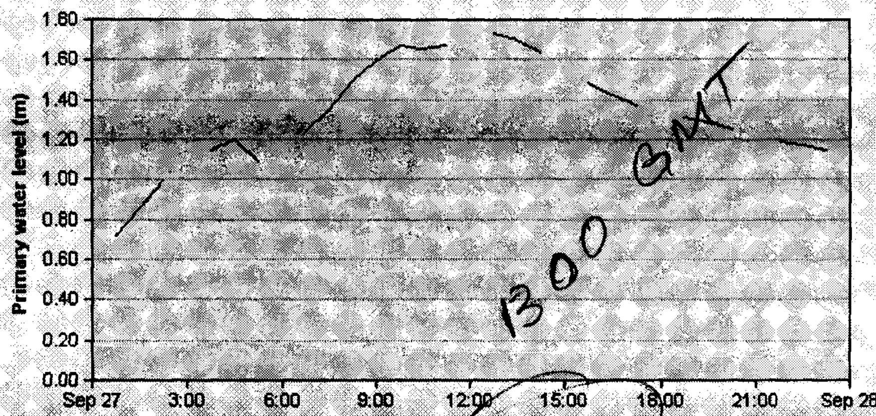
Hydrometric Portfolio

In partnership with

## SOUTH BROOK AT PASADENA (02YL004)

**Data Category:** Real Time Go

**Parameter Type:** Primary water level (Second Parameter)




Data Category: Real Time Go Date & Time in GMT

| Y-Axis View | | Start Date | | | End Date | | | |
|---|---|---|---|---|---|---|---|---|
| Min | Max | Sep | 27 | 2005 | Sep | 28 | 2005 | Redraw |

**Station Information:**

| | | | |
|---|---|---|---|
| **Active or discontinued** | Active | **Province/Territory** | NL |
| **Latitude** | 49° 00' 43" N | **Longitude** | 57° 36' 47" W |
| **Gross drainage area** | 58.5 km$^2$ | | |
| **Record length** | N/A | **Period of record** | 1983 - 0 |
| **Regulation type** | N/A | | |

**Hydrometric measurement**

| Period of record | Type | Operation schedule | Gauge type |
|---|---|---|---|
| 1983 - | Flow | Continuous | Recorder |

| | | | |
|---|---|---|---|
| **Real-time data available** | Yes | **Sediment data available** | NO |
| **Type of water body** | River | **RHBN** | NO |
| **EC regional office** | DARTMOUTH | **Data Contributed By** | |
| **Datum of published data** | ASSUMED DATUM | | |
| **To convert to** | N/A | | **add** m |

|Home | Disclaimer | Partners | Links | WSC|

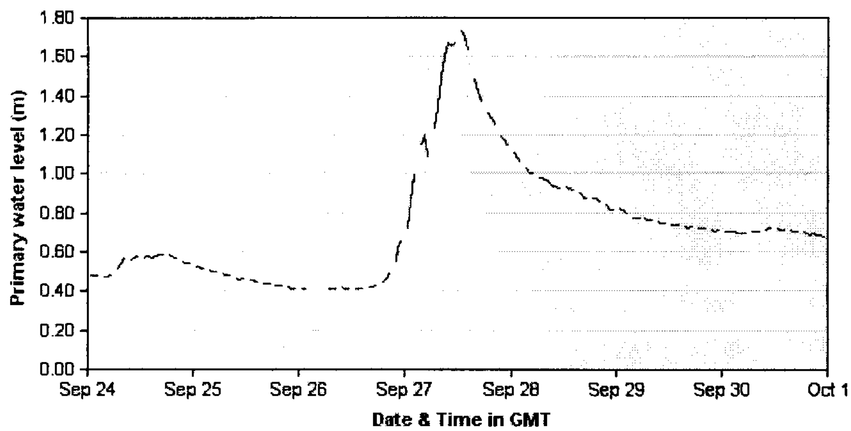
|What's New | About Us | Topics | Information/ Publications | Weather | Environment Canada|

## SOUTH BROOK AT PASADENA (02YL004)

**Data Category:** Real Time Go

**Parameter Type:** Primary water level (Second Parameter)

**Station Navigation**
Text Search Map Search
**Customization**
Hydrometric Portfolio
**In partnership with**




**Y-Axis View** Min Max **Start Date** Sep 24 2005 **End Date** Oct 1 2005 Redraw

### Station Information:

| | | | |
|---|---|---|---|
| **Active or discontinued** | Active | **Province/Territory** | NL |
| **Latitude** | 49° 00' 43" N | **Longitude** | 57° 36' 47" W |
| **Gross drainage area** | 58.5 $km^2$ | | |
| **Record length** | N/A | **Period of record** | 1983 - 0 |
| **Regulation type** | N/A | | |

**Hydrometric measurement**

| Period of record | Type | Operation schedule | Gauge type |
|---|---|---|---|
| 1983 - | Flow | Continuous | Recorder |

| | | | |
|---|---|---|---|
| **Real-time data available** | Yes | **Sediment data available** | NO |
| **Type of water body** | River | **RHBN** | NO |
| **EC regional office** | DARTMOUTH | **Data Contributed By** | |
| **Datum of published data** | ASSUMED DATUM | | |
| **To convert to** | N/A | **add** m | |

# Appendix B

# Community Engagement Summarizes

*This page left intentionally blank*

# Memo

**To:** Peter Nimmrichter

**From:** Titia Praamsma

**cc:** Richard Harvey, Matt Senior, Geoff Park

**Date:** February 21, 2019

**Re.** TPB188156 Humber River Flood Risk Study Community Meetings

---

### Town of Deer Lake – January 28, 2019; 8:30 am

Present:

- Maxine Hayden, Town Manager
- David Thomas, Superintendent – Public Works
- Geoff Park, Wood
- Titia Praamsma, Wood

Deer Lake has a history of damage from flooding, most recently from ice damming combined with a large snow and rain event with 15-degree temperatures. Historical flooding is generally attributed to Deer Lake Power opening their flood gates. The Town of Deer Lake is very interested in being part of the flood risk study process and provided input on historically impacted locations (described and illustrated below). The Town will also provide a copy of their draft official plan, as they are waiting for government input to have it finalized.

The last time Kruger/Deer Lake Power opened the flood gates from the Main Dam at Junction Brook was in May 2013. This was the first time that they had opened the flood gates in 15-20 years. Prior to that, the gates were opened fairly often and David Thomas remembers people canoeing across the river in the 1970s and 1980s, as the Nicholsville Bridge was often flooded at this time. Reduced spillage was attributed to changes in power distribution from Deer Lake Power. In the past it was used only to power Corner Brook Pulp and Paper. Electricity flow to the grid was integrated in the last 10-20 years, resulting in less spillage.

Some notes and observations about the 2013 flooding include:

- Park flooded out.
- No damage to park facility.
- Really mild weather.

Continued…

- Lots of snow that year.
- Deer Lake Power opened gate at Junction Brook to alleviate their own flooding.
- Town is on need to know basis with Kruger.

Prior to 2013, Kruger had a practice of calling the Town the day before they opened the gates, but they have improved communication with the town since then. The Town was provided an inundation map of a dam break study completed by Acres (Figure 1). The Town is very aware that should the dam break, most of the Town will be inundated, as well as the airport. It was also noted that the dam is in very good condition.

*Figure 1 - Deer Lake Inundation Map for Dam Break Study.*

The Town is concerned about the relationship with Kruger and indicated that Kruger could open the gates for an extended period of time in anticipation for potential flooding events.

The ice damming/flooding event that occurred in January 2018 was an anomalous event for the community. David indicated that "people have lived on the river for 70 years and have never seen what happened last year." Last year included 15.1 cm of snow, 75 mm rain (was forecasted to be 40-50 mm), temperatures reached 15 degrees, with Deer Lake iced over with no ability to accept flood water. Kruger did not spill any water from Main Dam and the south-eastern portion of the lake was open from the flows from the Power House.

The impact from last years' ice damming/flooding included:

- A house was shifted 50 ft up on shore, water reached the top of the counter in the house and the top of a cabin.
- Mr. Janes lost 30 ft of backyard and property value.
- Dave observed deep channel near Pine Tree Drive but shallower on outside that may have occurred after 2018 flooding.
- Pine Tree Dr. lost lots of shoreline (Figure 2).
- A new beach formed on Bailey's Avenue.

*Figure 2 - Lost shoreline on Pine Tree Drive (photo taken January 28, 2019).*

Continued…

Some additional notes include:

- Island is getting bigger over the years.
- Water is approximately four feet deep around the island.
- Airport water supply comes from the upper Humber.
- Groundwater flooding by canal – there are some houses with issues. Town does not think this is a significant issue.
- 95% of Deer Lake is beach sand.

Continued…

**Town of Reidville – January 28, 2019 – 11 am**

Present:

- Connie Reid, Town Clerk
- Geoff Park, Wood
- Titia Praamsma, Wood

Connie Reid indicated that there are three locations within the Town that are susceptible to flooding, including the Tranquil Waters Subdivision, Meadow Brook Subdivision and Riverview Subdivision. The town plan was completed in 2009 and they will update within the next couple of years, likely with the results of this study included. The town plan includes an environmental protection area that includes the flood risk areas. (Figure 3).

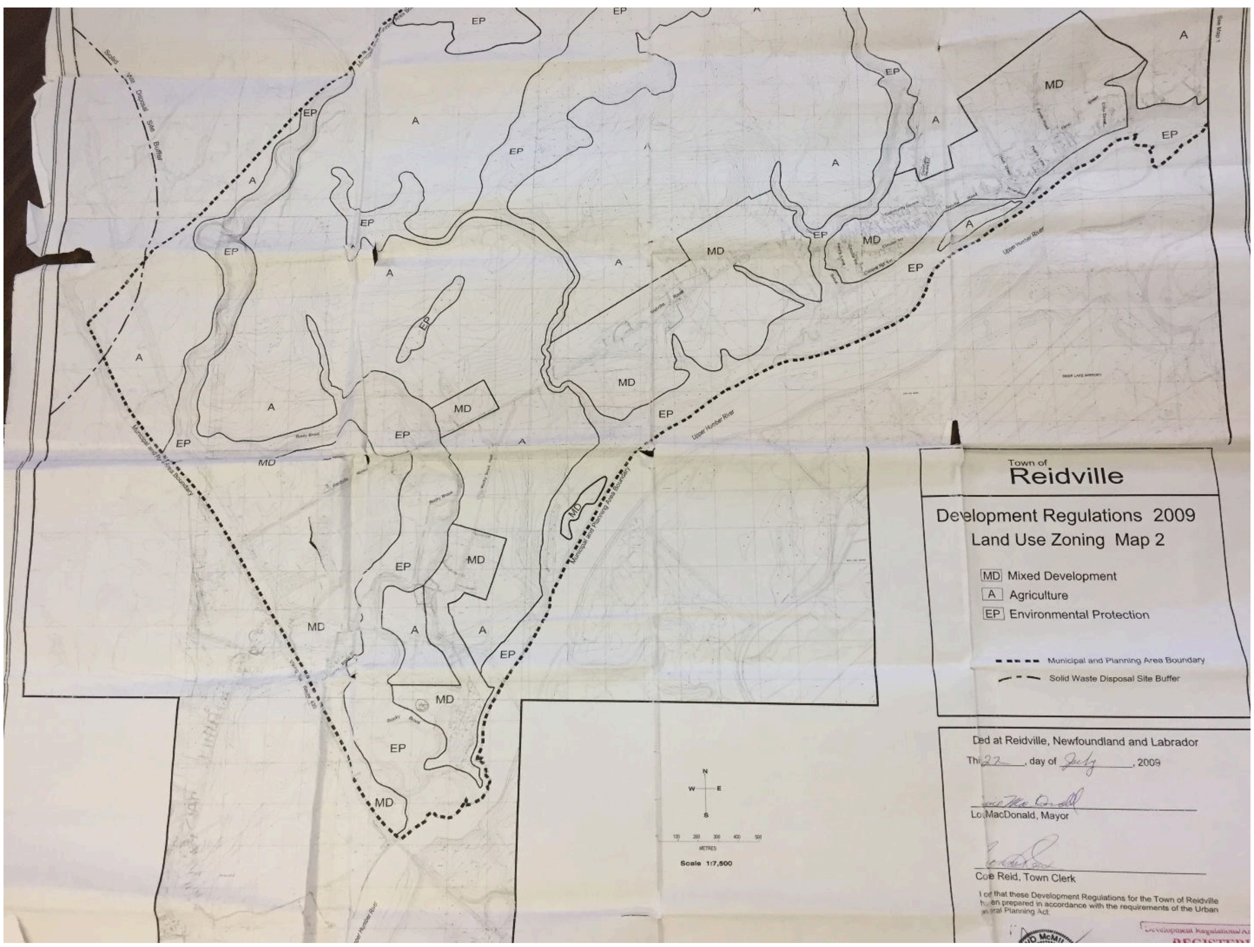



*Figure 3 - Town Plan for the Town of Reidville.*

The following information was provided about the subdivisions:

- Tranquil Waters Subdivision
    - Three houses
- Meadow Brook Subdivision
    - Four houses
    - Geotechnical studies were completed and houses were elevated as per recommendations
- Riverview
    - Last year ice backed up to Riverview

Significant flooding has not occurred in Reidville prior to last year. The clerk, Connie, indicated that she has never seen ice damming before last year. The ice damming affected a walking trail and boardwalk that was built near the river. Her historical knowledge of the area is extensive, as her grandfather settled Reidville. According to Connie, the original settlers lived by the water but eventually moved their houses higher-up (presumably to get away from flooding).

Continued…

**Town of Pasadena – January 28, 2019**

Present:

- Stuart Foote, Town Operations Manager
- Geoff Park, Wood
- Titia Praamsma, Wood

Flooding consistently occurs in the Town of Pasadena at three key locations described below. The town has a new plan in draft form, that includes a flood designation that is similar to the 1984 flood risk study. In general, Stuart feels very fortunate about a lack of flooding issues. The Town would like to be kept apprised of developments with our study.

Issues are more significant on South Brook than were anticipated during the flood study proposal phase, and cross sections should be added to this river to reflect this new information. Specifically, three basements in houses on South Brook flood every year on Maple Place. Forced evacuations occurred last year (https://www.cbc.ca/news/canada/newfoundland-labrador/flooding-pasadena-evacuation-5-1.4518381). Stuart noted that this isolates people. Mitigations on South Brook include gabion baskets that were installed to stabilize slopes near the sewage lagoon.

The Park Rd. Subdivision also floods every year (new subdivision on Lake) and experiences erosion of high banks, along Deer Lake proper. Stuart also thought that West Haven Lodge likely floods (retirement home), but was not certain

Some additional notes include:

- Stuart wanted to know more about the dam break studies from Deer Lake Power as he has never been provided a copy of the document.
- The soil is sandy up to Church St., hard pan everywhere else (cobble mixture), then sand underneath.
- A sod farm dammed off small stream to South Brook in Glendale area/Pine Rouken Glen – the Town has been trying to deal with owner.
- 2015: https://www.thewesternstar.com/news/local/pasadena-floods-during-short-intense-storm-118747/

**Town of Steady Brook – January 30, 2019**

Present:

- Steve Norman, P.Eng., Town Engineer
- Geoff Park, Wood
- Titia Praamsma, Wood

The Town of Steady Brook is interested in being part of the flood risk study. The Town recently hired a new engineer, who we met with. Steve was not in Steady Brook during the flooding in 2018, but was able to speak to monitoring that occurrs in 2019 for potential flooding and some current issues, along the Lower Humber River.

Planning drawings are available for 2010-2020 by CBCL. Our findings will likely be incorporated in the next official plan.

Steve indicated that in 2018, flooding came up to bottom of Steady Brook Bridge and half way up the retaining wall. The retaining wall is 8-10 feet high and was built 30-40 years ago. They used to dam off that area for swimming.

During potential flooding, the town watches levels on the stream behind the sewage settling ponds near Marble Mountain (Figure 4). Water also pools in the flat area near the sewage settling ponds there and in a good indicator area. Steve also recommended talking to Tony Abbott at Marble Mountain and noted that if the sewage lagoon floods and Steady Brook flood as Marble Mountain, flooding could reach the Steady Brook Bridge again. He noted that flow on Steady Brook is very turbulent (referring to waterfall under zipline) until it reaches Georges (ski shop, gas station and Tim Horton's).

The only other known flooding issue is at 241 Marble Drive, a residence that experiences basement flooding. The Town has installed many French drains but still flooding occurs.

133 Crosbie Road
PO Box 13216
St. John's, NL A1B 4A5
Tel +1 709 722 7023
woodplc.com

Wood Environment & Infrastructure Solutions
Registered office:
2020 Winston Park Drive, Suite 700, Oakville, ON L6H 6X7
Registered in Canada
No. 773289-9; GST: 899879050 RT0008; DUNS: 25-362-6642

Continued…

*Figure 4 - Stream near sewage settling ponds south of the Town of Steady Brook.*

# Appendix C

# SEM Field Survey Report

*This page left intentionally blank*

# RTK Survey of Water Levels at Water Gauge Stations &

# Bridge and River Surveys

**Prepared for:**
Wood
The Bowring Downtown Centre
277-281 Water Street, St. John's, NL
A1C 6L3


**Prepared by:**
Sikumiut Environmental Management Ltd.
SEM
2nd Floor, 79 Mews Place
St. John's, NL
A1B 4N2


November 19, 2019

SEM Project: 003-015

# Table of Contents



# List of Tables



# List of Figures

## List of Appendices

# 1.0 INTRODUCTION

Wood subcontracted Sikumiut Environmental Management Ltd. (SEM) to complete surveys for locations from Corner Brook to Deer Lake using GNSS (Global Navigation Satellite System). This work consisted of surveying four different water gauge areas, nine bridges and 11 river transects. The field work for this project occurred from November 14 to November 15, 2019.

Following the completion of the required tasks outlined in the proposal, this report was created to document the technical aspects of the work scope in order to provide the client with an understanding of the work tasks and deliverables.

# 2.0 METHODOLOGY

## 2.1 Equipment

Surveying was completed using Trimble R10-2 Global Navigation Satellite System (GNSS). The Trimble R10-2 GNSS was used to complete Real Time Kinematic (RTK) measurements, with a base receiver set up over a control point with known coordinates and a rover receiver that was used for measurements. For each setup SEM staff checked to a nearby control monument. The accuracy of RTK measurements is 8 mm + 1 ppm RMS (horizontally) and 15 mm + 1 ppm RMS (vertically). Refer to Appendix A for Trimble R10 datasheet. In order to extend the range of the Trimble R10-2 GNSS, a Trimble TDL450 radio was used alongside the base receiver (Figure 1).

**Figure 1 Trimble GNSS and Radio.**

## 2.2 Activity 1 – Establish Control Network

Due to the requirement for this survey to have survey grade accuracy, it was necessary to establish a network of control across the study area. Existing control in the study areas were located and surveyed using the Trimble R10 GNSS. Accuracy of existing control was checked by setting up a base receiver over one control point and then surveying a different control point. The coordinates of these control monuments were established by Natural Resources Canada (NRCAN) and taken from the Passive Control Network Map Application (https://webapp.geod.nrcan.gc.ca/geod/data-donnees/passive-passif.php?network=hc&locale=en).

The coordinates of these control monuments are in NAD83 (CSRS) UTM 21, CGVD2013 Geoid (epoch 2010). Table 1 lists the primary control that was used for the project. The primary control was chosen as NRCAN provides precise three dimensional coordinates with CGVD 2013 (epoch 2010) elevations. Refer to Appendices B, C and D for station reports for each control marker. Table 2 lists the secondary 'check mark' control points.

A map with control locations is shown on Figure 2.

**Table 1 Primary Control.**

| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 76F731 | 5450625.061 | 467398.13 | 45.233 | Brass Plaque |
| 76F068 | 5429556.145 | 456598.119 | 32.664 | Brass Plaque |
| 96G7002 | 5421667.15 | 430456.596 | 68.237 | Concrete Pillar with plate |

**Table 2 Check Marks.**

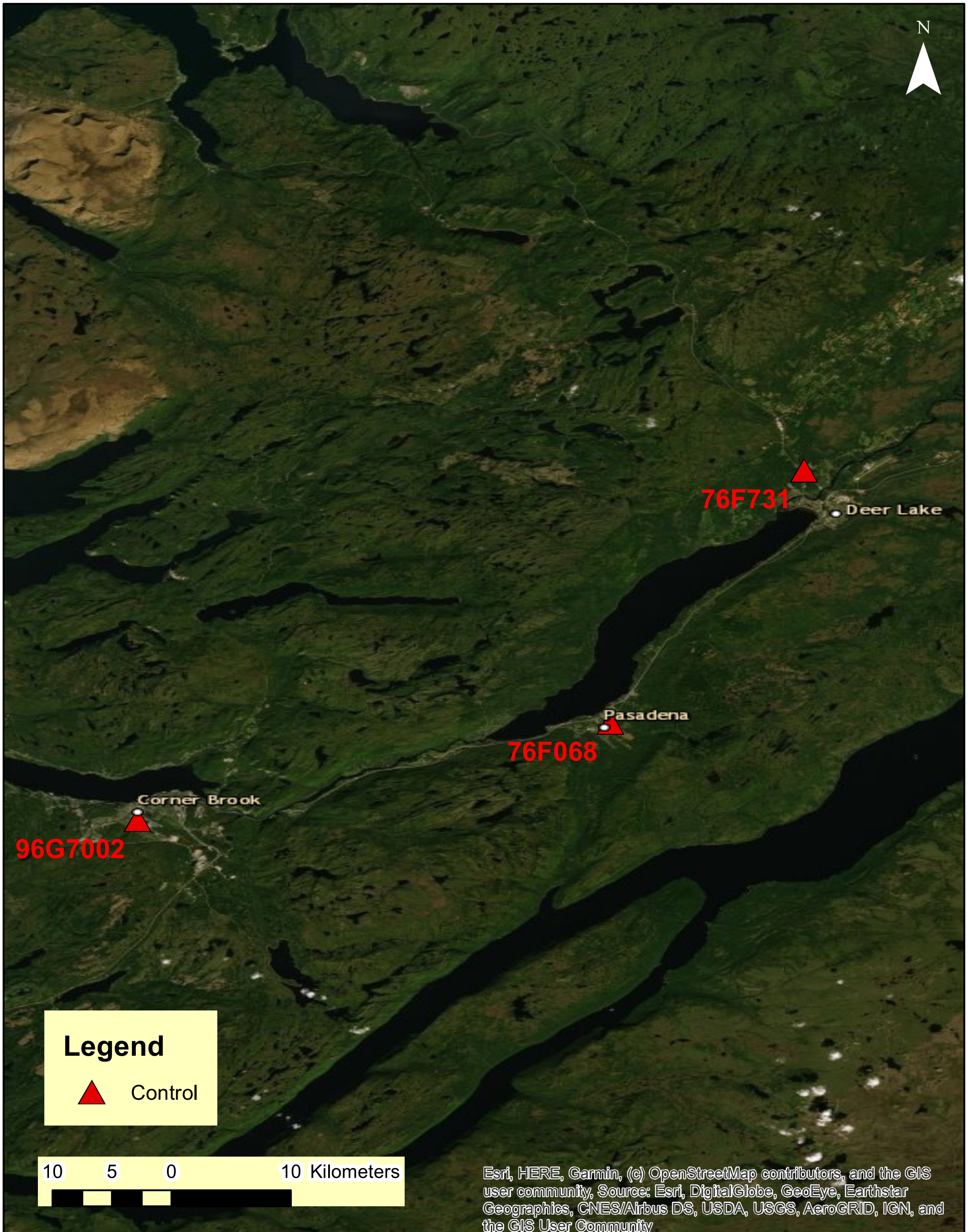
| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 87G4419 | 5451421.176 | 466773.798 | 65.300 | Brass Plaque |
| 2001G01 | 5429398.025 | 456508.681 | 32.545 | Brass Plaque |
| 98F002 | N/A | N/A | 66.248 | Brass Plaque |
| 18G0004 | 5422591.124 | 439319.686 | 4.560 | Brass Plaque |

## 2.3 Activity 2 – River Transects

SEM completed the river transect surveys by using chest waders to physically enter the streams and survey with the Trimble GNSS. In some areas where river was too deep or turbulent to cross, transects were moved for safer access.

The required deliverables for this project are points with coordinates (X, Y and Z). The coordinates have been provided in NAD 83 (CSRS) UTM Zone 21. The Z elevations are referenced to nearby control monuments which use the CGVD2013 geoid (epoch 2010).

These data points contain the point name; the X, Y, & Z coordinate; date of acquisition; and time of acquisition.




| | | |
|---|---|---|
| 003-015 RTK Surveying | FIGURE NO: 2 | SEM |
| **Control Locations** | COORDINATE SYSTEM: NAD 83 UTM Zone 21 | DATE: 11/18/19 |

The South Brook had five transects completed, as shown in Figure 3. For transects SO-1 and SO-5, the actual location of the transect shots differ from the proposed transect location due to the depth of the water and the turbulence of the water – the transects were moved to an area where it was safe to cross, as shown in Figure 3.

Nichols Brook had six transects completed, as shown in Figure 4. For transect N-6 the actual location of the transect shots differ from the proposed transect location due to the depth of the water and the turbulence of the water – the transect was moved to an area where it was safe to cross. For transect N-5 the river converges here so additional shots were taken on the westerly brook where possible.

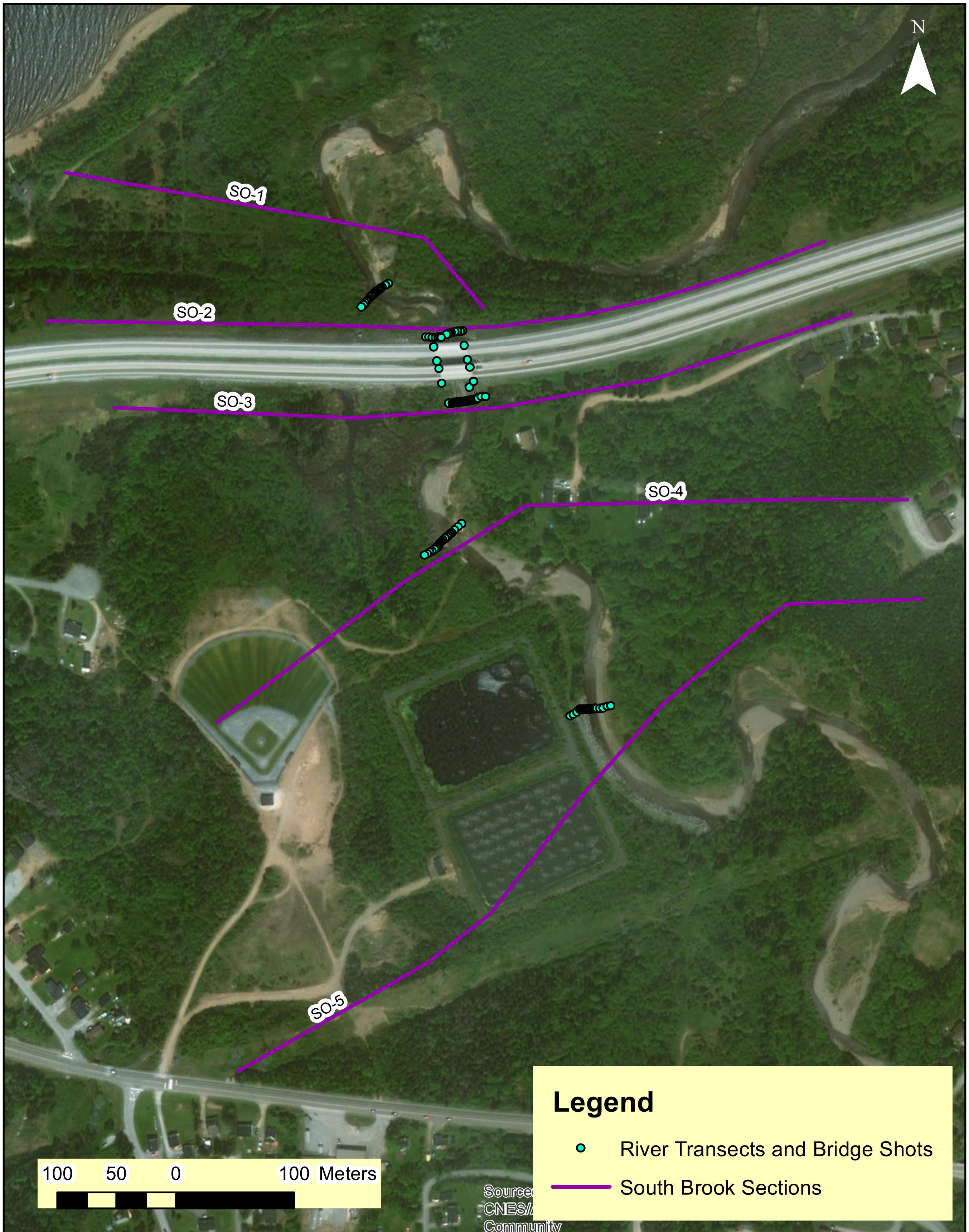
For each transect location pictures and notes were taken. Appendix E contains all pictures and notes for transects.

## 2.4 Activity 3 – Bridge Surveys

Nine bridges were surveyed for this project. The bridges surveyed were Lower Humber – North Shore Highway, Lower Humber –Tamarack Street Bridge, Lower Humber, Bridge to Humber Valley Resort, Steady Brook – Bridge to Marblewood Village, Steady Brook TCH Bridges, Steady Brook – Marble Drive Bridge, Pasadena – TCH Bridges, Upper Humber – Nicholsville Bridge and Upper Humber – Viking Trail Bridge.

At each bridge GPS shots were taken of the water level, road and top of deck. Measurements were taken with a measuring tape to measure the underside of the bridge. Pictures were taken of the bridge as well as downstream and upstream of the bridge. Steady Brook – Bridge to Marblewood Village was partially covered and it wasn't possible to take GPS shots on the bridge on the west side. Instead measurements were taken in the field using a measuring tape to get the span and length of the bridge.

Bridge descriptions can be found in Appendix F.




| | | |
|---|---|---|
| 003-015 RTK Surveying | FIGURE NO: 3 | |
| **River Transects: South Brook** | COORDINATE SYSTEM: NAD 83 UTM Zone 21 | DATE: 11/18/19 |


| | | |
|---|---|---|
| 003-015 RTK Surveying | FIGURE NO: 4 | SEM |
| **River Transects: Nichols Brook** | COORDINATE SYSTEM: NAD 83 UTM Zone 21 | DATE: 11/18/19 |

## 2.5 Activity 4 – Water Gauge Surveying

The four water gauge locations where RTK surveys were completed were 02YL001, 02YL003, 02YL004 and 02YL012. Multiple shots were taken of the water level at these locations. Bench marks and reference points were located with a metal detector and, if possible, surveyed.

### 2.5.1 02YL001

Station 02YL001 had three referenced benchmarks. NL90-025 (rebar) and TBM06-001 (lag screw in tree) were found however, NL90-027 could not be found. A nail was placed in the concrete and surveyed by the Field Team (19-SEM1). Table 3 shows the coordinates of benchmarks for 02YL001. Figure 5 is an updated sketch showing what was found in the field for this location. Photos of benchmarks were taken and are provided in the deliverables. GNSS observations for NL90-027 and 19-SEM1 were taken over a three minute period. TBM06-001 was also shot multiple times, but the field team were unable to level the GPS pole over the lag screw as it was in a tree. All benchmarks for station 02YL001 were surveyed using the GPS base station at 76F731 (see Section 2.2 of this report for more details).

Water level shots were taken at this location and are shown in Table 4.

**Table 3 02YL001 Benchmarks.**

| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| NL90-027 | 5454512.469 | 473771.778 | 11.935 | Rebar in concrete |
| TBM06- | 5454509.142* | 473767.394* | 12.674* | Lag Screw* |
| 19-SEM1 | 5454508.700 | 473754.172 | 12.118 | Nail in concrete |

*Lag screw shot was in tree and unable to be leveled over

**Table 4 02YL001 Water Level Shots.**

| Point | Northing | Easting | Elevation | Date | Time (NST) |
|---|---|---|---|---|---|
| 1000 | 5454497.334 | 473762.721 | 10.620 | 11/14/2019 | 9:20:21 |
| 1001 | 5454497.327 | 473762.727 | 10.615 | 11/14/2019 | 9:20:38 |
| 1002 | 5454497.332 | 473762.725 | 10.613 | 11/14/2019 | 9:20:44 |
| 1003 | 5454496.045 | 473761.443 | 10.619 | 11/14/2019 | 9:27:27 |
| 1004 | 5454509.243 | 473776.509 | 10.624 | 11/14/2019 | 9:44:53 |
| 1005 | 5454509.247 | 473776.510 | 10.622 | 11/14/2019 | 9:45:04 |

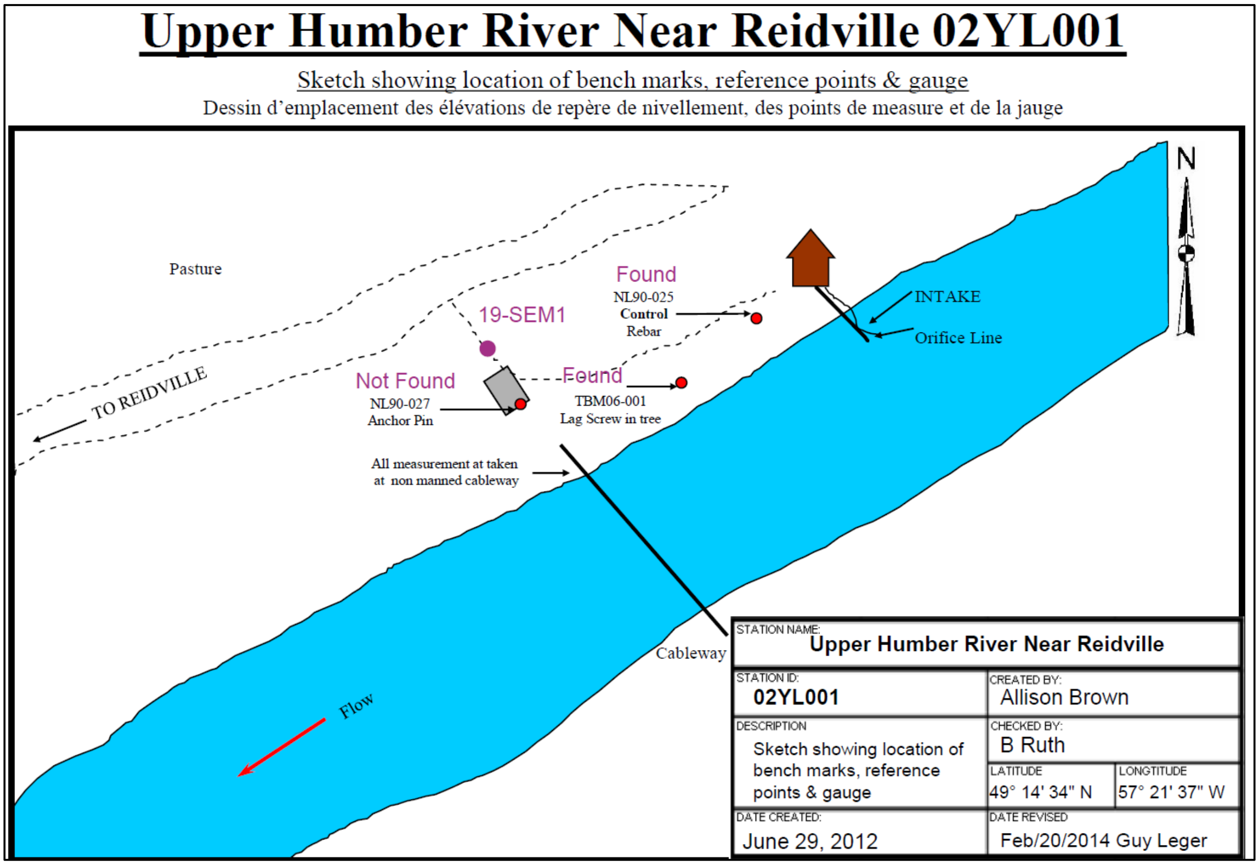



**Figure 5 Upper Humber River, 02YL001.**

### 2.5.2 02YL003

Station 02YL003 had five referenced benchmarks, as shown in Figure 6. NL12-064, NL92-031, TBM92-03 and TBM92-033 were all under the bridge and therefore the Field Team were unable to survey them with the GPS (as GPS needs a sky view to collect observations). The team searched for NL12-065 for an hour with a metal detector but were unable to find it; therefore, two new benchmarks were put in: 19-SEM3 was a bolt on top of bridge that was surveyed; and 19-SEM2 was a nail on top of bridge that was surveyed, as shown in Table 5. Photos of benchmarks were taken and are provided in the deliverables. GNSS observations of benchmarks were taken over a three minute period. All benchmarks for station 02YL003 were surveyed using the GPS base station at 76F038 (see section 2.2 of this report for more details).

Water level shots were taken at this location and are shown in Table 6.

**Table 5 02YL003 Benchmarks.**

| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 19-SEM3 | 5425830.558 | 444369.026 | 10.143 | Bolt |
| 19-SEM2 | 5425835.931 | 444367.357 | 9.871 | Nail |

**Table 6 02YL003 Water Level Shots.**

| Point | Northing | Easting | Elevation | Date | Time (NST) |
|---|---|---|---|---|---|
| 3100 | 5425852.766 | 444359.644 | 3.473 | 11/15/2019 | 10:34:32 |
| 3101 | 5425852.780 | 444359.671 | 3.483 | 11/15/2019 | 10:34:43 |
| 3102 | 5425852.788 | 444359.683 | 3.464 | 11/15/2019 | 10:34:50 |
| 3103 | 5425852.789 | 444359.676 | 3.483 | 11/15/2019 | 10:35:06 |
| 3104 | 5425851.430 | 444379.407 | 3.464 | 11/15/2019 | 10:39:28 |
| 3104 | 5425851.416 | 444379.414 | 3.470 | 11/15/2019 | 10:39:51 |

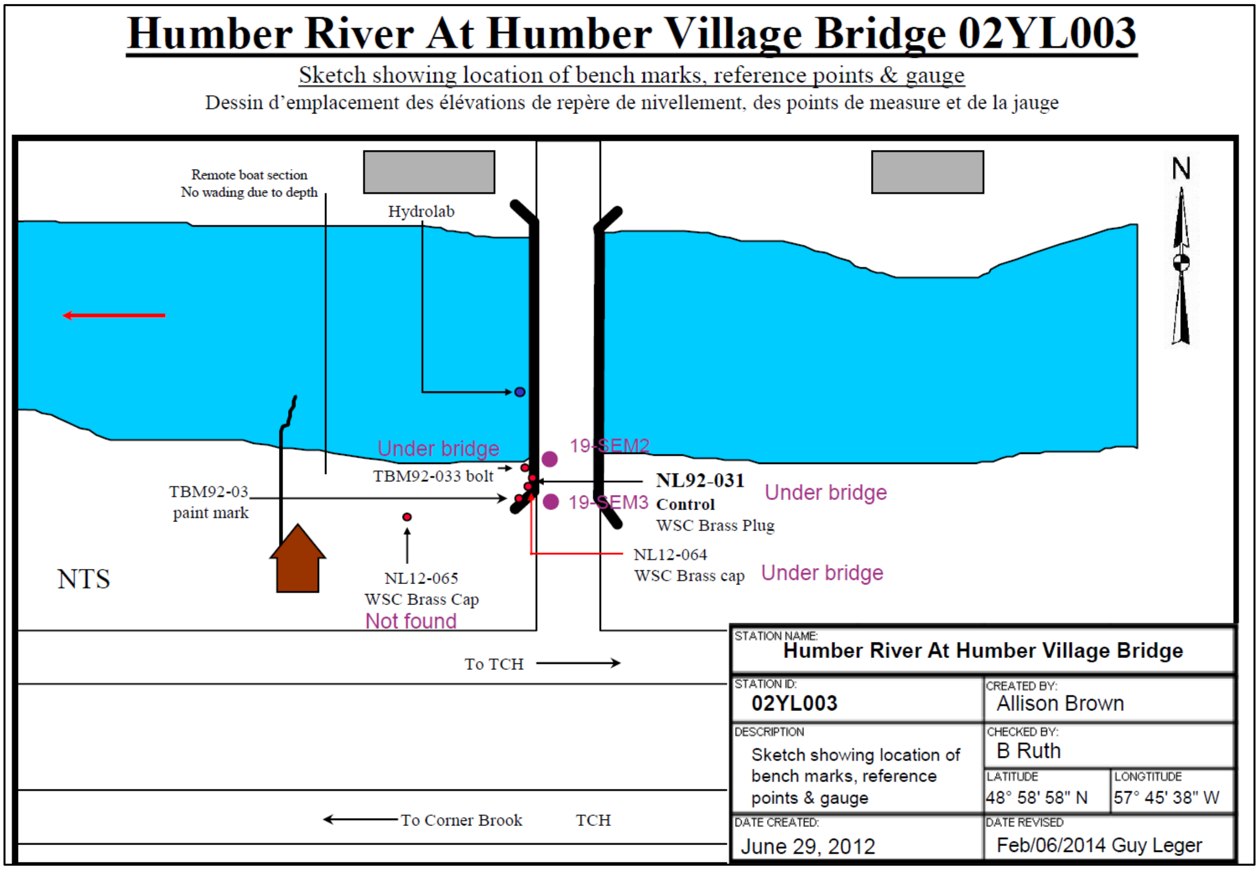



**Figure 6 Humber River, 02YL003.**

### 2.5.3 02YL004

Station 02YL004 had four referenced benchmarks. NL92-052 (brass plug), TBM07-002 (loop in rebar) and NL12-061 (brass plug) were all located, however, NL92-054 was destroyed. Table 7 shows the coordinates of benchmarks for 02YL004. Figure 7 is an updated sketch showing what was found in the field for this location. Photos of benchmarks were taken and are provided in the deliverables. GNSS observations for these benchmarks were taken over a three minute period. Water level shots were taken at this location and are shown in Table 8. All benchmarks for station 02YL004 were surveyed using the GPS base station at 76F038 (see Section 2.2 of this report for more details).

**Table 7 02YL004 Benchmarks.**

| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| NL12-061 | 5429002.362 | 455288.688 | 16.799 | Brass plug |
| TBM-07002 | 5429002.685 | 455288.739 | 16.85 | Loop in rebar |
| NL92-052 | 5429003.856 | 455286.674 | 18.045 | Brass plug |

**Table 8 02YL004 Water Level Shots.**

| Point | Northing | Easting | Elevation | Date | Time (NST) |
|---|---|---|---|---|---|
| 2000 | 5428995.305 | 455298.094 | 13.595 | 11/14/2019 | 16:19:50 |
| 2001 | 5428995.296 | 455298.109 | 13.596 | 11/14/2019 | 16:20:27 |
| 2002 | 5428995.324 | 455298.097 | 13.664 | 11/14/2019 | 16:25:22 |
| 2003 | 5429015.338 | 455276.419 | 13.596 | 11/14/2019 | 16:51:41 |
| 2004 | 5429015.339 | 455276.421 | 13.584 | 11/14/2019 | 16:52:00 |

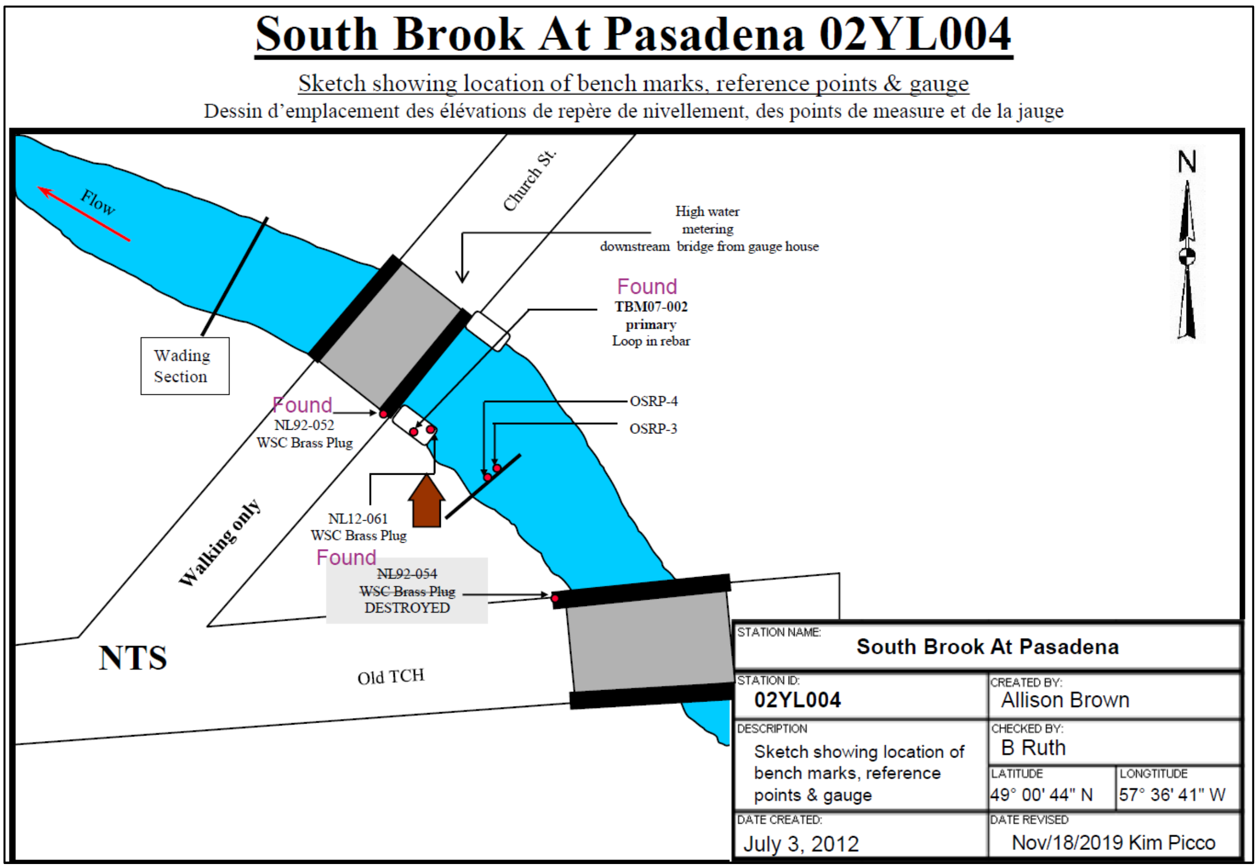



**Figure 7 South Brook, 02YL004.**

## 2.5.4 02YL012

Station 02YL012 had two referenced benchmarks. NL14-007 (bolt) was found, however NL14-006 could not be located and 19-SEM4 (nail in wood) was placed. In addition, 18G0004 (Brass plaque) was located which is a provincial survey marker. Figure 8 is an updated sketch showing benchmarks. Photos of benchmarks were taken and are provided in the deliverables. GNSS observations for these benchmarks were taken over a three minute period and coordinates are provided in Table 9. Water level shots were taken at this location and are shown in Table 10. All benchmarks for station 02YL012 were surveyed using the GPS base station at 96G7002 (see Section 2.2 of this report for more details).

**Table 9 02YL012 Benchmarks.**

| Point | Northing | Easting | Elevation | Code |
|---|---|---|---|---|
| 19-SEM4 | 5422583.744 | 439398.165 | 6.060 | Nail |
| NL14-007 | 5422581.218 | 439395.595 | 6.104 | Bold |
| 18G0004 | 5422592.117 | 439319.684 | 4.539 | Brass plaque |

**Table 10 02YL012 Water Level Shots.**

| Point | Northing | Easting | Elevation | Date | Time (NST) |
|---|---|---|---|---|---|
| 4000 | 5422581.919 | 439389.502 | 3.182 | 11/15/2019 | 14:49:59 |
| 4001 | 5422581.91 | 439389.512 | 3.181 | 11/15/2019 | 14:50:11 |
| 4002 | 5422581.921 | 439389.496 | 3.183 | 11/15/2019 | 14:50:20 |
| 4003 | 5422581.913 | 439389.507 | 3.175 | 11/15/2019 | 14:51:53 |

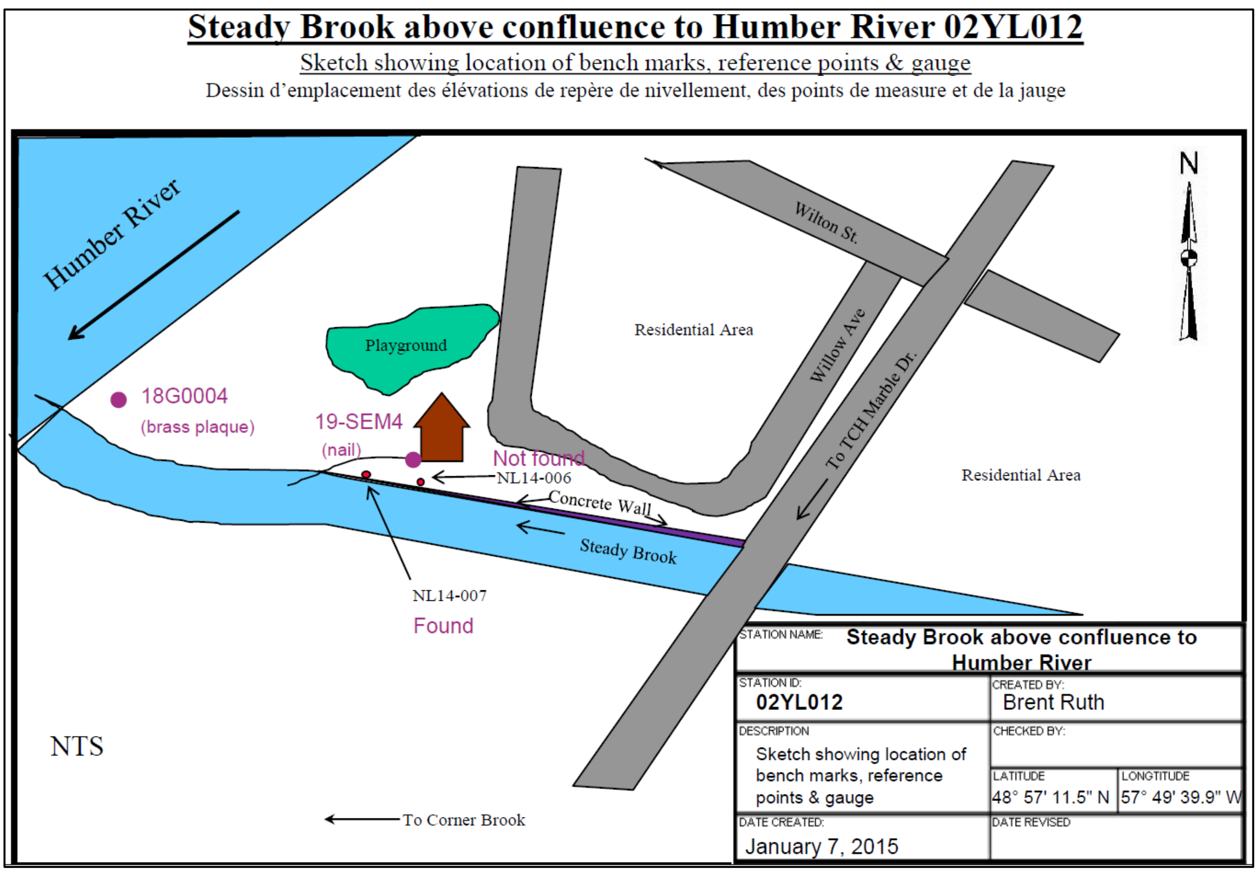



**Figure 8 Steady Brook, 02YL012.**

## 2.6 Deliverables

Deliverables submitted:

- Report;
- Photos;
- Codelist (.xlsf format) with descriptions of codes;
- Raw data (.csv format) of all data in NAD 83 (CSRS) UTM Zone 21, CGVD 2013 (epoch 2010):
    - River Transects and Bridge shots;
    - 02YL001;
    - 02YL003;
    - 02YL004; and
    - 02YL012
- Bridge Descriptions (pdf format); and
- River Transect descriptions (pdf format).

# Appendix A

# Trimble R10 GNSS Specification Sheet

# Trimble R10

## MODEL 2 GNSS SYSTEM

### PURE, UNINTERRUPTED SURVEYING

Collect more accurate data faster and easier, no matter what the job or the environment, with the Trimble® R10 GNSS system.

### Trimble 360 Receiver

Powerful Trimble 360 receiver technology in the Trimble R10 supports signals from all existing and planned GNSS constellations and augmentation systems. With the latest and most advanced Trimble GNSS technology, the Trimble R10 offers an unparalleled 672 GNSS channels to future-proof your investment.

The new Trimble R10 also provides improved interference protection to suppress a variety of intentional and unintentional sources of interference, as well as spoofing, for optimal performance in today's increasingly crowded signal frequency spectrum.

### Trimble HD-GNSS Processing Engine

The advanced Trimble HD-GNSS processing engine provides markedly reduced convergence times as well as high position and precision reliability while reducing measurement occupation time. Transcending traditional fixed/float techniques, it provides a more accurate assessment of error estimates than traditional GNSS technology.

### Trimble SurePoint

With Trimble SurePoint™ technology, an electronic level bubble is displayed on the Trimble controller screen, allowing surveyors to maintain focus where it matters most. Full tilt compensation allows the survey pole to be tilted up to 15° when measuring, allowing the Trimble R10 to capture points that would be inaccessible to other GNSS surveying systems.

### Trimble CenterPoint RTX

Trimble CenterPoint® RTX delivers RTK level precision anywhere in the world without the use of a local base station or VRS™ network. Survey using satellite or internet delivered CenterPoint RTX correction services in areas where terrestrial based corrections are not available.

### Trimble xFill

Leveraging a worldwide network of Trimble GNSS reference stations and satellite datalinks, Trimble xFill® technology seamlessly fills in for gaps in your RTK or VRS correction stream. Maintain centimeter-level accuracy beyond 5 minutes with a CenterPoint RTX subscription.

### Smart, Versatile

The Trimble R10 is a versatile solution, loaded with smart features to support any workflow, all day long:

- Integrated cellular modem to receive VRS corrections or operate as a mobile hotspot
- Wi-Fi to connect to a laptop or smartphone to configure the receiver without a Trimble controller
- Bluetooth to connect to an Android or iOS mobile device running supported apps
- 6 GB internal memory to store raw observations
- Smart lithium-ion battery, with built-in battery status indicator
- Improved power management increases battery life and operating time in the field on average by 33%

## Key Features

- Advanced satellite tracking with Trimble 360 receiver technology and latest generation Trimble Custom Survey GNSS ASIC with 672 GNSS channels
- Improved protection against sources of interference and spoofed signals
- Support for Android and iOS platforms
- Cutting-edge Trimble HD-GNSS processing engine
- Precise position capture and full tilt compensation with Trimble SurePoint technology
- Trimble CenterPoint RTX provides RTK level precision worldwide without the need for a base station or VRS network
- Trimble xFill technology provides centimeter-level positioning during connection outages
- Sleek ergonomic design for easier handling

## PERFORMANCE SPECIFICATIONS

### MEASUREMENTS

| | | |
|---|---|---|
| | Measuring points sooner and faster with Trimble HD-GNSS technology | |
| | Increased measurement productivity and traceability with Trimble SurePoint electronic level bubble and tilt compensation | |
| | Worldwide centimeter-level positioning using Trimble CenterPoint RTX satellite or internet delivered correction services | |
| | Reduced downtime due to loss of radio signal or cellular connectivity with Trimble xFill technology | |
| | Advanced Trimble Custom Survey GNSS chips with 672 channels | |
| | Future-proof your investment with Trimble 360 GNSS tracking | |
| | Satellite signals tracked simultaneously | GPS: L1C/A, L2C, L2E, L5<br>GLONASS: L1C/A, L1P, L2C/A, L2P, L3<br>SBAS: L1C/A, L5 (For SBAS satellites that support L5)<br>Galileo: E1, E5A, E5B, E5 AltBOC, E6[1]<br>BeiDou: B1, B2, B3<br>QZSS: L1C/A, L1-SAIF, L1C, L2C, L5<br>NavIC (IRNSS): L5 |
| | CenterPoint RTX, OmniSTAR® HP, XP, G2, VBS correction services | |
| | WAAS, EGNOS, GAGAN, MSAS | |
| | Reliable tracking in challenging environments with advanced Low Noise Amplifier (LNA) with 50 dB signal gain to reduce signal tracking effects caused by high power out-of-band transmitters | |
| | Additional iridium filtering above 1616 MHz allows antenna to be used as close as 20 m of iridium transmitter | |
| | Additional Japanese filtering below 1510 MHz allows antenna to be used as close as 100 m of Japanese LTE cell tower | |
| | Digital Signal Processor (DSP) techniques to detect and recover from spoofed GNSS signals | |
| | Advanced Receiver Autonomous Integrity Monitoring (RAIM) algorithm to detect and reject problem satellite measurements to improve position quality | |
| | Improved protection from erroneous ephemeris data | |
| | Positioning Rates | 1 Hz, 2 Hz, 5 Hz, 10 Hz, and 20 Hz |

## POSITIONING PERFORMANCE[2]

| | | |
|---|---|---|
| **CODE DIFFERENTIAL GNSS POSITIONING** | | |
| | Horizontal | 0.25 m + 1 ppm RMS |
| | Vertical | 0.50 m + 1 ppm RMS |
| | SBAS differential positioning accuracy[3] | typically <5 m 3DRMS |
| **STATIC GNSS SURVEYING** | | |
| High-Precision Static | | |
| | Horizontal | 3 mm + 0.1 ppm RMS |
| | Vertical | 3.5 mm + 0.4 ppm RMS |
| Static and Fast Static | | |
| | Horizontal | 3 mm + 0.5 ppm RMS |
| | Vertical | 5 mm + 0.5 ppm RMS |
| **REAL TIME KINEMATIC SURVEYING** | | |
| Single Baseline <30 km | | |
| | Horizontal | 8 mm + 1 ppm RMS |
| | Vertical | 15 mm + 1 ppm RMS |
| Network RTK[4] | | |
| | Horizontal | 8 mm + 0.5 ppm RMS |
| | Vertical | 15 mm + 0.5 ppm RMS |
| RTK start-up time for specified precisions[5] | | 2 to 8 seconds |
| **TRIMBLE RTX™ TECHNOLOGY (SATELLITE AND CELLULAR/INTERNET (IP))** | | |
| CenterPoint RTX[6] | | |
| | Horizontal | 2 cm RMS |
| | Vertical | 5 cm RMS |
| | RTX convergence time for specified precisions - Worldwide | < 15 min |
| | RTX QuickStart convergence time for specified precisions | < 1 min |
| | RTX convergence time for specified precisions in select regions (Trimble RTX Fast Regions) | < 1 min |
| **TRIMBLE XFILL[7]** | | |
| | Horizontal | RTK[8] + 10 mm/minute RMS |
| | Vertical | RTK[8] + 20 mm/minute RMS |

| | | |
|---|---|---|
| **HARDWARE** | | |
| **PHYSICAL** | | |
| Dimensions (W×H) | 11.9 cm x 13.6 cm (4.6 in x 5.4 in) | |
| Weight | 1.12 kg (2.49 lb) with internal battery, internal radio with UHF antenna,<br>3.57 kg (7.86 lb) items above plus range pole, controller & bracket | |
| Temperature[9] | | |
| | Operating | −40 °C to +65 °C (−40 °F to +149 °F) |
| | Storage | −40 °C to +75 °C (−40 °F to +167 °F) |
| Humidity | | 100%, condensing |
| Ingress protection | | IP67 dustproof, protected from temporary immersion to depth of 1 m (3.28 ft) |
| Shock and vibration (Tested and meets the following environmental standards) | | |
| | Shock | Non-operating: Designed to survive a 2 m (6.6 ft) pole drop onto concrete.<br>Operating: to 40 G, 10 msec, sawtooth |
| | Vibration | MIL-STD-810F, FIG.514.5C-1 |
| **ELECTRICAL** | | |
| | Power 11 to 24 V DC external power input with over-voltage protection on Port 1 and Port 2 (7-pin Lemo) | |
| | Rechargeable, removable 7.4 V, 3.7 Ah Lithium-ion smart battery with LED status indicators | |
| | Power consumption is 4.2 W in RTK rover mode with internal radio[10] | |
| Operating times on internal battery[11] | | |
| | 450 MHz receive only option | 6.5 hours |
| | 450 MHz receive/transmit option (0.5 W) | 6.0 hours |
| | 450 MHz receive/transmit option (2.0 W) | 5.5 hours |
| | Cellular receive option | 6.5 hours |
| **COMMUNICATIONS AND DATA STORAGE** | | |
| Serial | 3-wire serial (7-pin Lemo) | |
| USB v2.0 | Supports data download and high speed communications | |
| Radio modem | Fully Integrated, sealed 450 MHz wide band receiver/transmitter with frequency range of 403 MHz to 473 MHz, support of Trimble, Pacific Crest, and SATEL radio protocols: | |
| | Transmit power | 2 W |
| | Range | 3–5 km typical / 10 km optimal[12] |
| Cellular | Integrated, 3.5 G modem, HSDPA 7.2 Mbps (download), GPRS multi-slot class 12, EDGE multi-slot class 12, Penta-band UMTS/HSDPA (WCDMA/FDD) 800/850/900/1900/2100 MHz, Quad-band EGSM 850/900/1800/1900 MHz, GSM CSD, 3GPP LTE | |
| Bluetooth | Fully integrated, fully sealed 2.4 GHz communications port (Bluetooth)[13] | |
| Wi-Fi | 802.11 b,g, access point and client mode, WPA/WPA2/WEP64/WEP128 encryption | |
| USB v2.0 | Supports data download and high speed communications | |
| External communication devices for corrections supported on | Serial, USB, TCP/IP and Bluetooth ports | |
| Data storage | 6 GB internal memory; over ten years of raw observables (approx. 1.4 MB /day), based on recording every 15 seconds from an average of 14 satellites | |
| Data format | CMR+, CMRx, RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1, RTCM 3.2 input and output | |
| | 24 NMEA outputs, GSOF, RT17 and RT27 outputs | |
| **WEBUI** | | |
| | Offers simple configuration, operation, status, and data transfer | |
| | Accessible via Wi-Fi, Serial, USB, and Bluetooth | |
| **SUPPORTED CONTROLLERS** | | |
| | Trimble TSC7, Trimble T10, Trimble TSC3, Trimble Slate, Trimble CU, Trimble Tablet Rugged PC, Android and iOS devices running supported apps | |
| **CERTIFICATIONS** | | |
| | FCC Part 15 (Class B device), 24, 32; CE Mark; RCM; PTCRB; BT SIG | |

# Trimble R10 MODEL 2 GNSS SYSTEM

1 The current capability in the receivers is based on publicly available information. As such, Trimble cannot guarantee that these receivers will be fully compatible with a future generation of Galileo satellites or signals.
2 Precision and reliability may be subject to anomalies due to multipath, obstructions, satellite geometry, and atmospheric conditions. The specifications stated recommend the use of stable mounts in an open sky view, EMI and multipath clean environment, optimal GNSS constellation configurations, along with the use of survey practices that are generally accepted for performing the highest-order surveys for the applicable application including occupation times appropriate for baseline length. Baselines longer than 30 km require precise ephemeris and occupations up to 24 hours may be required to achieve the high precision static specification.
3 Depends on WAAS/EGNOS system performance.
4 Network RTK PPM values are referenced to the closest physical base station.
5 May be affected by atmospheric conditions, signal multipath, obstructions and satellite geometry. Initialization reliability is continuously monitored to ensure highest quality.
6 RMS performance based on repeatable in field measurements. Achievable accuracy and initialization time may vary based on type and capability of receiver and antenna, user's geographic location and atmospheric activity, scintillation levels, GNSS constellation health and availability and level of multipath including obstructions such as large trees and buildings.
7 Accuracies are dependent on GNSS satellite availability. xFill positioning without a Trimble CenterPoint RTX subscription ends after 5 minutes of radio downtime. xFill positioning with a CenterPoint RTX subscription will continue beyond 5 minutes providing the Trimble RTX solution has converged, with typical precisions not exceeding 6 cm horizontal, 14 cm vertical or 3 cm horizontal, 7 cm vertical in Trimble RTX Fast regions. xFill is not available in all regions, check with your local sales representative for more information.
8 RTK refers to the last reported precision before the correction source was lost and xFill started.
9 Receiver will operate normally to −40 °C, internal batteries are rated to −20 °C.
10 Tracking GPS, GLONASS and SBAS satellites.
11 Varies with temperature and wireless data rate. When using a receiver and internal radio in the transmit mode, it is recommended that an external 6 Ah or higher battery is used.
12 Varies with terrain and operating conditions.
13 Bluetooth type approvals are country specific.

Specifications subject to change without notice.



Contact your local Trimble Authorized Distribution Partner for more information

NORTH AMERICA
Trimble Inc.
10368 Westmoor Drive
Westminster CO 80021
USA

EUROPE
Trimble Germany GmbH
Am Prime Parc 11
65479 Raunheim
GERMANY

ASIA-PACIFIC
Trimble Navigation
Singapore PTE Limited
3 HarbourFront Place
#13-02 HarbourFront Tower Two
Singapore 099254
SINGAPORE

# Appendix B

# 76F031 Station Report

Government of Canada Gouvernement du Canada

Canada

Natural Resources Canada



# Station Report

Download Report

## Site Identification

| Name | Province | NTS (National Topographic System) map sheet | Unique Number | Provincial Identifier | Network |
|---|---|---|---|---|---|
| 76F731 | Newfoundland | 012H03 | 76F731 | | 49057 |

## Station Coordinates

CGG2013a is the current realization of CGVD2013 and the default geoid model.

**Coordinates**

UTM

**Reference Frame**

NAD83(CSRS)

**Vertical Datum**

CGVD2013

**Geoid**

CGG2013

**Epoch**

2010.0

The velocities are interpolated from the national Velocity Grid version 7.0.

| Zone | Easting (metres) | Northing (metres) |
|---|---|---|
| UTM21 | 467398.130 | 5450625.061 |

| h (Ellipsoidal Height) (metres) | Scale | Combined |
|---|---|---|
| 45.985 | 0.999613 | 0.999606 |

Convergence

0° 20' 19.92"

| N (Geoid Height) (metres) | H (Orthometric Height) (metres) | Published date and project ID |
|---|---|---|
| 0.752 ± 0.016 | 45.233 | 2004-01-01 M04711 |

## Vertical Data

| Vertical Datum | Elevation (m) | Order | Gravity (mGal) | Published | Project ID |
|---|---|---|---|---|---|
| CGVD2013 (2010.0) | 45.185 | 1st | 980999.71 | 2013 | H13NF1311 |
| CGVD28 | 45.495 | 1st | 980993.61 | 1990 | CP90206 |

The CGVD2013 height reported in the Vertical Data table is approximate because it is calculated from historical levelling data and not from the combination of GNSS and a geoid model.

## Station Marker

| Marker Type | Inspected in | Established by | Status | Comments |
|---|---|---|---|---|
| Permanent agency marker | 1992 | Canadian geodetic survey - nrcan | Good | None |

## Location

Accessible by passenger car or light truck and a walk of less than 50 m.

### Deer Lake

Iron pipe with brass cap east of "route 430" sign behind bushes along route no. 430 at northeast corner of junction with reidville road, 2.8 km southeast of junction with road to incinerator, 2.6 km northwest of trans-canada highway overpass, 41.1 m north of centre line of reidville road, 21.7 m east of centre line of route no. 340, 1 m above road level. Blue flat witness sign set 0.23 m e of sta.



Geodetic Reference Systems Information

Date modified: 2019-10-10

# Appendix C

# 76F0068 Station Report

Government of Canada Gouvernement du Canada Canada

Natural Resources Canada



# Station Report

Download Report

## Site Identification

| Name | Province | NTS (National Topographic System) map sheet | Unique Number | Provincial Identifier | Network |
|---|---|---|---|---|---|
| 76F068 | Newfoundland | 012H04 | 76F068 | | 49057 |

## Station Coordinates

CGG2013a is the current realization of CGVD2013 and the default geoid model.

**Coordinates**

UTM

**Reference Frame**

NAD83(CSRS)

**Vertical Datum**

CGVD2013

**Geoid**

CGG2013

**Epoch**

2010.0

The velocities are interpolated from the national Velocity Grid version 7.0.

| Zone | Easting (metres) | Northing (metres) |
|---|---|---|
| UTM21 | 456598.119 | 5429556.145 |

| h (Ellipsoidal Height) (metres) | Scale | Combined |
|---|---|---|
| 32.821 | 0.999623 | 0.999618 |

Convergence

0° 26' 53.22"

| N (Geoid Height) (metres) | H (Orthometric Height) (metres) | Published date and project ID |
|---|---|---|
| 0.157 ± 0.033 | 32.664 | 2004-01-01 M04711 |

## Vertical Data

| Vertical Datum | Elevation (m) | Order | Gravity (mGal) | Published | Project ID |
|---|---|---|---|---|---|
| CGVD2013 (2010.0) | 32.656 | 1st | 980978.58 | 2013 | H13NF1311 |
| CGVD28 | 32.966 | 1st | 980976.69 | 1976 | VA1F76 |

The CGVD2013 height reported in the Vertical Data table is approximate because it is calculated from historical levelling data and not from the combination of GNSS and a geoid model.

## Station Marker

| Marker Type | Inspected in | Established by | Status | Comments |
|---|---|---|---|---|
| Permanent agency marker | 1992 | Canadian geodetic survey - nrcan | Good | None |

## Location

### Pasadena

Trans-canada highway concrete bridge over blue gulch brook, 0.9 km northeast of pentacostal church, tablet in top of southeast concrete abutment, 77 cm northwest of 50 cm southwest of east corner of bridge, 20 cm above road level.



Geodetic Reference Systems Information

Date modified: 2019-10-10

# Appendix D

## 96G7002 Station Report

Government of Canada Gouvernement du Canada

Canada

Natural Resources Canada



# Station Report

Download Report

## Site Identification

| Name | Province | NTS (National Topographic System) map sheet | Unique Number | Provincial Identifier | Network |
|---|---|---|---|---|---|
| CBRK CORNERBROOK | Newfoundland | 012A13 | 96G7002 | | CBN |

## Station Coordinates

CGG2013a is the current realization of CGVD2013 and the default geoid model.

**Coordinates**

UTM

**Reference Frame**

NAD83(CSRS)

**Vertical Datum**

CGVD2013

**Geoid**

CGG2013

**Epoch**

2010.0 - Epoch of adjustment

The velocities are estimated from the GNSS time series at the station.

| Zone | Easting (metres) | Northing (metres) |
|---|---|---|
| UTM21 | 430456.596 ± 0.0019 | 5421667.150 ± 0.0029 |

| h (Ellipsoidal Height) (metres) | Scale | Combined |
|---|---|---|
| 66.460 ± 0.0024 | 0.999659 | 0.999649 |

| Convergence |
|---|
| 0° 42' 58.3" |

| N (Geoid Height) (metres) | H (Orthometric Height) (metres) | Published date and project ID |
|---|---|---|
| -1.777 ± 0.024 | 68.237 | 2019-02-14 M18-020 |

## Vertical Data

| Vertical Datum | Elevation (m) | Order | Gravity (mGal) | Published | Project ID |
|---|---|---|---|---|---|
| CGVD2013 (2010.0) | 68.240 | 1st | 980954.08 | 2013 | H13NF1311 |
| CGVD28 | 68.554 | 1st | 980970.15 | 1999 | N1F99 |

The CGVD2013 height reported in the Vertical Data table is approximate because it is calculated from historical levelling data and not from the combination of GNSS and a geoid model.

## Station Marker

| Marker Type | Inspected in | Established by | Status | Comments |
|---|---|---|---|---|
| Self centering plate | 2016 | Nfld dept of forest resources and lands (survey directorate, | Good | None |

## Location

Accessible by passenger car or light truck and a walk of less than 50 m.

### Corner Brook

Cbn concrete pillar on north side of o'connell drive, on rock outcrop on grounds of college of the north atlantic, forced centering plate set in top of pillar. West of the fisher building, 45 m east of pioneer street, 43 m from north edge of o'connell drive.



Geodetic Reference Systems Information

Date modified: 2019-10-10

# Appendix E

# River Transects

| River Cross Sections | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-1 | Date: | 14-Nov-19 |
| Location | Northing: | 5448685 | Easting: | 467398 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-2 | Date: | 14-Nov-19 |
| Location | Northing: | 5448761 | Easting: | 467265 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

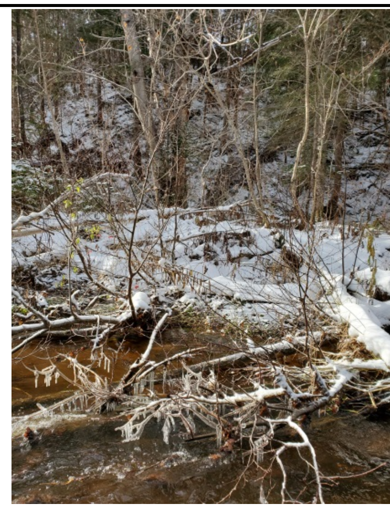
Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-3 | Date: | 14-Nov-19 |
| Location | Northing: | 5448923.2 | Easting: | 467228 | |

Downstream:

Right Bank:



Upstream:

Left Bank:

Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-4 | Date: | 14-Nov-19 |
| Location | Northing: | 5449001 | Easting: | 467224 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

| River Cross Sections | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-5 | Date: | 14-Nov-19 |
| Location | Northing: | 5449043 | Easting: | 467210 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

| River Cross Sections | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-6 | Date: | 14-Nov-19 |
| Location | Northing: | 5449058 | Easting: | 467194 | |

| Downstream: | Right Bank: |
|---|---|
|  |  |
| **Upstream:** | **Left Bank:** |
|  |  |

| Comments: | |
|---|---|
| | Moved this transect to an area we could safely cross |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-1 | Date: | 15-Nov-19 |
| Location | Northing: | 5249707 | Easting: | 454817 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

| | |
|---|---|
| Comments: | Moved this transect to safer crossing area |

SEM

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-2 | Date: | 15-Nov-19 |
| Location | Northing: | 5429668 | Easting: | 454869 | |

| | |
|---|---|
| Downstream: | Right Bank: |
|  |  |
| Upstream: | Left Bank: |
|  |  |

| | |
|---|---|
| Comments: | Small section in middle we were unable to get some shots in due to the area being too deep and turbulent to cross |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-3 | Date: | 15-Nov-19 |
| Location | Northing: | 5429613 | Easting: | 454889 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-4 | Date: | 15-Nov-19 |
| Location | Northing: | 5429500 | Easting: | 454876 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

| River Cross Sections | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-5 | Date: | 15-Nov-19 |
| Location | Northing: | 5428353 | Easting: | 454990 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

| | |
|---|---|
| Comments: | Moved this transect to a less turbulent/deep area so we could safely cross. |

# Appendix F

# Bridge Data Sheets

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Lower Humber - Bridge to Humber Valley Resort | Underside of Deck Elevation: | 10 |
| GPS Northing: | 5428011 | Top of Deck Elevation: | 12.6 |
| GPS Easting: | 449240 | Water Level: | 5.7 |
| Span: | 146.5 | No of piers: | 2 |
| Length (parallel to river): | 9.2 | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/cobble |
| | Left bank: | Boulders/cobble | Right Bank: | Boulder/cobble |
| | Left floodplain: | Alders/gravel | Right floodplain: | Trees (medium)/alders |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/cobble |
| | Left bank: | Boulders/cobble | Right Bank: | Boulder/cobble |
| | Left floodplain: | Alders/gravel | Right floodplain: | Alders/gravel |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Lower Humber - North Shore Highway (Ballam Bridge 4129) | Underside of Deck Elevation: | 3.17 |
| GPS Northing: | 5422705 | Top of Deck Elevation: | 4.52 |
| GPS Easting: | 435038 | Water Level: | 0.43 |
| Span: | 61.2 | No of piers: | 2 |
| Length (parallel to river): | 8.8 | Width of piers: | 23.9 |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | Concrete road bridge |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/Cobble |
| | Left bank: | Cobble/grass | Right Bank: | Boulders/grass/gravel |
| | Left floodplain: | Grass/gravel | Right floodplain: | Gravel/grass |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/Cobble |
| | Left bank: | Gravel/cobble | Right Bank: | Boulder/Cobble |
| | Left floodplain: | Grass/gravel | Right floodplain: | Grass/Asphalt Road |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Lower Humber - Tamarack Street Bridge | Underside of Deck Elevation: | 6.7 (RB), 7.7 (LB) |
| GPS Northing: | 5425933 | Top of Deck Elevation: | 9.0 (RB), 10.0 (LB) |
| GPS Easting: | 444360 | Water Level: | 3.5 |
| Span: | 143.7 | No of piers: | 2 |
| Length (parallel to river): | 5.5 | Width of piers: | 45.9 |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | Metal bridge |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Grass/cobble | Right Bank: | Grass/cobble |
| | Left floodplain: | Grass/bush | Right floodplain: | Medium trees |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Grass/cobble | Right Bank: | Grass/bush |
| | Left floodplain: | Grass/gravel | Right floodplain: | Grass |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 14/11/2019 |
| Bridge Location: | Pasadena - TCH Bridges over South Brook | Underside of Deck Elevation: | 11.1 (U/S), 10.3 (D/S) |
| GPS Northing: | 5429647 | Top of Deck Elevation: | 13.5 (U/S), 12.7 (D/S) |
| GPS Easting: | 454866 | Water Level: | 7.6 (U/S), 7.1 (D/S) |
| Span: | 25.9 (U/S), 25.9 (D/S) | No of piers: | 0 |
| Length (parallel to river): | 12.4 (U/S), 12.5 (D/S) | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition, concrete road bridges |
| Other: | 2 bridges |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/cobble |
| | Left bank: | Grass | Right Bank: | Boulder/cobble |
| | Left floodplain: | Grass/medium trees | Right floodplain: | Cobble/grass |
| **D/S** | Alignment: | Narrows and then turns to west | Substrate: | Boulder/cobble |
| | Left bank: | Boulder/cobble | Right Bank: | Cobble/grass |
| | Left floodplain: | Medium trees | Right floodplain: | Grass/small bush |

## Photos

Downstream:


Upstream:


## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Steady Brook - Marble Drive Bridge | Underside of Deck Elevation: | 8 |
| GPS Northing: | 5422541 | Top of Deck Elevation: | 9.8 |
| GPS  Easting: | 439534 | Water Level: | 4.9 |
| Span: | 26.1 | No of piers: | 0 |
| Length (parallel to river): | 12.4 | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Boulders | Right Bank: | Boulders |
| | Left floodplain: | Grass/bush | Right floodplain: | Grass |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Boulders | Right Bank: | Concrete retaining wall |
| | Left floodplain: | Grass | Right floodplain: | Grass/gravel |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Steady Brook - Bridge to Marblewood Village | Underside of Deck Elevation: | 21 |
| GPS Northing: | 5422263 | Top of Deck Elevation: | 21.6 |
| GPS Easting: | 439777 | Water Level: | 13.2 |
| Span: | 19.7 | No of piers: | 0 |
| Length (parallel to river): | 6.6 | Width of piers: | NA |

## Comments

| | |
|---|---|
| Condition: | Some crumbling/cracked concrete |
| Other: | Bridge is over a gorge, couldn't physically access the water level but dropped measuring tape down to measure |
| | Also dropped tape to measure underside of bridge as couldn't physically acces |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Bedrock |
| | Left bank: | Bedrock | Right Bank: | Bedrock |
| | Left floodplain: | Gravel/trees | Right floodplain: | Gravel |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Bedrock |
| | Left bank: | Bedrock | Right Bank: | Bedrock |
| | Left floodplain: | Gravel/trees | Right floodplain: | Gravel/trees |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 15/11/2019 |
| Bridge Location: | Steady Brook - TCH Bridges (TCH-124 and TCH-064) | Underside of Deck Elevation: | 15.3 |
| GPS Northing: | 5422398 | Top of Deck Elevation: | 17.2 |
| GPS Easting: | 439756 | Water Level: | 8.7 |
| Span: | 30.5 | No of piers: | 0 |
| Length (parallel to river): | 25.5 | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders |
| | Left bank: | Boulders | Right Bank: | Boulders |
| | Left floodplain: | Grass | Right floodplain: | Gravel/grass |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders |
| | Left bank: | Boulders | Right Bank: | Boulders |
| | Left floodplain: | Grass | Right floodplain: | Gravel/grass |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 14/11/2019 |
| Bridge Location: | Upper Humber - Nichols Bridge (4-050) | Underside of Deck Elevation: | 10 |
| GPS Northing: | 5448580 | Top of Deck Elevation: | 11.6 |
| GPS Easting: | 467377 | Water Level: | 5.7 |
| Span: | 110 | No of piers: | 0 |
| Length (parallel to river): | 5.9 | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | (See additional photo of bridge in deliverables) |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Cobble/gravel | Right Bank: | Cobble/Boulders |
| | Left floodplain: | Gravel/grass | Right floodplain: | Gravel/grass |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulders/cobble |
| | Left bank: | Cobble/gravel | Right Bank: | Cobble/Boulders |
| | Left floodplain: | Gravel/grass | Right floodplain: | Cobble/gravel |

## Photos

Downstream:

Upstream:

## Bridge Data Sheet

| | | | |
|---|---|---|---|
| Project: | **RTK Bridge Surveys** | Date: | 14/11/2019 |
| Bridge Location: | Upper Humber - Viking Trail Bridge | Underside of Deck Elevation: | 10.2 |
| GPS Northing: | 5449096 | Top of Deck Elevation: | 12.5 |
| GPS Easting: | 468415 | Water Level: | 5.77 |
| Span: | 139.9 | No of piers: | 2 |
| Length (parallel to river): | 11.3 | Width of piers: | N/A |

## Comments

| | |
|---|---|
| Condition: | In good condition |
| Other: | Concrete road bridge, unable to measure piers on bridge due to heavy traffic |
| | |

## Channel Conditions

| | | | | |
|---|---|---|---|---|
| **U/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/cobble |
| | Left bank: | Boulder/cobble | Right Bank: | Boulder/cobble |
| | Left floodplain: | Grass | Right floodplain: | Grass |
| **D/S** | Alignment: | Fairly straight and regular | Substrate: | Boulder/cobble |
| | Left bank: | Boulder/cobble | Right Bank: | Boulder/cobble |
| | Left floodplain: | Grass | Right floodplain: | Grass |

## Photos

Downstream:

Upstream:

# SEM Field Survey Report – Supplemental Data

TPB188156

*This page left intentionally blank*

CLIMATE CHANGE FLOOD RISK MAPPING STUDY and the
DEVELOPMENT OF A FLOOD FORECASTING SERVICE
HUMBER RIVER COMMUNITIES

wood.

| Point | Northing | Easting | Elevation | Code | Date | Time (NST) |
|---|---|---|---|---|---|---|
| 19-SEM4 | 5422583.744 | 439398.2 | 6.06 | NAIL | 15/11/2019 | 13:14:39 |
| NL14-007 | 5422581.218 | 439395.6 | 6.104 | BOLT | 15/11/2019 | 14:37:53 |
| 18G0004 | 5422592.117 | 439319.7 | 4.539 | BRASS PLA | 15/11/2019 | 14:46:02 |
| 4000 | 5422581.919 | 439389.5 | 3.182 | WL | 15/11/2019 | 14:49:59 |
| 4001 | 5422581.91 | 439389.5 | 3.181 | WL | 15/11/2019 | 14:50:11 |
| 4002 | 5422581.921 | 439389.5 | 3.183 | WL | 15/11/2019 | 14:50:20 |
| 4003 | 5422581.913 | 439389.5 | 3.175 | WL | 15/11/2019 | 14:51:53 |

Station Information
02YL012 - Steady Brook anove Confluence to Humber River
Stage recorded every 5 minutes

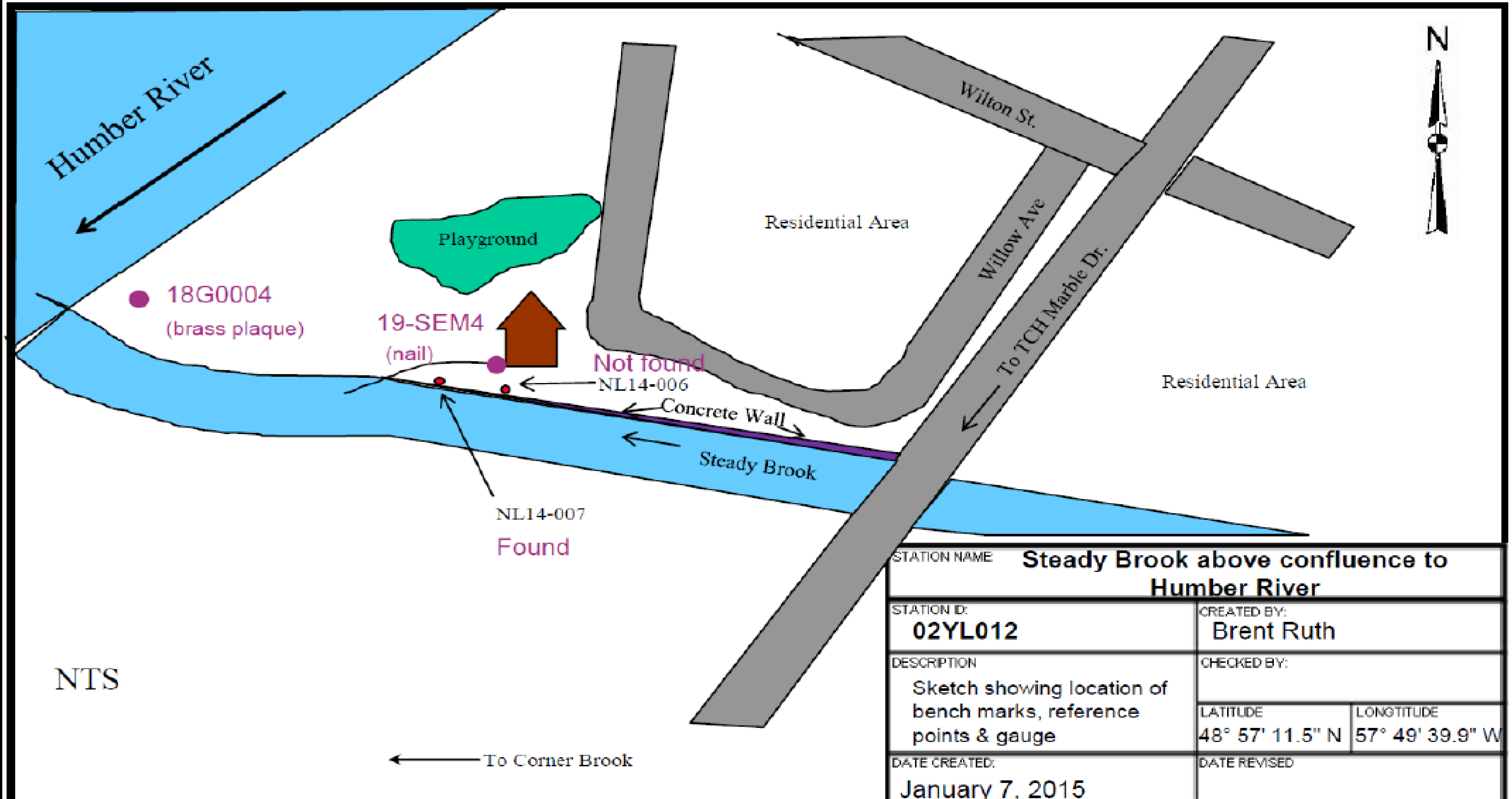
| Local Stage | Date | Comparison to Local Datum |
|---|---|---|
| 2.107 | 15 Nov 19, 14:40 | |
| 2.108 | 15 Nov 19, 14:45 | |
| 2.104 | 15 Nov 19, 14:50 | 1.077 |
| 2.111 | 15 Nov 19, 14:55 | |

Which suggests an elevation adjustment for this site of: 1.08 m


# Steady Brook above confluence to Humber River 02YL012

Sketch showing location of bench marks, reference points & gauge

Dessin d'emplacement des élévations de repère de nivellement, des points de measure et de la jauge




| STATION NAME: Steady Brook above confluence to Humber River | |
|---|---|
| STATION ID: 02YL012 | CREATED BY: Brent Ruth |
| DESCRIPTION: Sketch showing location of bench marks, reference points & gauge | CHECKED BY: |
| | LATITUDE: 48° 57' 11.5" N / LONGTITUDE: 57° 49' 39.9" W |
| DATE CREATED: January 7, 2015 | DATE REVISED: |

| Point | Northing | Easting | Elevation | Code | Date | Time (NST) |
|---|---|---|---|---|---|---|
| TBM06-001 | 5454509 | 473767.4 | 12.674 | LAGSCREW | 14/11/2019 | 9:08:28 |
| NL90-025 | 5454512 | 473771.8 | 11.935 | REBAR | 14/11/2019 | 9:15:47 |
| 1000 | 5454497 | 473762.7 | 10.62 | WL | 14/11/2019 | 9:20:21 |
| 1001 | 5454497 | 473762.7 | 10.615 | WL | 14/11/2019 | 9:20:38 |
| 1002 | 5454497 | 473762.7 | 10.613 | WL | 14/11/2019 | 9:20:44 |
| 1003 | 5454496 | 473761.4 | 10.619 | WL | 14/11/2019 | 9:27:27 |
| 19-SEM5 | 5454509 | 473754.2 | 12.118 | NAIL | 14/11/2019 | 9:42:52 |
| 1004 | 5454509 | 473776.5 | 10.624 | WL-intake | 14/11/2019 | 9:44:53 |
| 1005 | 5454509 | 473776.5 | 10.622 | WL-intake | 14/11/2019 | 9:45:04 |

Station Information

02YL001 Upper Humber River near Reidville

Stage recorded every 5 minutes

Line data from the same date indicates the local datum water level at the same time of the survey

| Local Stage (m) | Date | Comparison to Local Datum |
|---|---|---|
| 1.987 | 14 Nov 19, 09:15 | |
| 1.988 | 14 Nov 19, 09:20 | 8.627 |
| 1.989 | 14 Nov 19, 09:25 | |

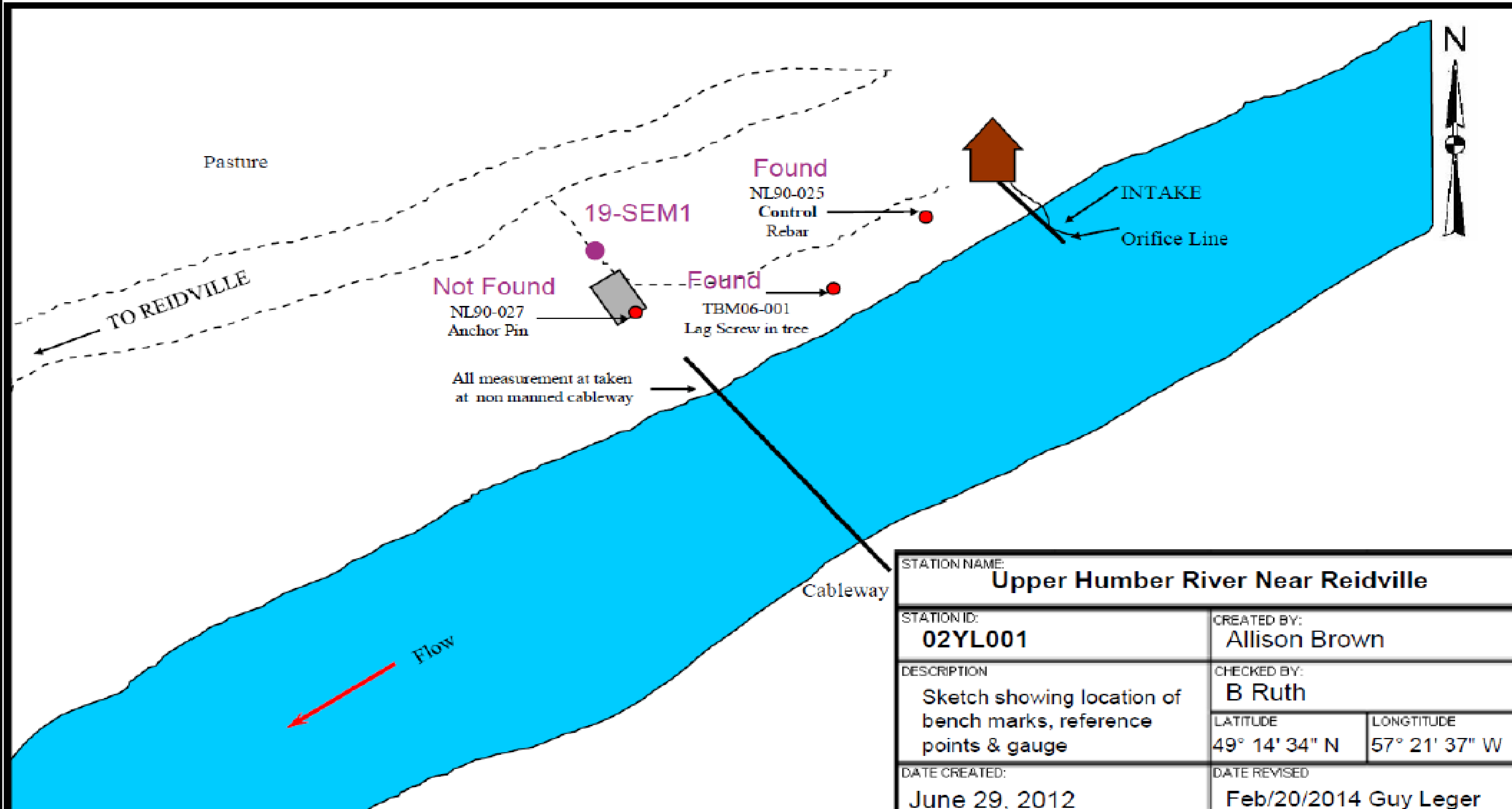
Which suggests an elevation adjustment for this site of: 8.627 m

(RTK CGVD2013 Datum WL - ADRS Local Datum WL)

# Upper Humber River Near Reidville 02YL001

Sketch showing location of bench marks, reference points & gauge

Dessin d'emplacement des élévations de repère de nivellement, des points de measure et de la jauge




| STATION NAME: Upper Humber River Near Reidville | | |
|---|---|---|
| STATION ID: 02YL001 | CREATED BY: Allison Brown | |
| DESCRIPTION: Sketch showing location of bench marks, reference points & gauge | CHECKED BY: B Ruth | |
| | LATITUDE: 49° 14' 34" N | LONGTITUDE: 57° 21' 37" W |
| DATE CREATED: June 29, 2012 | DATE REVISED: Feb/20/2014 Guy Leger | |

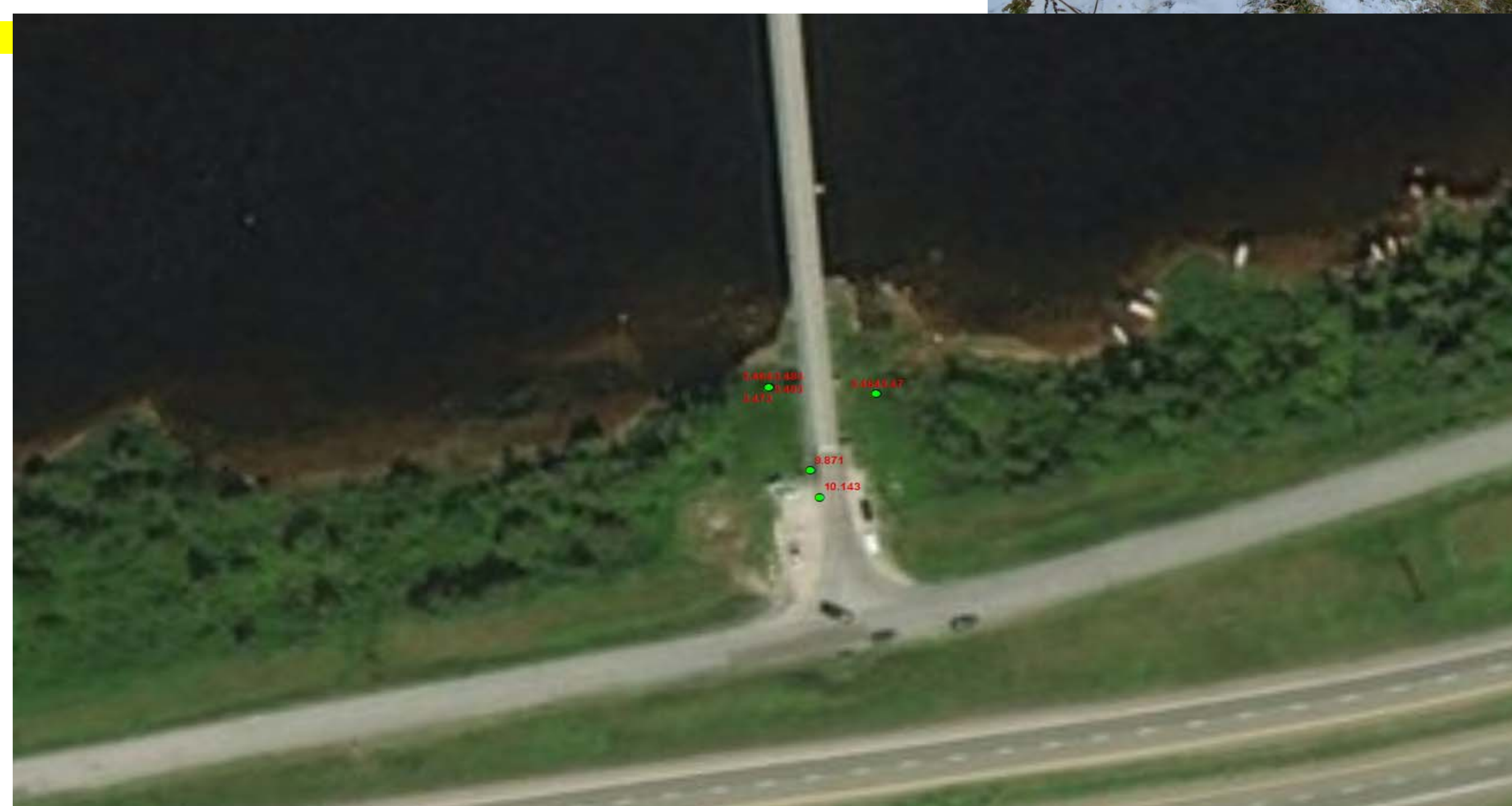
CLIMATE CHANGE FLOOD RISK MAPPING STUDY and the
DEVELOPMENT OF A FLOOD FORECASTING SERVICE
HUMBER RIVER COMMUNITIES

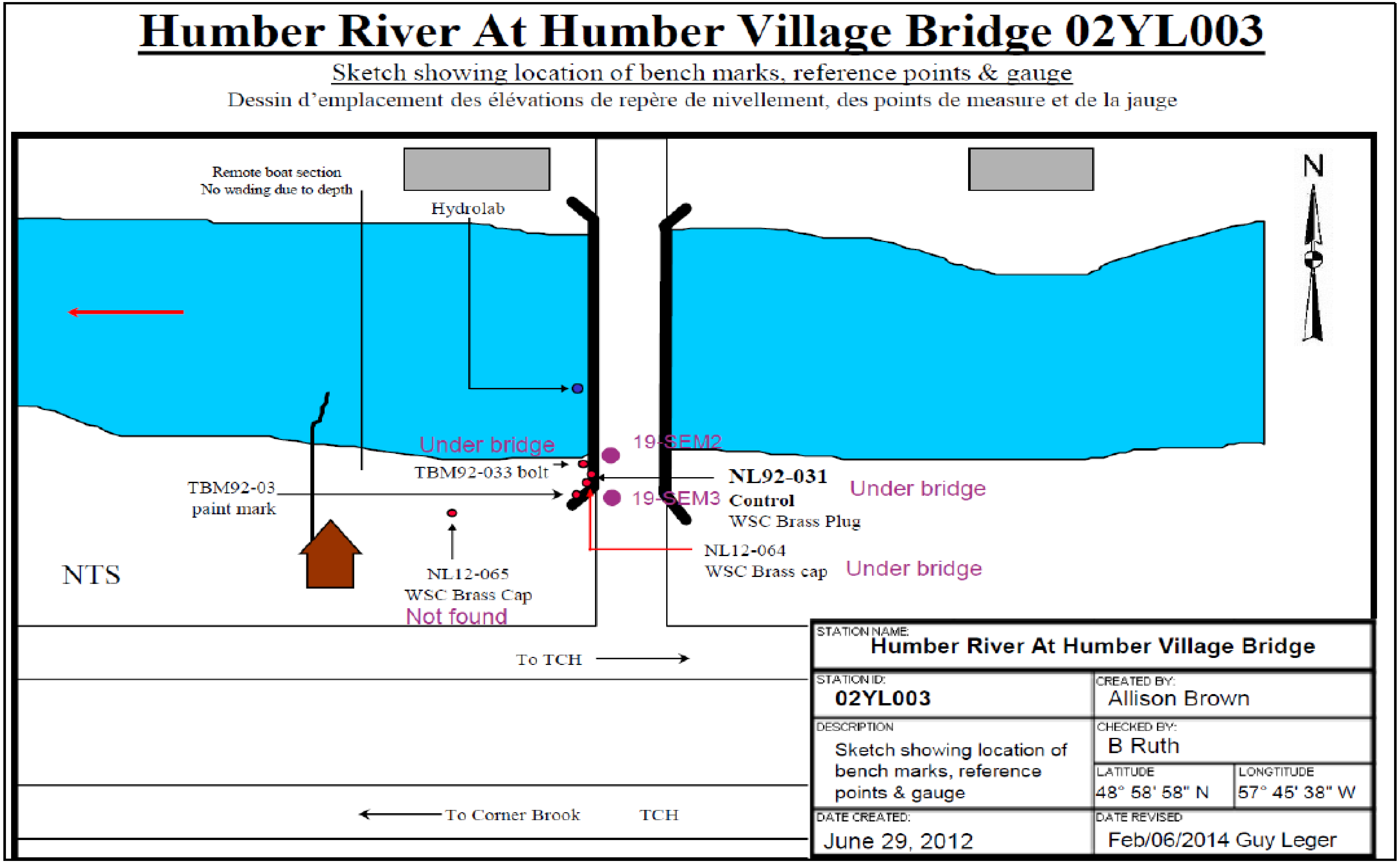
| Point | Northing | Easting | Elevation | Code | Date | Time (NST) |
|---|---|---|---|---|---|---|
| 19-sem2 | 5425835.931 | 444367.4 | 9.871 | NAIL | 15/11/2019 | 10:17:50 |
| 19-sem3 | 5425830.558 | 444369 | 10.143 | BOLT | 15/11/2019 | 10:22:59 |
| 3100 | 5425852.766 | 444359.6 | 3.473 | WL | 15/11/2019 | 10:34:32 |
| 3101 | 5425852.78 | 444359.7 | 3.483 | WL | 15/11/2019 | 10:34:43 |
| 3102 | 5425852.788 | 444359.7 | 3.464 | WL | 15/11/2019 | 10:34:50 |
| 3103 | 5425852.789 | 444359.7 | 3.483 | WL | 15/11/2019 | 10:35:06 |
| 3104 | 5425851.43 | 444379.4 | 3.464 | WL | 15/11/2019 | 10:39:28 |
| 3104 | 5425851.416 | 444379.4 | 3.47 | WL | 15/11/2019 | 10:39:51 |

Station Information
02YL003 - Humber River at Humber Village Bridge
Stage recorded every 15 minutes
Line data from the same date indicates the local datum water level at the same time of the survey

| Local Stage (m) | Date | Comparison to Local Datum |
|---|---|---|
| 3.047 | 15 Nov 19, 10:15 | |
| 3.044 | 15 Nov 19, 10:30 | 0.429 |
| 3.051 | 15 Nov 19, 10:45 | |

Which suggests an elevation adjustment for this site of: 0.429 m
(RTK CGVD2013 Datum WL - ADRS Local Datum WL)




Humber River At Humber Village Bridge 02YL003
Sketch showing location of bench marks, reference points & gauge
Dessin d'emplacement des élévations de repère de nivellement, des points de measure et de la jauge
Remote boat section
No wading due to depth
Hydrolab
N
Under bridge
19-SEM2
TBM92-033 bolt
TBM92-03
paint mark
NL92-031
Control
WSC Brass Plug
Under bridge
19-SEM3
NL12-065
WSC Brass Cap
Not found
NL12-064
WSC Brass cap
Under bridge
NTS
To TCH
To Corner Brook
TCH
STATION NAME:
Humber River At Humber Village Bridge
STATION ID:
02YL003
CREATED BY:
Allison Brown
DESCRIPTION
Sketch showing location of bench marks, reference points & gauge
CHECKED BY:
B Ruth
LATITUDE
48° 58' 58" N
LONGTITUDE
57° 45' 38" W
DATE CREATED:
June 29, 2012
DATE REVISED
Feb/06/2014 Guy Leger

CLIMATE CHANGE FLOOD RISK MAPPING STUDY and the
DEVELOPMENT OF A FLOOD FORECASTING SERVICE
HUMBER RIVER COMMUNITIES

| Point | Northing | Easting | Elevation | Code | Date | Time (NST) |
|---|---|---|---|---|---|---|
| 2000 | 5428995.305 | 455298.1 | 13.595 | WL | 14/11/2019 | 16:19:50 |
| 2001 | 5428995.296 | 455298.1 | 13.596 | WL | 14/11/2019 | 16:20:27 |
| 2002 | 5428995.324 | 455298.1 | 13.664 | WL | 14/11/2019 | 16:25:22 |
| 2003 | 5429015.338 | 455276.4 | 13.596 | WL | 14/11/2019 | 16:51:41 |
| 2004 | 5429015.339 | 455276.4 | 13.584 | WL | 14/11/2019 | 16:52:00 |
| NL12-061 | 5429002.362 | 455288.7 | 16.799 | BRASS PLUG | 14/11/2019 | 16:33:51 |
| TBM-07002 | 5429002.685 | 455288.7 | 16.85 | LOOP IN REBAR | 14/11/2019 | 16:39:35 |
| NL92-052 | 5429003.856 | 455286.7 | 18.045 | BRASS PLUG | 14/11/2019 | 16:45:42 |

Station Information
02YL004 - South Brook at Pasadena
Stage recorded every 5 minutes

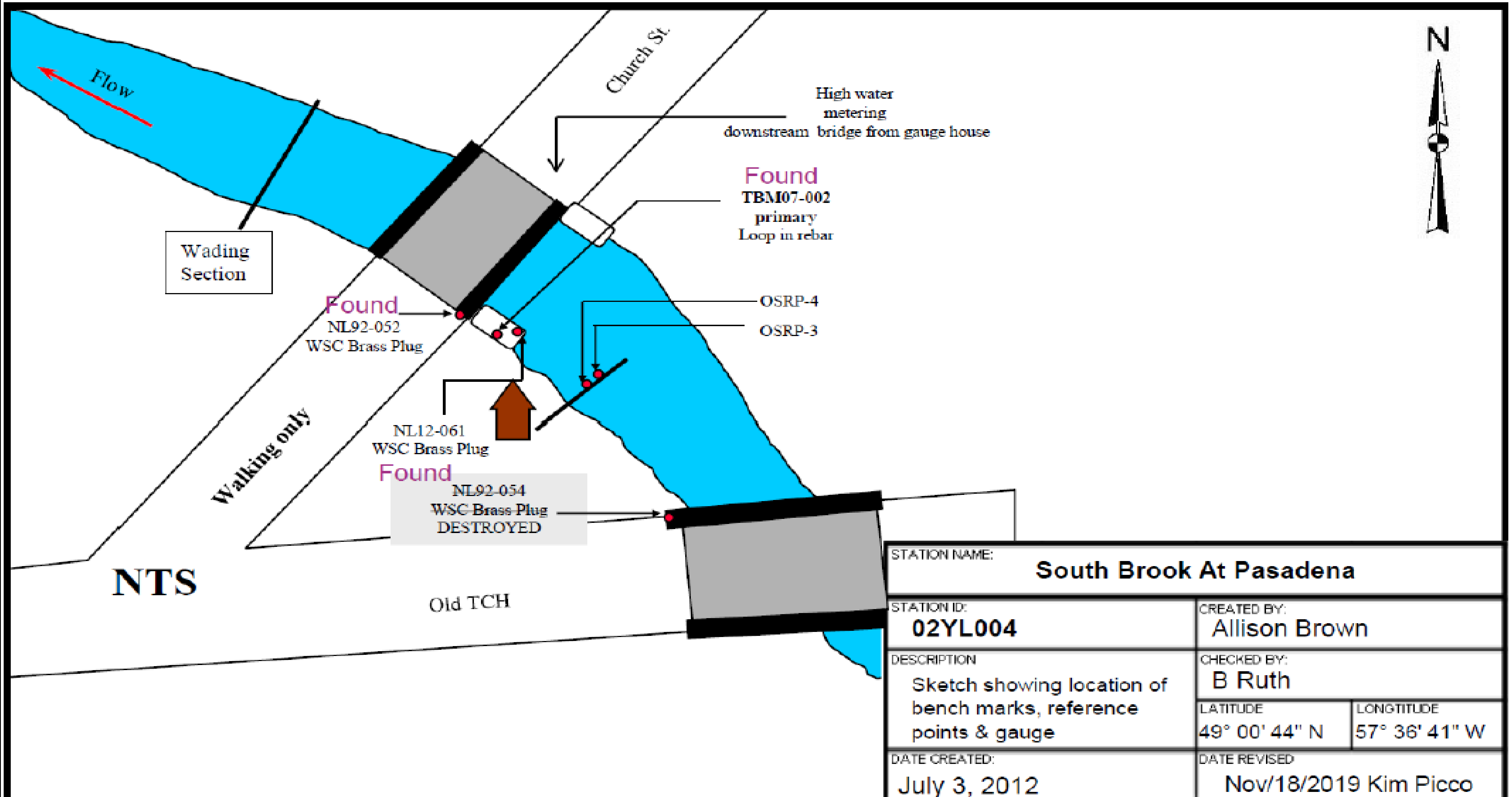
| Local Stage (m) | Date | Comparison to Local Datum |
|---|---|---|
| 0.492 | 14 Nov 19, 16:05 | |
| 0.493 | 14 Nov 19, 16:10 | |
| 0.493 | 14 Nov 19, 16:15 | |
| 0.493 | 14 Nov 19, 16:20 | 13.103 |
| 0.492 | 14 Nov 19, 16:25 | 13.172 |
| 0.491 | 14 Nov 19, 16:30 | |
| 0.491 | 14 Nov 19, 16:35 | |
| 0.49 | 14 Nov 19, 16:40 | |
| 0.489 | 14 Nov 19, 16:45 | |
| 0.488 | 14 Nov 19, 16:50 | 13.108 |
| 0.488 | 14 Nov 19, 16:55 | |

Which suggests an elevation adjustment for this site of: 13.13 m

# South Brook At Pasadena 02YL004

Sketch showing location of bench marks, reference points & gauge

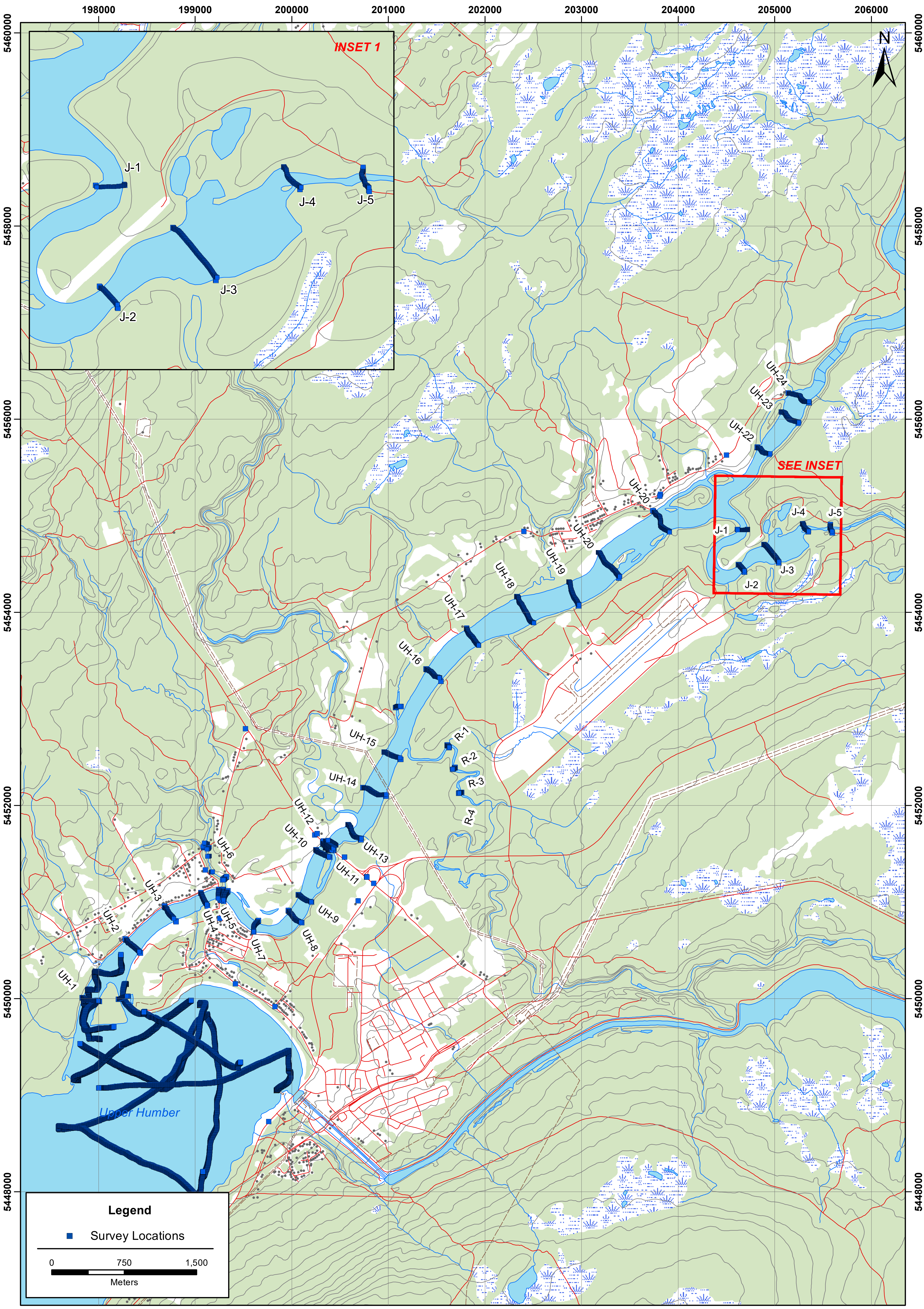
Dessin d'emplacement des élévations de repère de nivellement, des points de measure et de la jauge



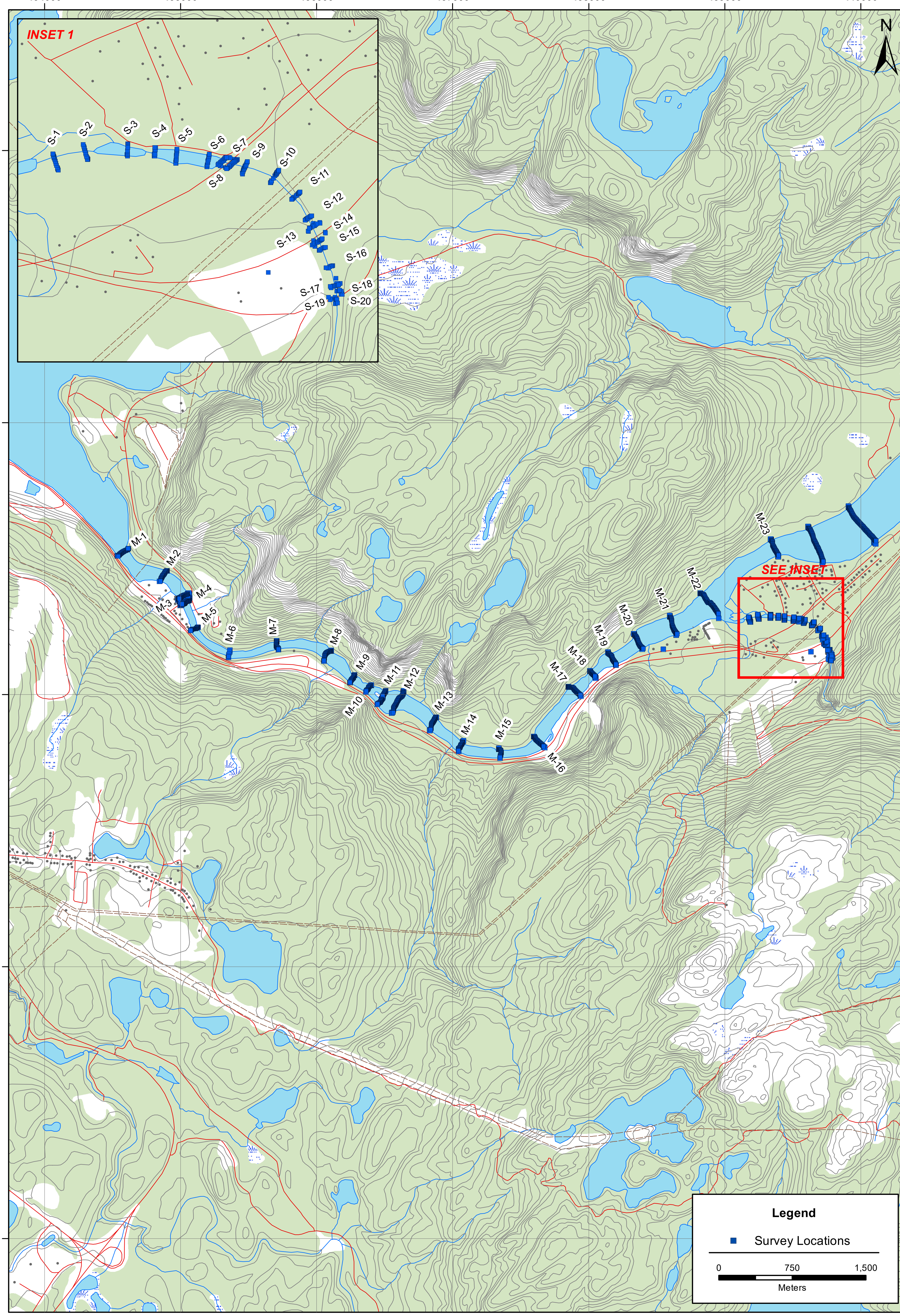
# Appendix D

# Field Survey Bathymetry Data

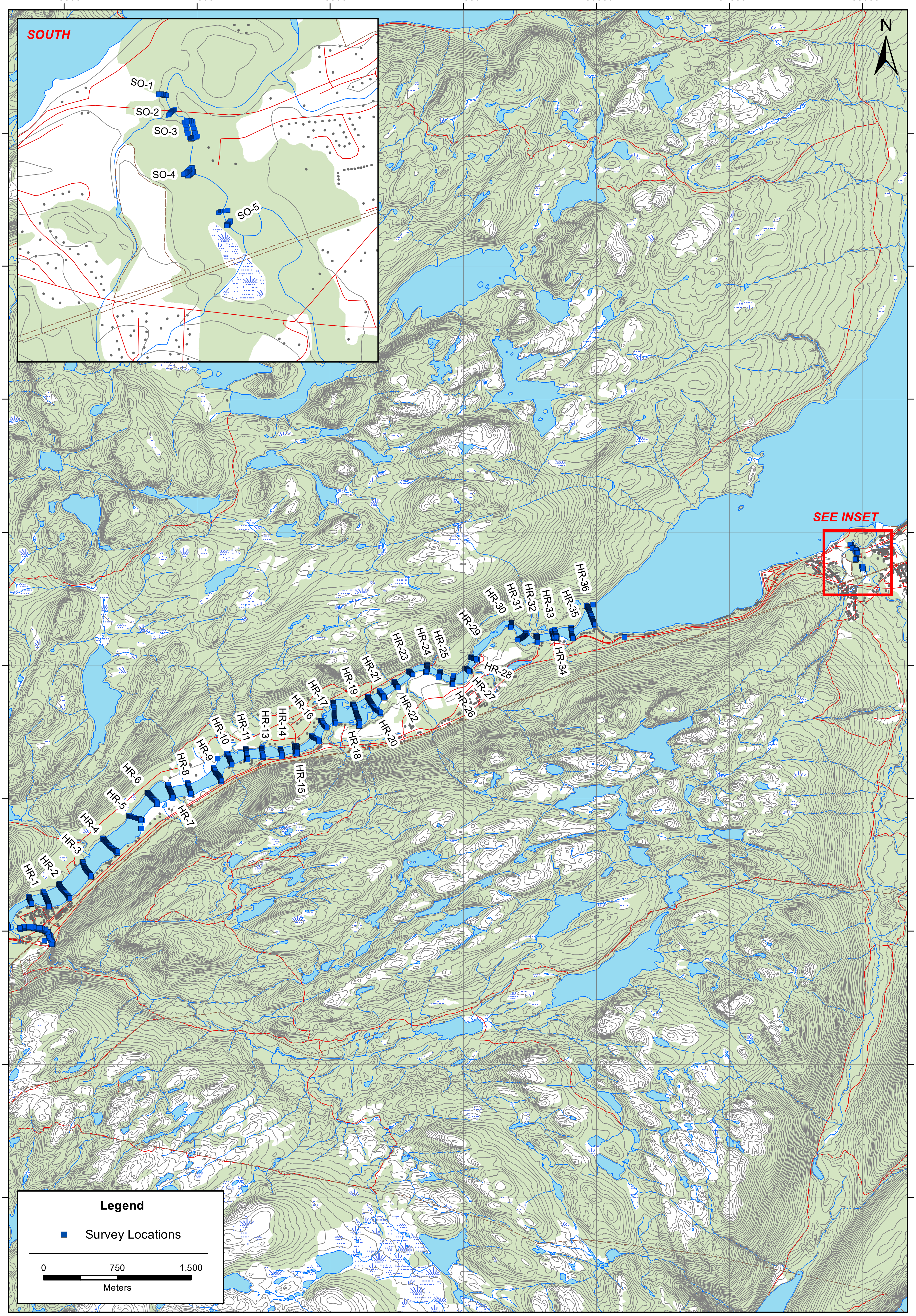
*This page left intentionally blank*




| Notes: | Client: | Date: | Project: |
|---|---|---|---|
| 1. This map is intended to show relative locations in support of this report.<br>2. All locations, dimensions, and orientations are approximate.<br>3. All coordinates are UTM NAD83, Zone 21. | Government of Newfoundland and Labrador<br>Department of Municipal Affairs and Environment<br>Water Resources Management Division | December 2019 | Humber River - Flood Risk Mapping Project |
| | | Drawn by: J. Abbott | Title: Stream Crossings - Upper Region |
| | wood. | Approved by: T. Praamsma | Scale: As Shown · Project No.: TPB188156 · Figure No.: 1 |

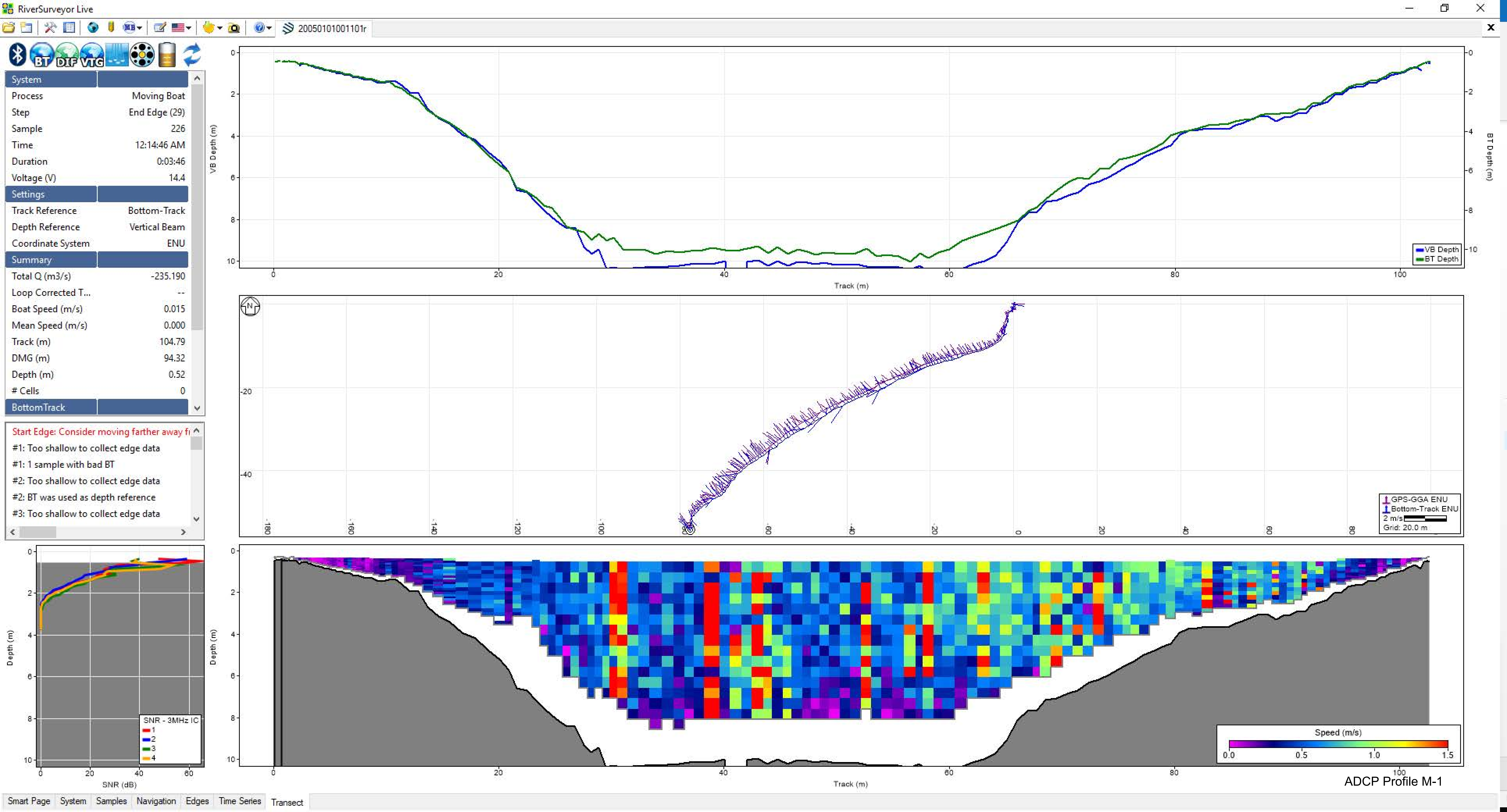



| Notes: | Client: | Date: | Project: |
|---|---|---|---|
| 1. This map is intended to show relative locations in support of this report.<br>2. All locations, dimensions, and orientations are approximate.<br>3. All coordinates are UTM NAD83, Zone 21. | Government of Newfoundland and Labrador<br>Department of Municipal Affairs and Environment<br>Water Resources Management Division | December 2019 | Humber River - Flood Risk Mapping Project |
| | | Drawn by: J. Abbott | Title: Stream Crossings - Lower Region 1 |
| | wood. | Approved by: T. Praamsma | Scale: As Shown / Project No.: TPB188156 / Figure No.: 2 |



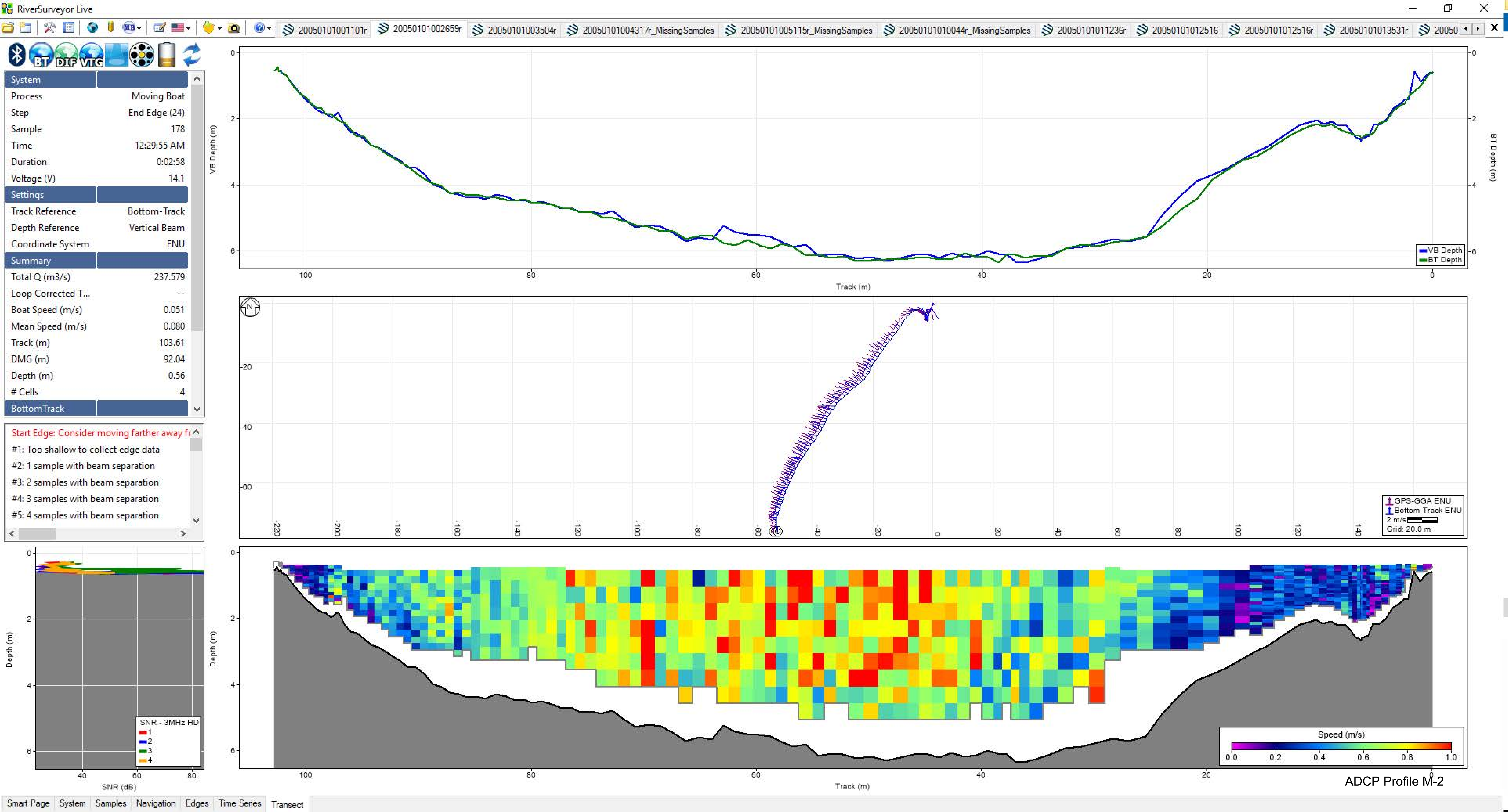

| Notes: | Client: | Date: | Project: |
|---|---|---|---|
| 1. This map is intended to show relative locations in support of this report.<br>2. All locations, dimensions, and orientations are approximate.<br>3. All coordinates are UTM NAD83, Zone 21. | Government of Newfoundland and Labrador<br>Department of Municipal Affairs and Environment<br>Water Resources Management Division | December 2019 | Humber River - Flood Risk Mapping Project |
| | | Drawn by: J. Abbott | Title: Stream Crossings - Lower Region 2 |
| | wood. | Approved by: T. Praamsma | Scale: As Shown / Project No.: TPB188156 / Figure No.: 3 |

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-1 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349198.528, 5424466.371 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.282 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:45AM |



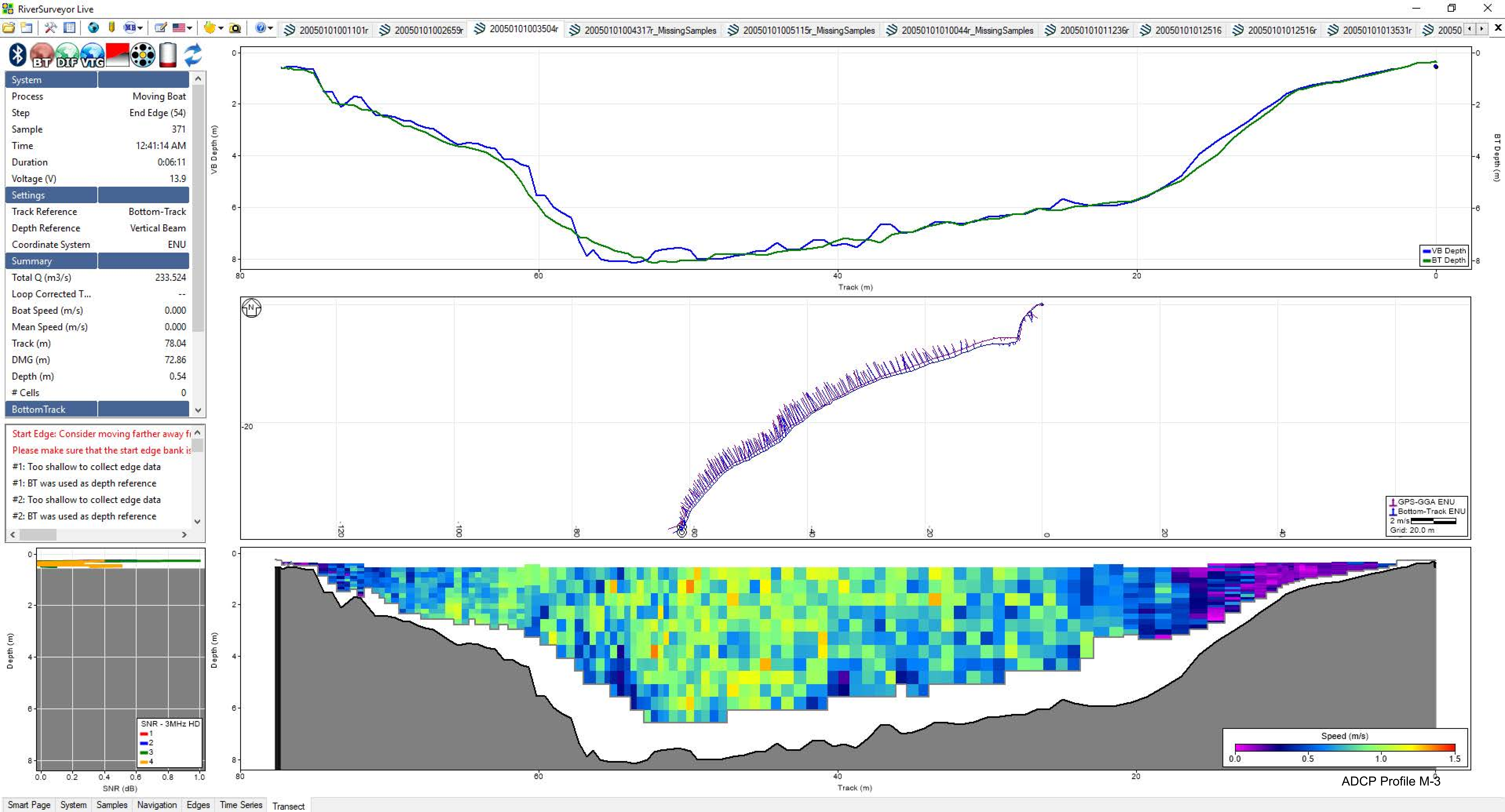
ADCP Profile M-1

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-2 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349498.628, 5424297.128 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.281 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:15PM |



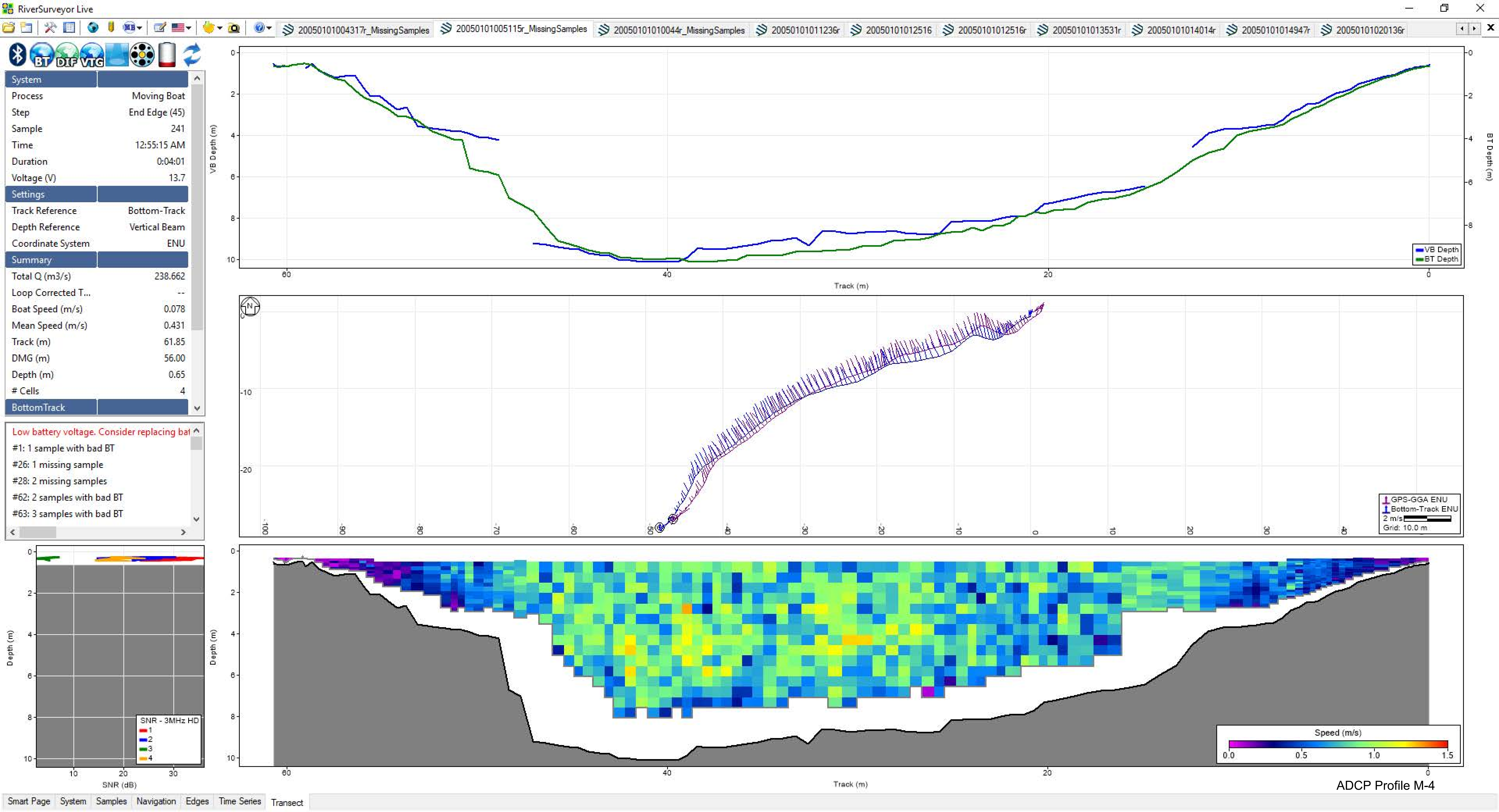

ADCP Profile M-2

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-3 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349650.525, 5424149.476 | | |
| **Bridge/culvert ID:** | Ballon Bridge (downstream) | | |
| **Water level elevation at time of survey (m):** | | 0.173 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:25 PM |



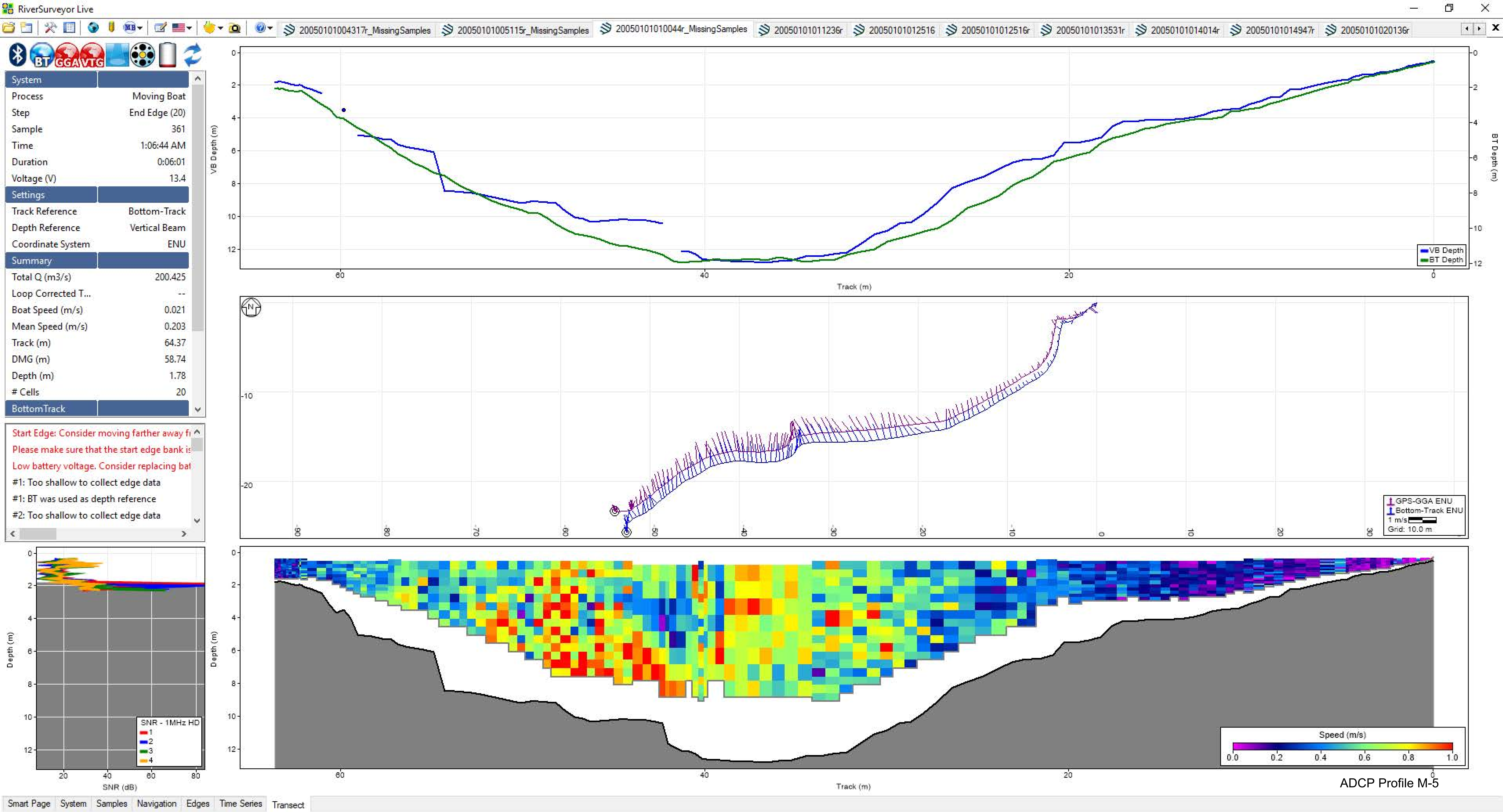
ADCP Profile M-3

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-4 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349666.324, 5424108.270 | | |
| **Bridge/culvert ID:** | Ballon Bridge (Upstream) | | |
| **Water level elevation at time of survey (m):** | | 0.09 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:25 PM |



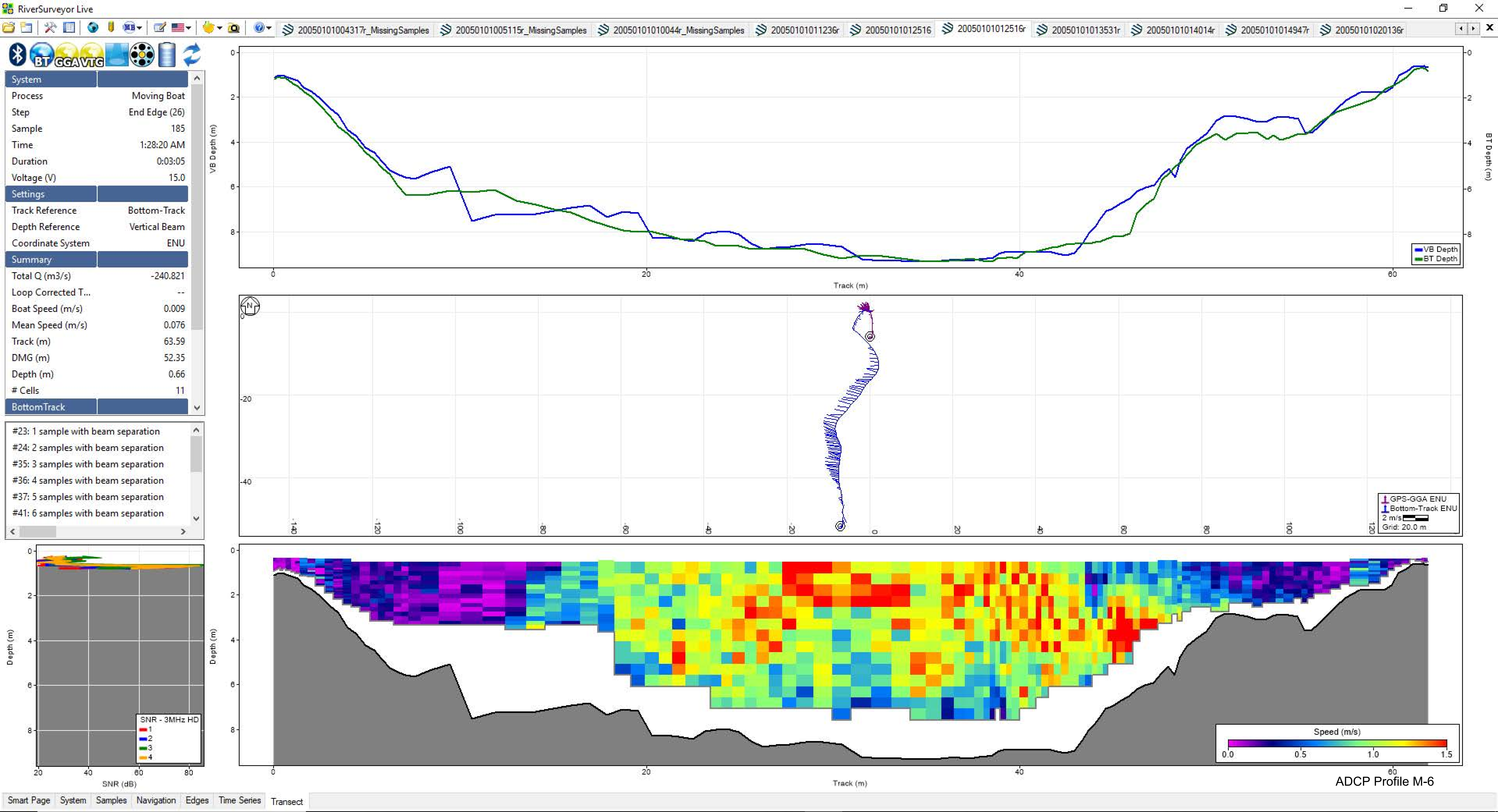

ADCP Profile M-4

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-5 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349734.737, 5423913.301 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.128 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:40PM |



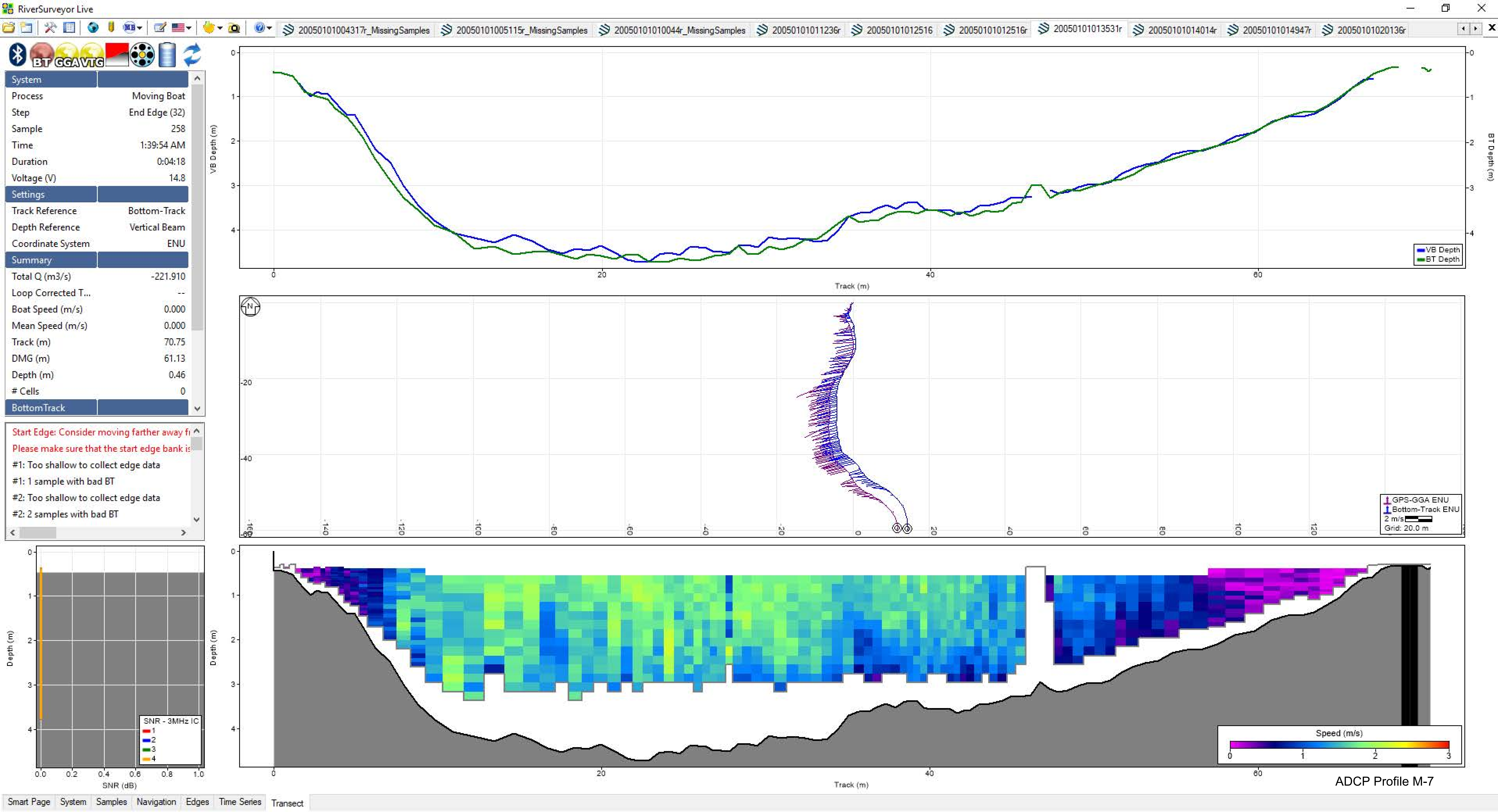

ADCP Profile M-5

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-6 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 349994.280, 5423733.980 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.134 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:55PM |



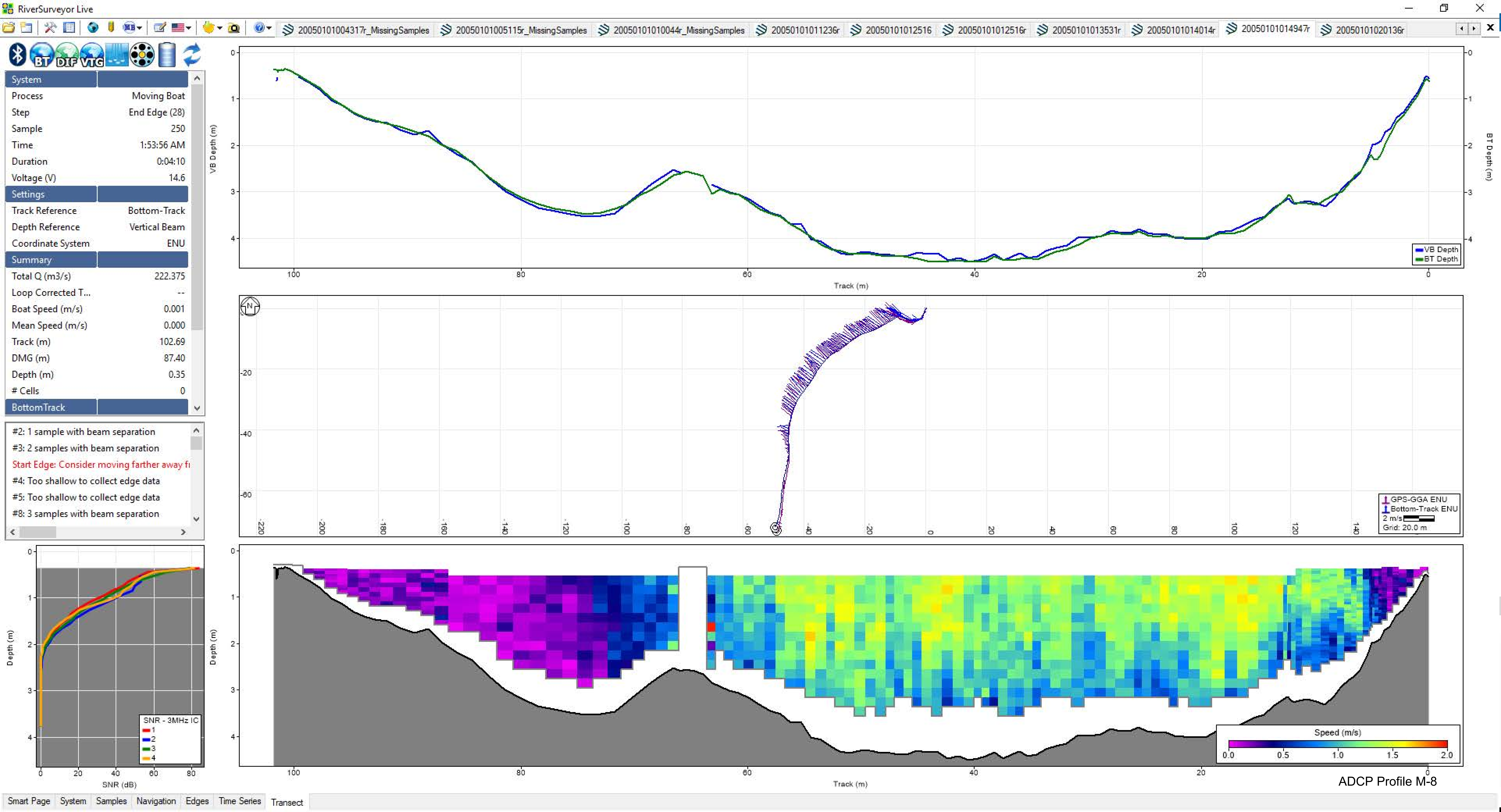
ADCP Profile M-6

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-7 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 350347.933, 5423802.507 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.025 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:15 PM |



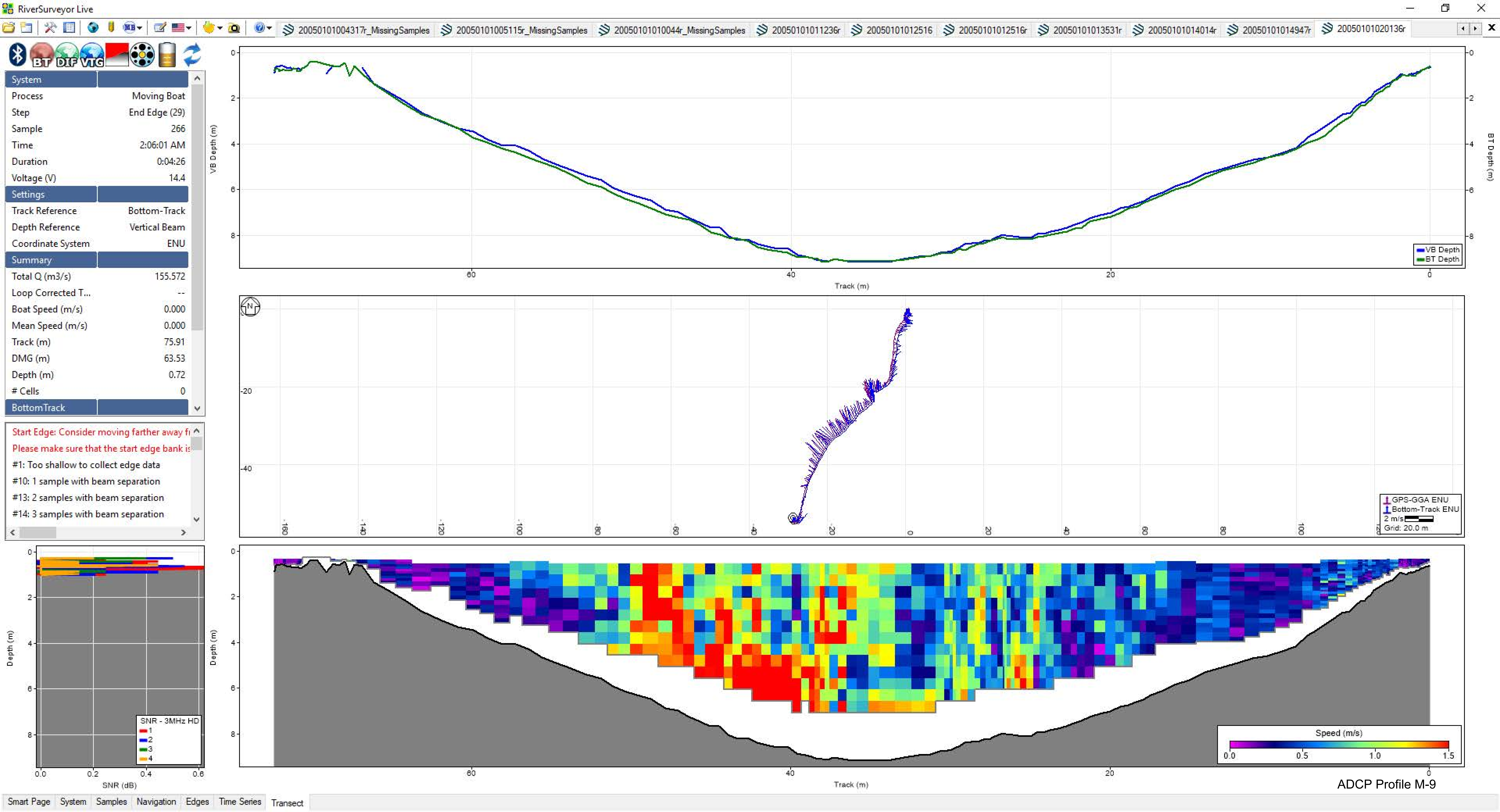
ADCP Profile M-7

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-8 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 350717.981, 5423732.253 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.139 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:30 PM |



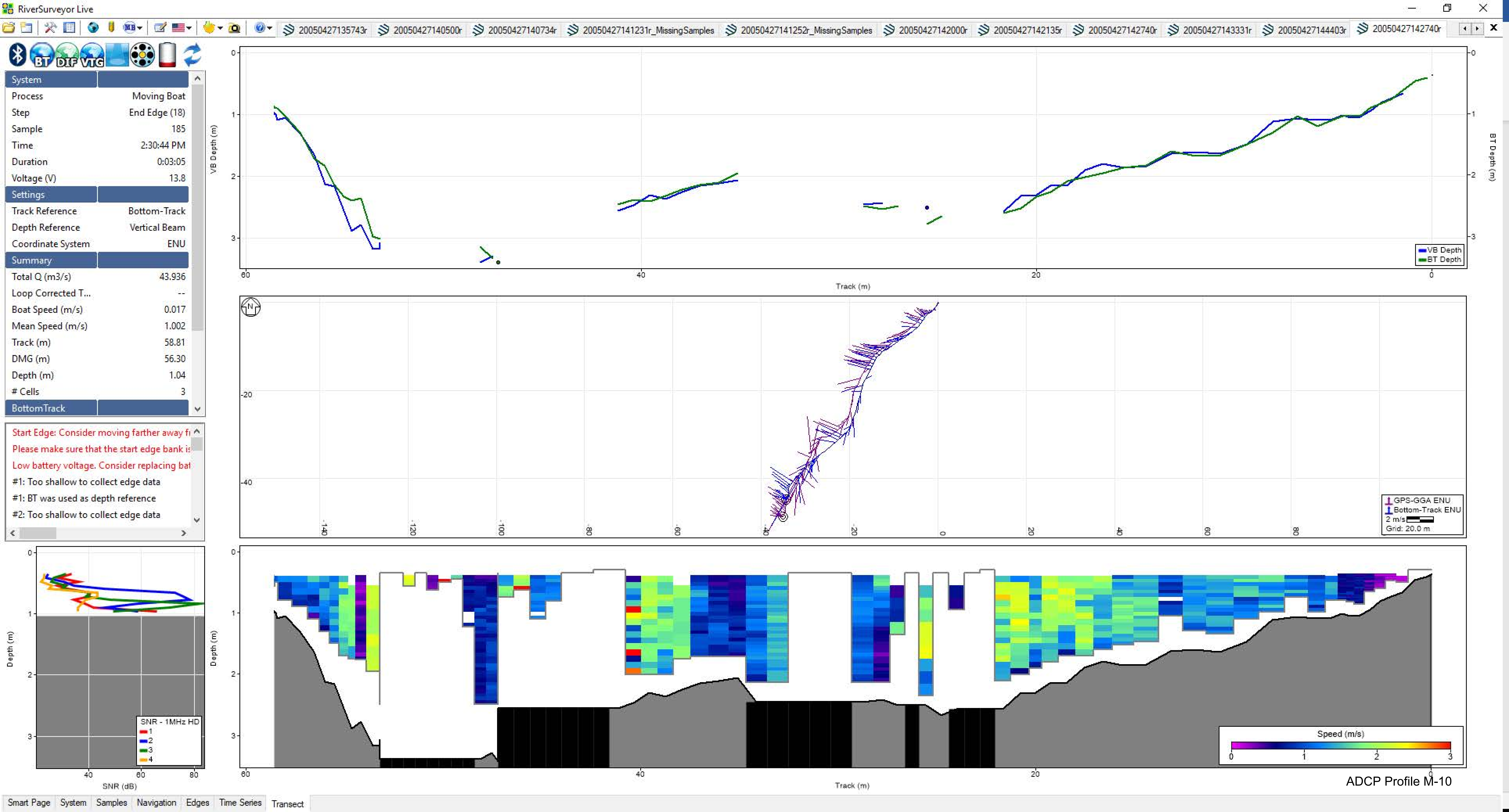

ADCP Profile M-8

| | | | | |
|---|---|---|---|---|
| **X-Section ID:** | M-9 | | | |
| **Name of Stream:** | Humber River | | | |
| **GPS coordinates:** | 350902.755, 5423568.255 | | | |
| **Bridge/culvert ID:** | | | | |
| **Water level elevation at time of survey (m):** | | 0.139 | | |
| **Channel Alignment Condition** | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | |
| **Substrate (can check more than one)** | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | |
| | Gravel, cobble and occasional boulders | X | Some vegetation | |
| X | Cobbles with frequent large boulders | | Dense vegetation | |
| X | Bedrock | | | |
| | Other (please describe) | | | |
| **Left Bank** | | **Right Bank** | | |
| X | Light brush/trees | | Light brush/trees | |
| | Medium brush/trees | X | Medium brush/trees | |
| | Heavy brush/trees | | Heavy brush/trees | |
| **Left Flood Plain** | | **Right Flood Plain** | | |
| X | No to sparse vegetation | | No to sparse vegetation | |
| | Medium to dense grass | | Medium to dense grass | |
| | Medium to dense brush | X | Medium to dense brush | |
| | Medium to dense trees | | Medium to dense trees | |
| **Pictures (check)** | | X | Picture looking toward left bank | |
| | | X | Picture looking toward right bank | |
| | | X | Picture looking downstream | |
| | | X | Picture looking upstream | |
| **Date of Survey:** | **Dec. 5 2018** | **Surveyed by :** | | GP & JM |
| **Time Started:** | | **Time Completed:** | | 1:50 PM |



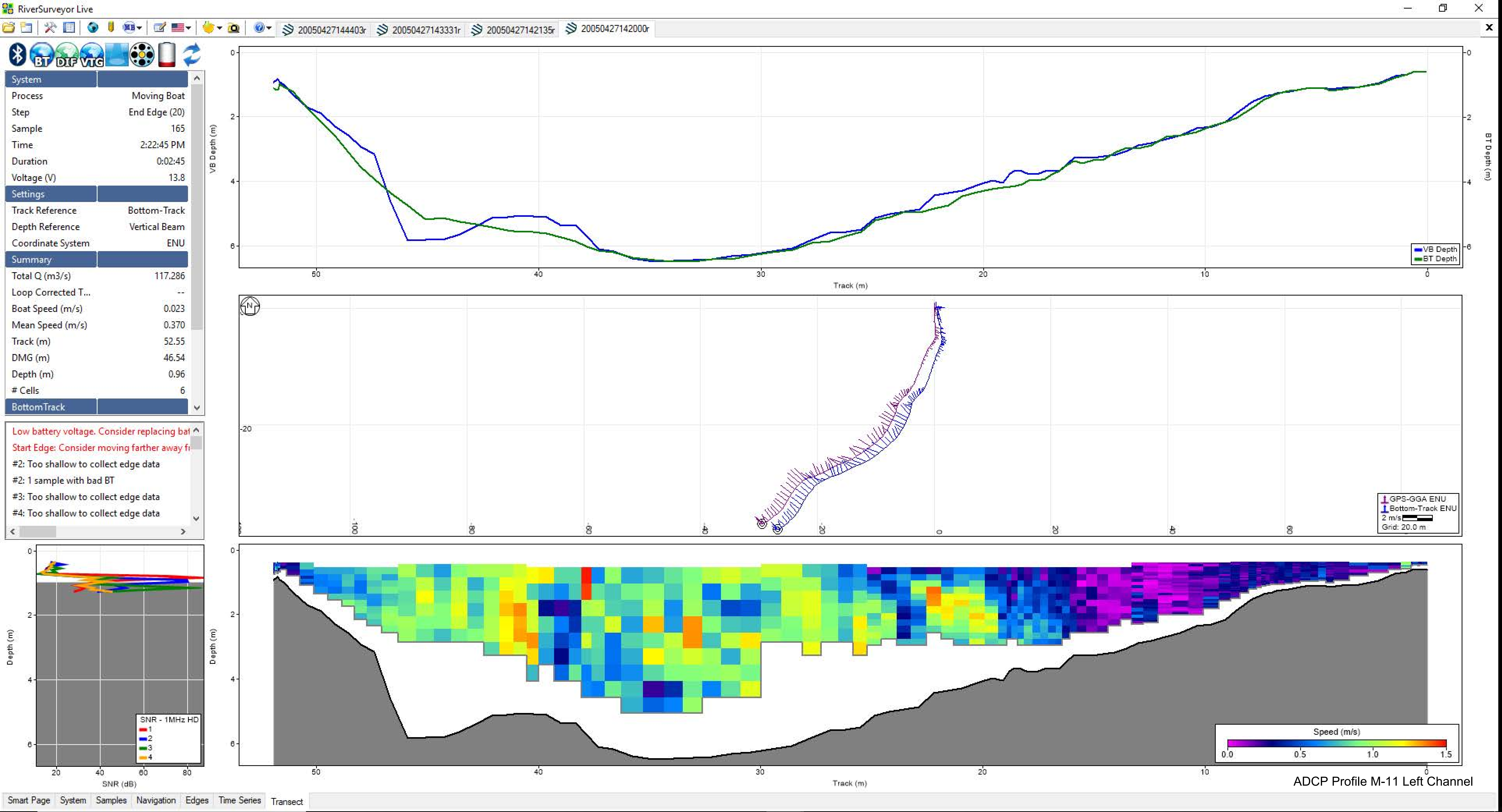

ADCP Profile M-9

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-10 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351024.126, 5423497.500 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.507 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:40 PM |

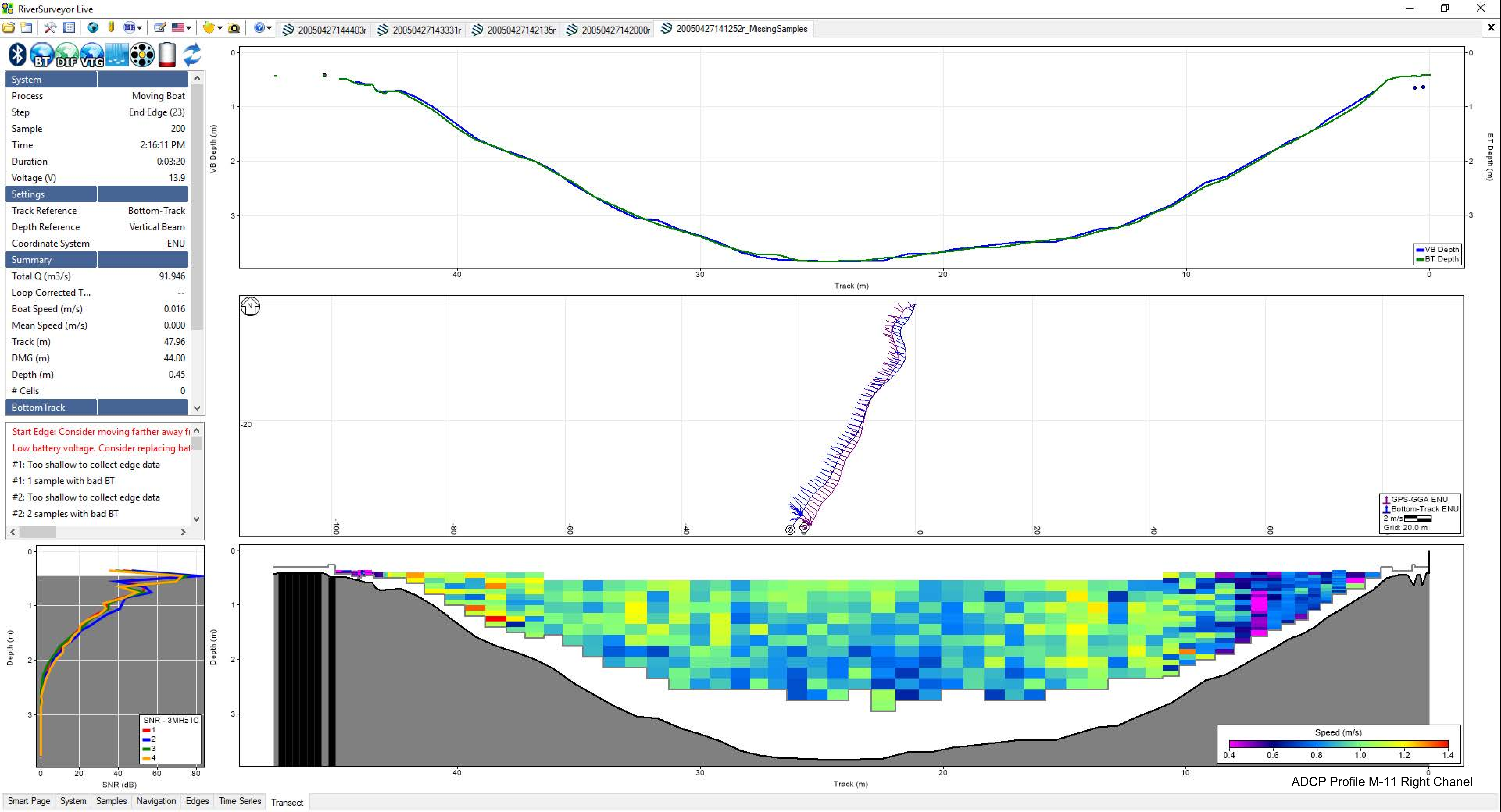



ADCP Profile M-10

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-11 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351134.705, 5423453.348 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.841 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:30 PM |

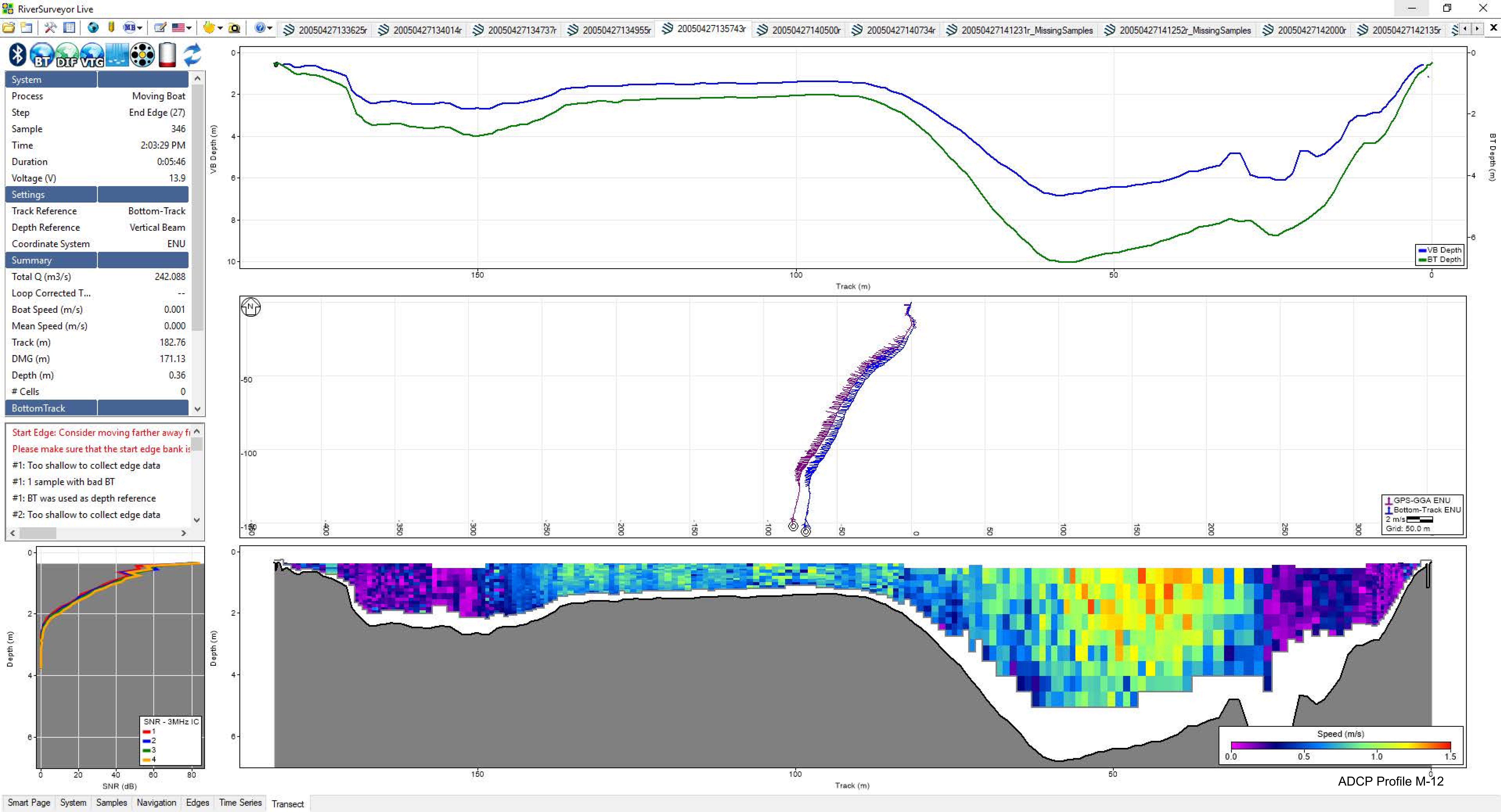



ADCP Profile M-11 Left Channel



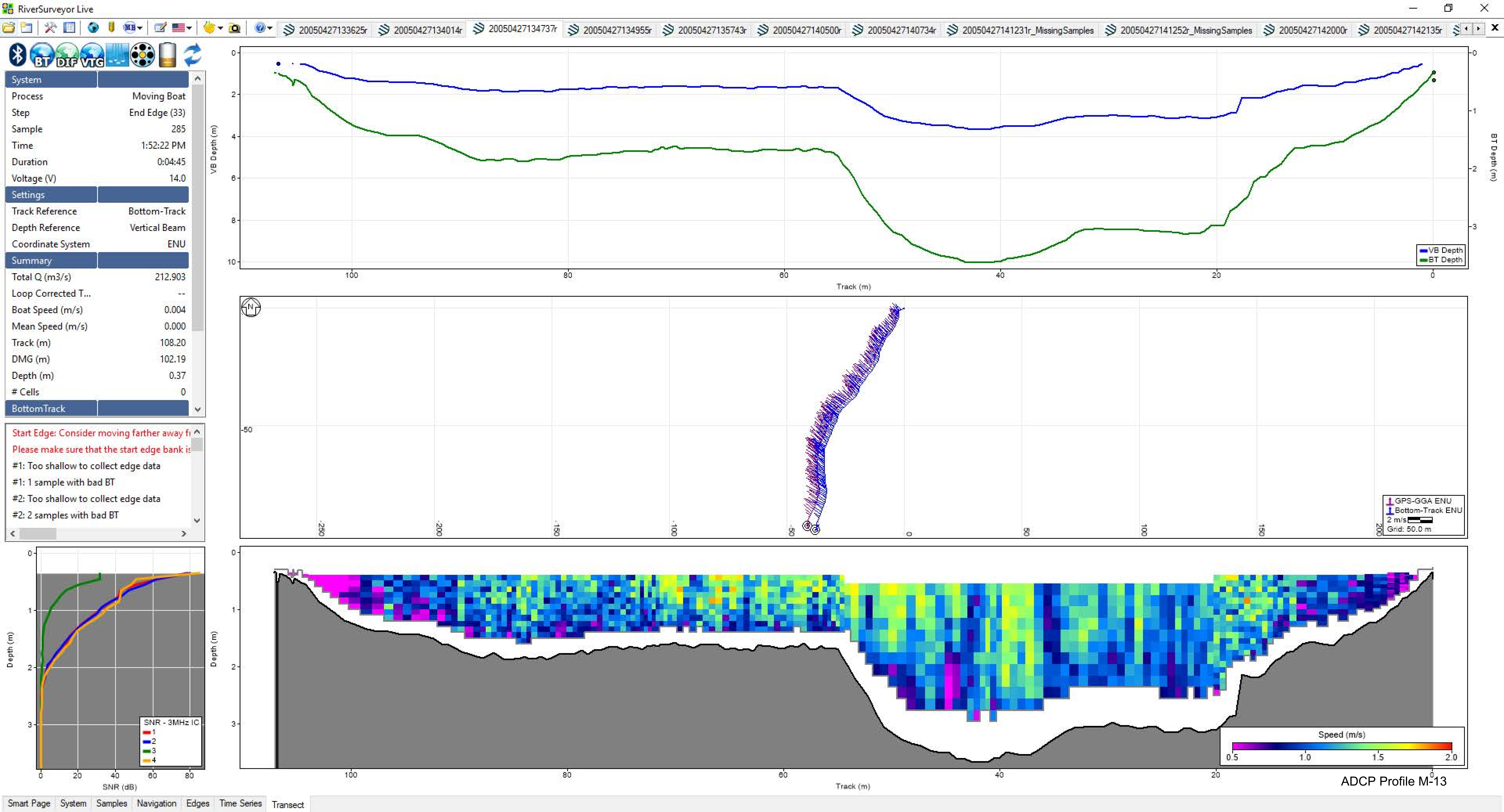

ADCP Profile M-11 Right Chanel

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-12 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351239.530, 5423403.105 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 0.869 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:10 PM |



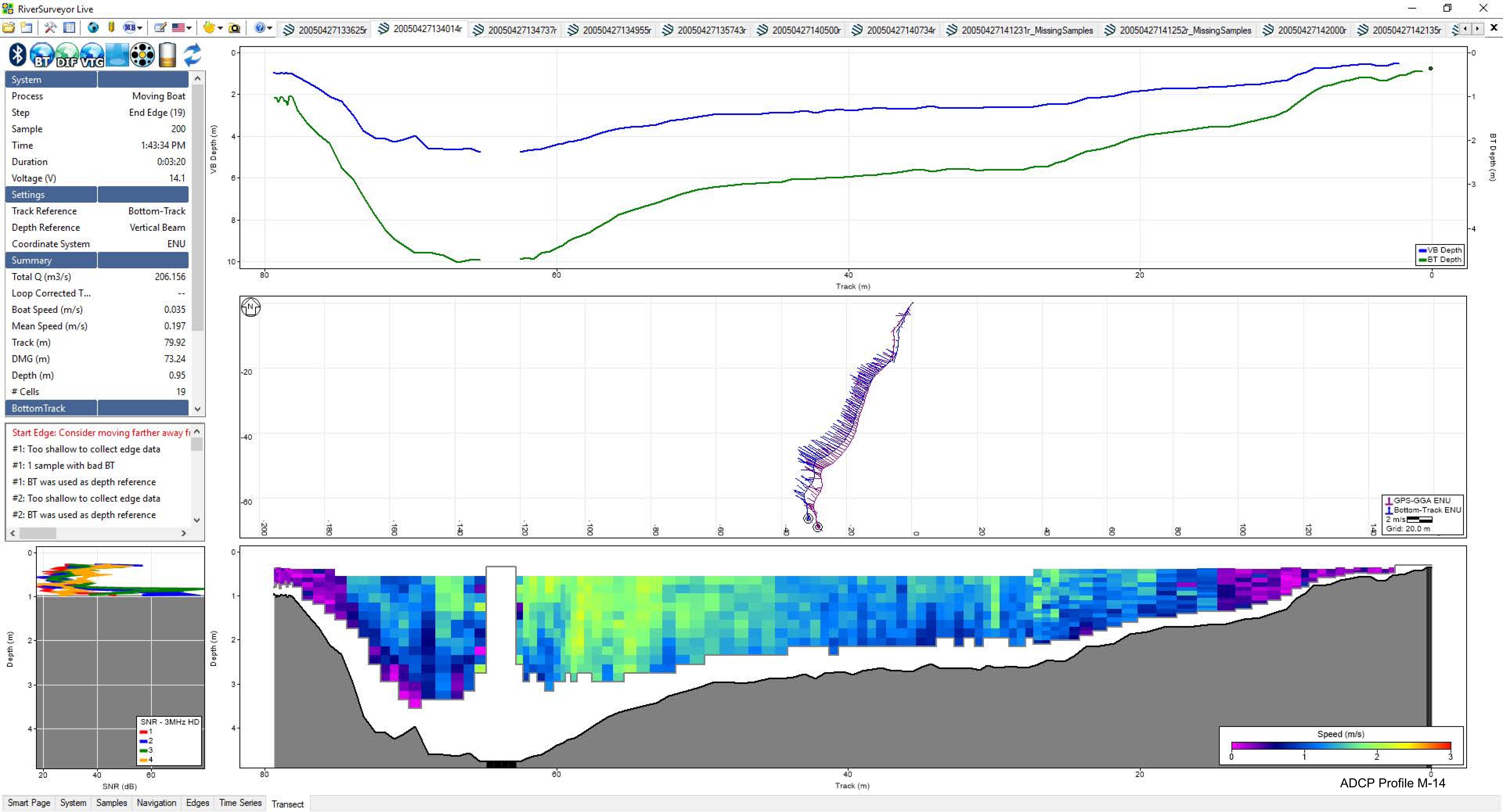

ADCP Profile M-12

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-13 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351502.623, 5423250.178 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.058 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:00 PM |



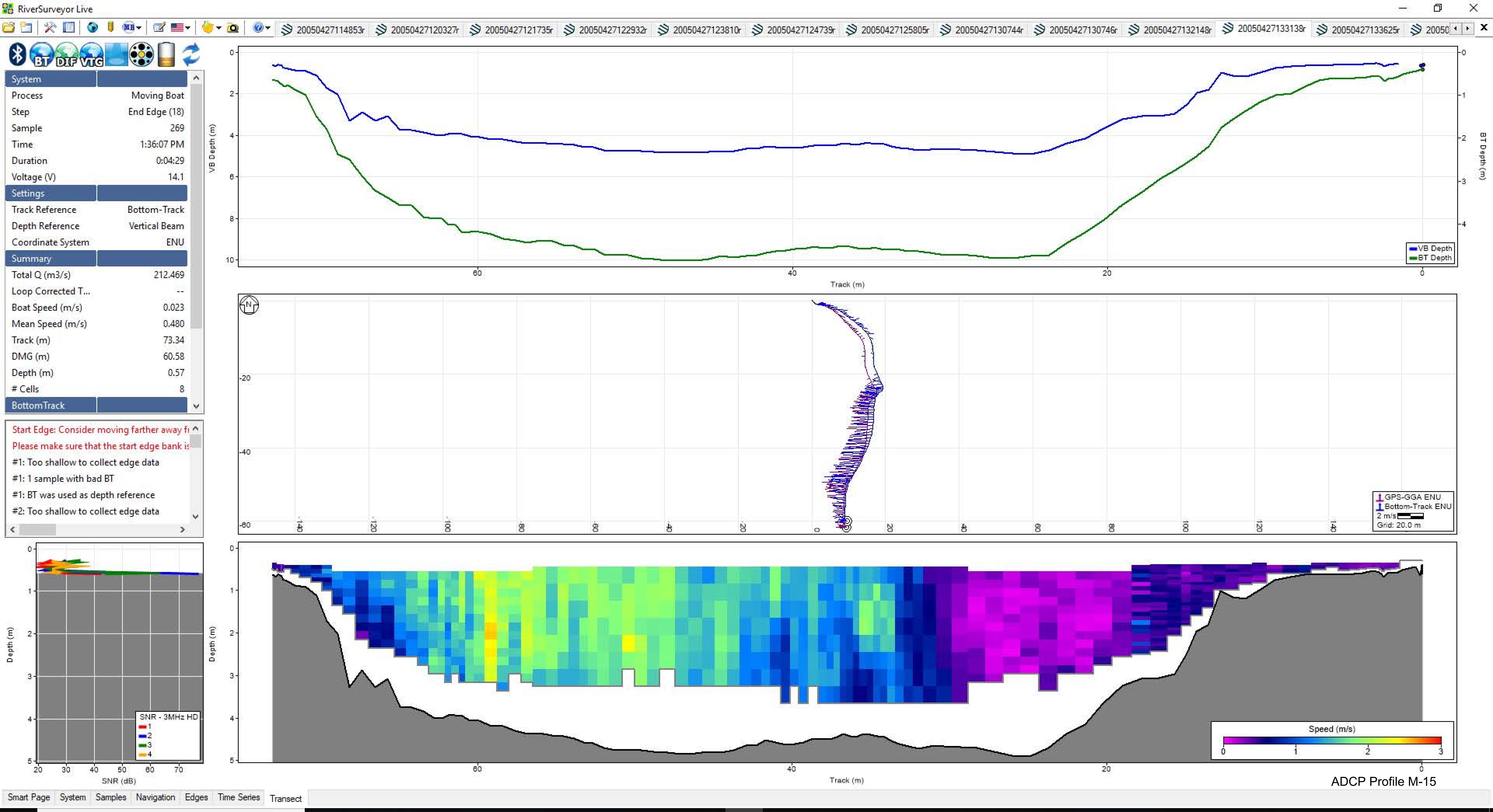

ADCP Profile M-13

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-14 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351709.517, 5423085.905 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.132 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:50 AM |



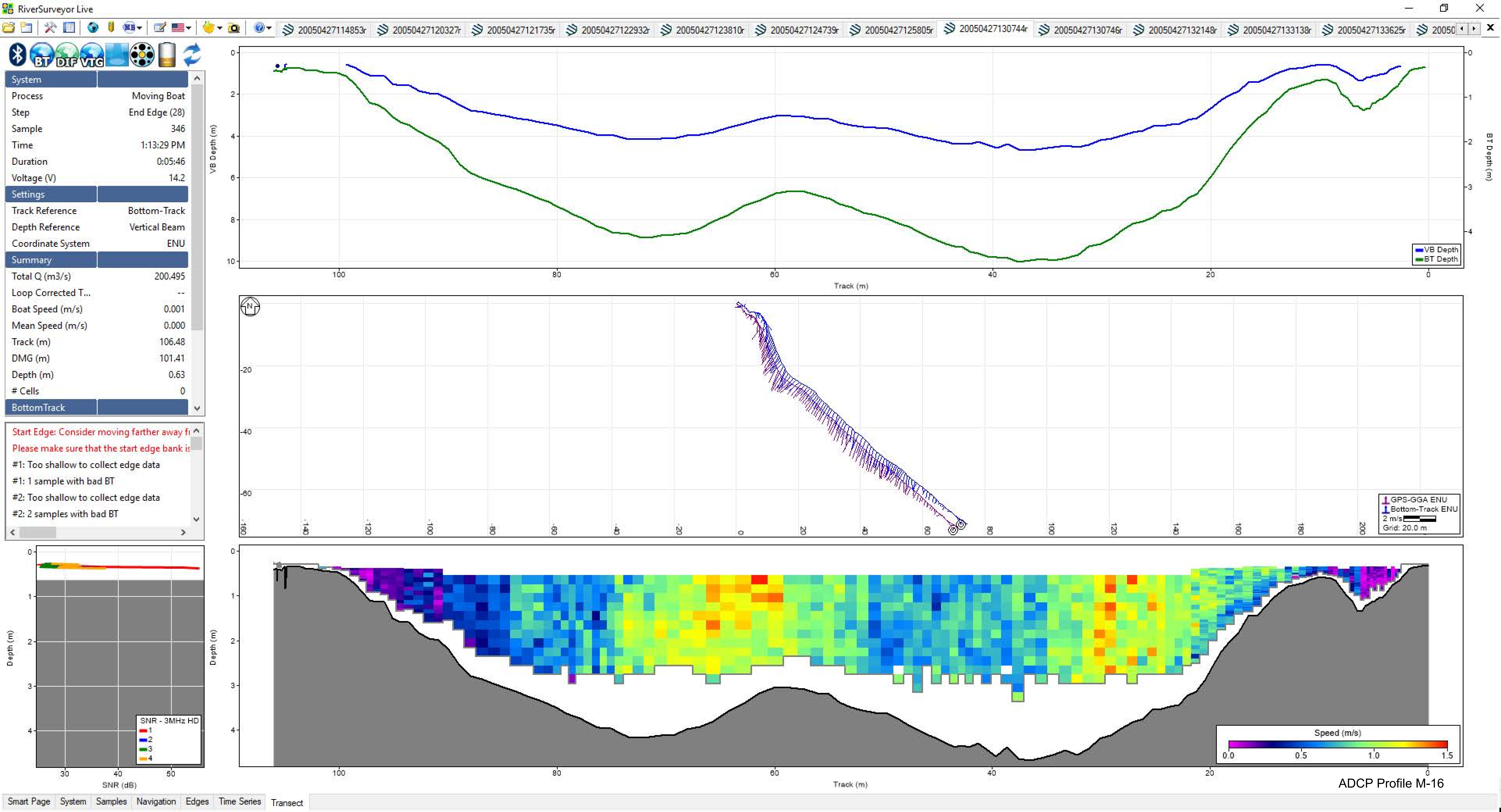

ADCP Profile M-14

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-15 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 351996.310, 5423038.964 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.448 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | | | Medium to dense grass |
| | | | Medium to dense brush |
| | | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:45 AM |



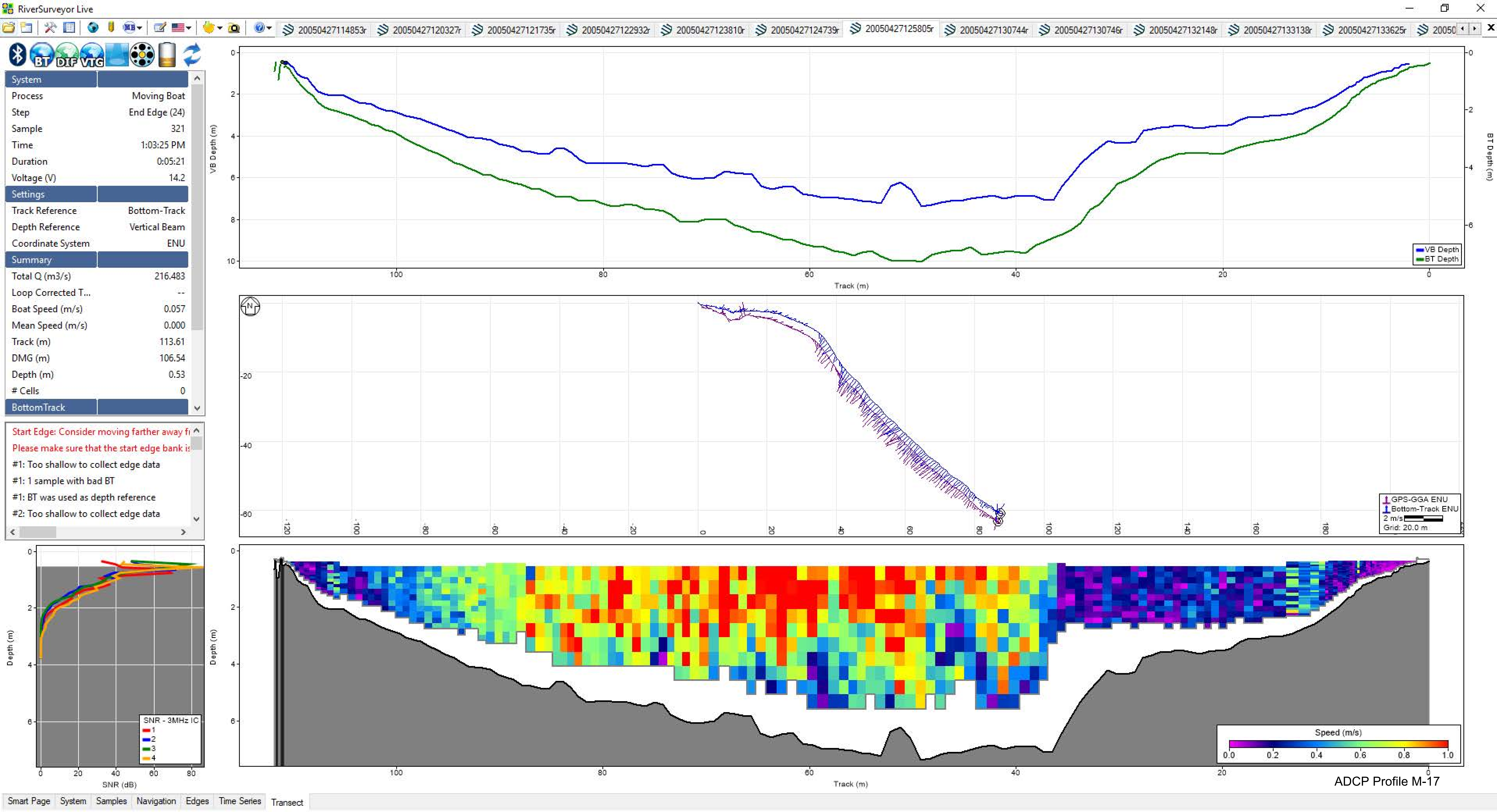

ADCP Profile M-15

| | | | | |
|---|---|---|---|---|
| **X-Section ID:** | M-16 | | | |
| **Name of Stream:** | Humber River | | | |
| **GPS coordinates:** | 352283.552, 5423131.908 | | | |
| **Bridge/culvert ID:** | | | | |
| **Water level elevation at time of survey (m):** | | 1.644 | | |
| **Channel Alignment Condition** | | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish | |
| **Substrate (can check more than one)** | | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation | |
| X | Gravel, cobble and occasional boulders | | Some vegetation | |
| X | Cobbles with frequent large boulders | X | Dense vegetation | |
| | Bedrock | | | |
| | Other (please describe) | | | |
| **Left Bank** | | **Right Bank** | | |
| X | Light brush/trees | | Light brush/trees | |
| | Medium brush/trees | | Medium brush/trees | |
| | Heavy brush/trees | X | Heavy brush/trees | |
| **Left Flood Plain** | | **Right Flood Plain** | | |
| X | No to sparse vegetation | | No to sparse vegetation | |
| | Medium to dense grass | | Medium to dense grass | |
| | Medium to dense brush | | Medium to dense brush | |
| | Medium to dense trees | X | Medium to dense trees | |
| **Pictures (check)** | | X | Picture looking toward left bank | |
| | | X | Picture looking toward right bank | |
| | | X | Picture looking downstream | |
| | | X | Picture looking upstream | |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | | GP & JM |
| **Time Started:** | | **Time Completed:** | | 11:45 AM |



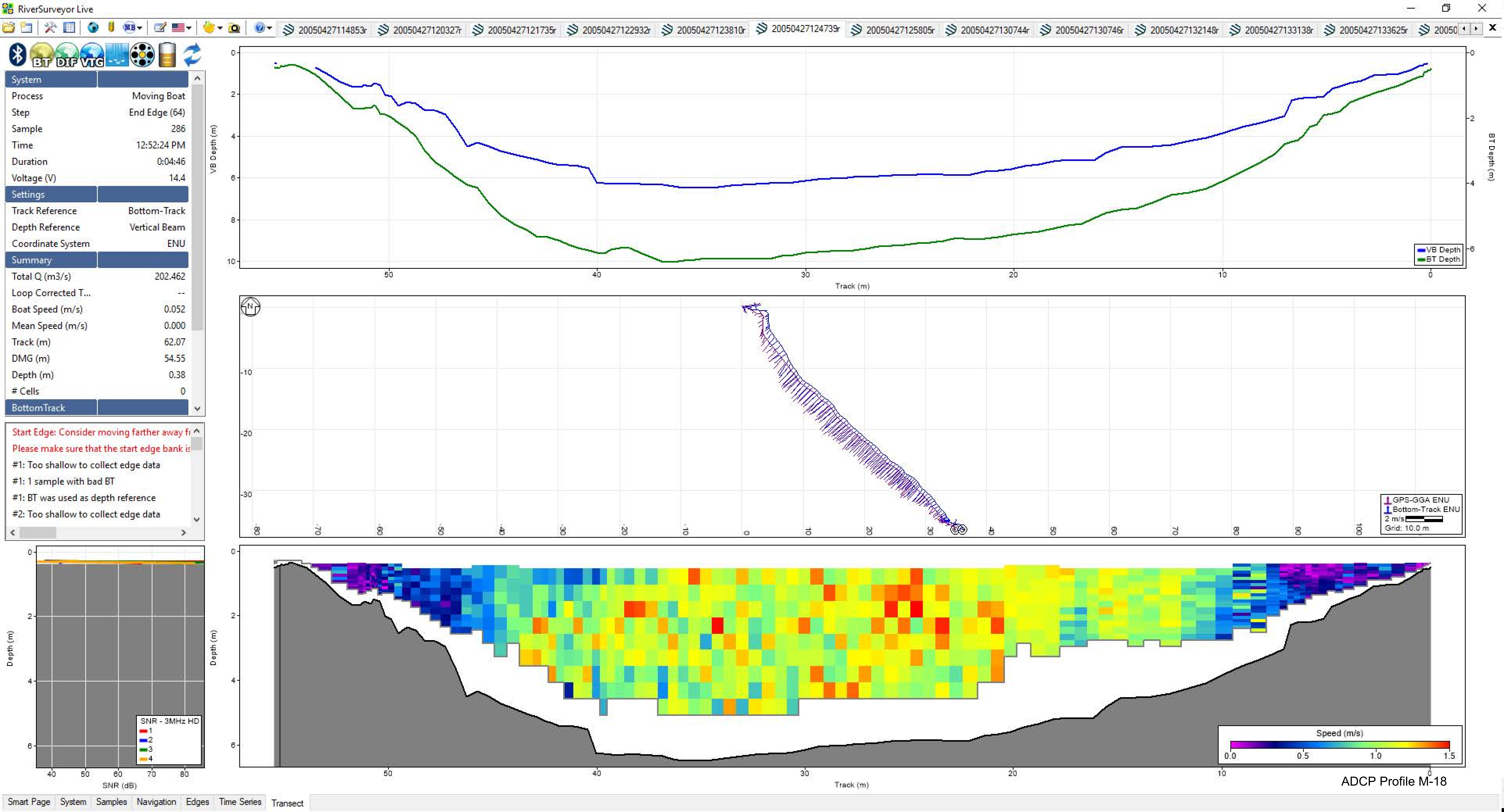
ADCP Profile M-16

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-17 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 352537.694, 5423508.061 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.89 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation (roadway) | | No to sparse vegetation |
| | | | Medium to dense grass |
| | | X | Medium to dense brush |
| | | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:09 AM |



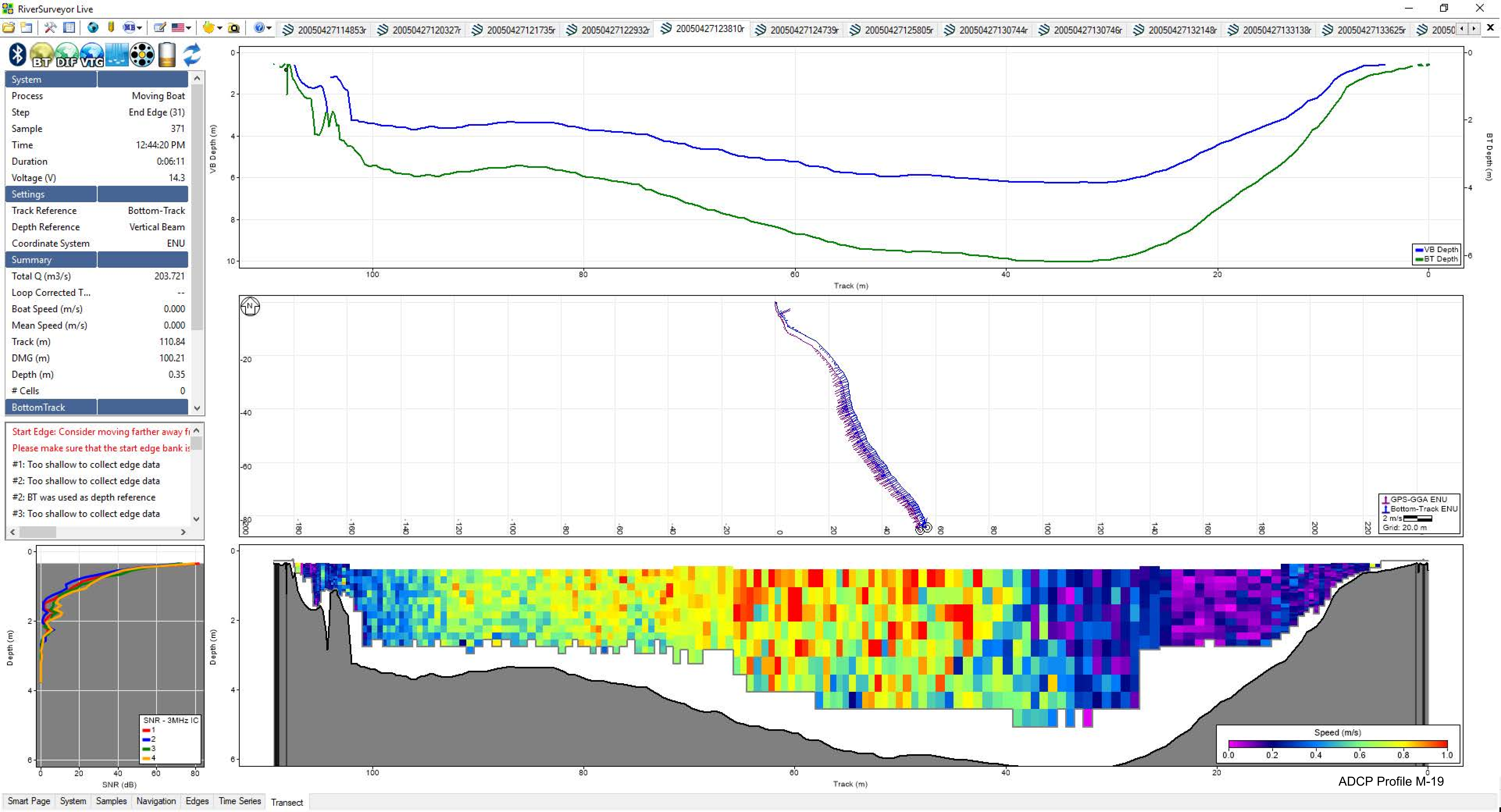
ADCP Profile M-17

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-18 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 352668.294, 5423638.911 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.916 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation (Roadway) | | No to sparse vegetation |
| | | | Medium to dense grass |
| | | | Medium to dense brush |
| | | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:09 AM |



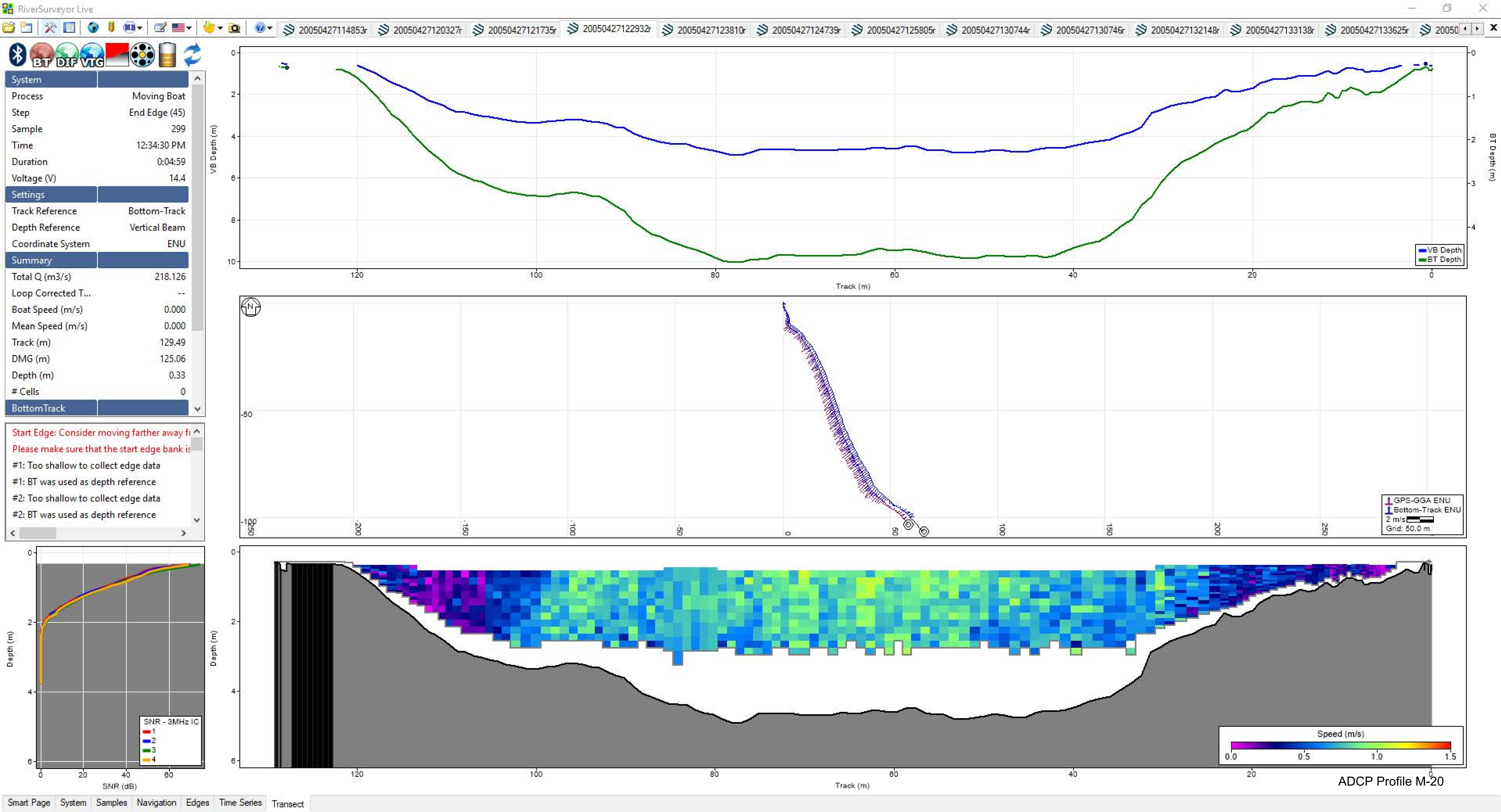

ADCP Profile M-18

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-19 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 352807.920, 5423753.460 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.94 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| X | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation (roadway) | | No to sparse vegetation |
| | | | Medium to dense grass |
| | | | Medium to dense brush |
| | | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:50 AM |



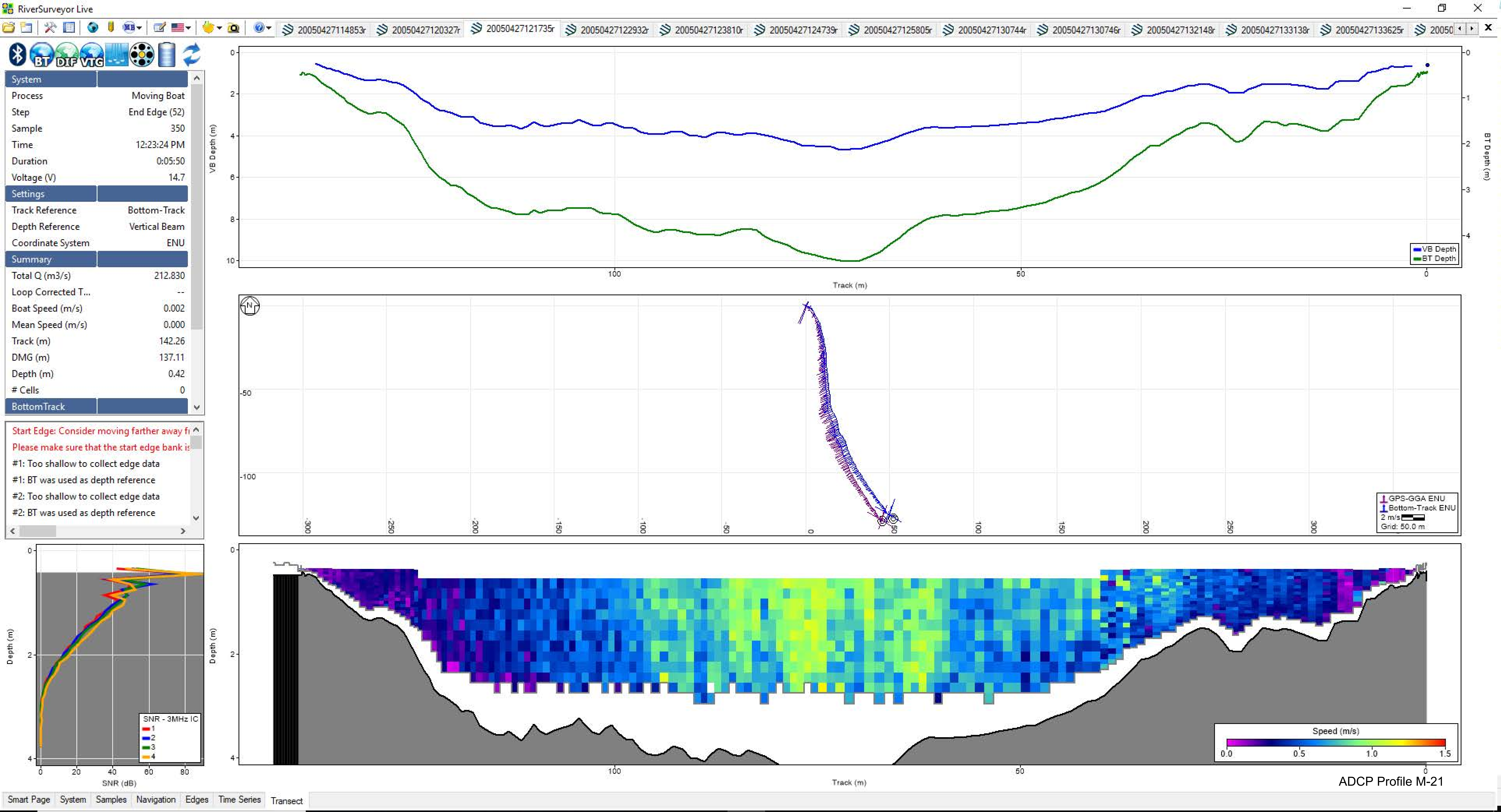
ADCP Profile M-19

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-20 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 352999.339, 5423883.528 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.95 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:40 AM |



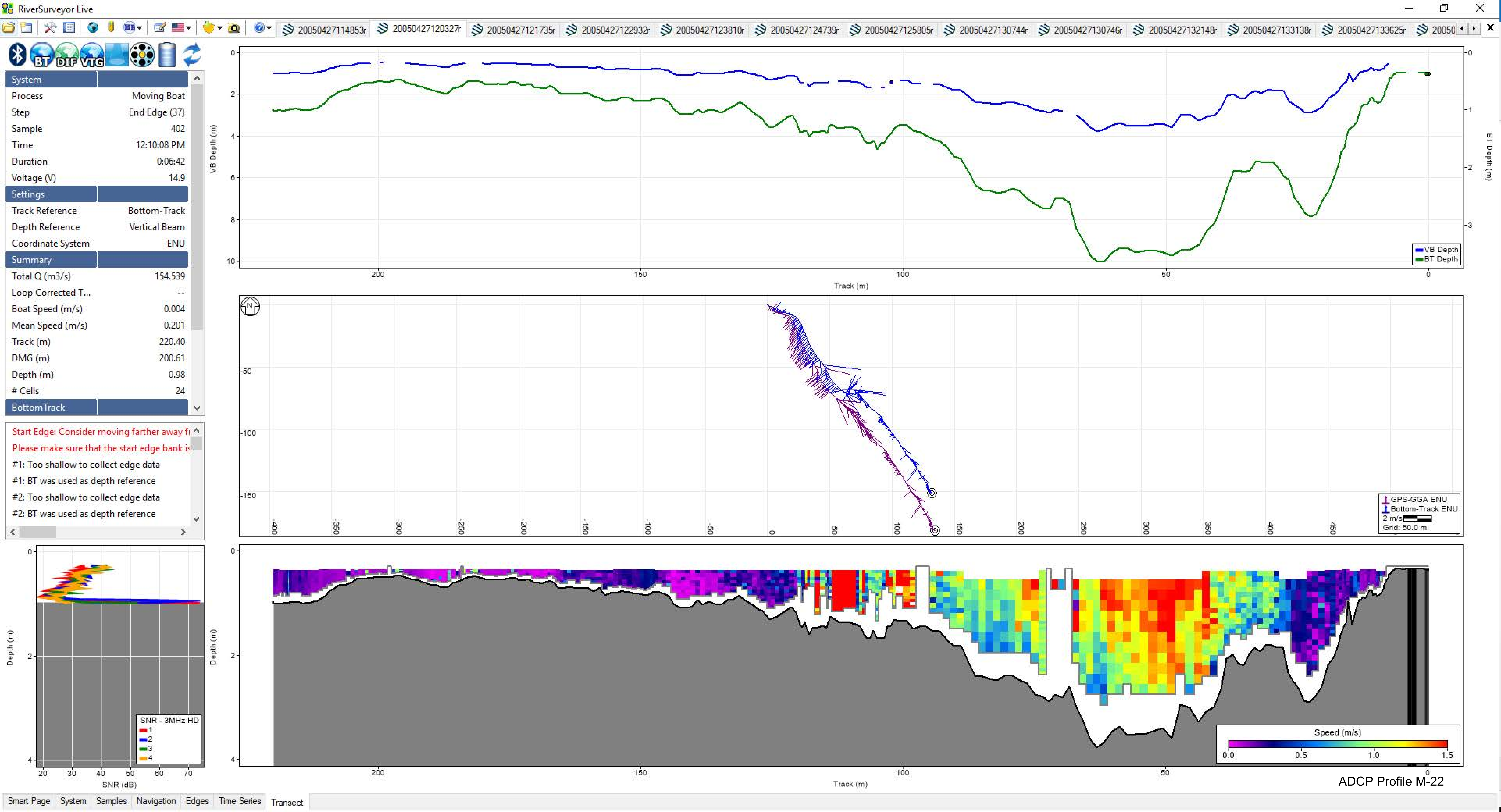

ADCP Profile M-20

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-21 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 353252.878, 5424004.566 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.95 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:34 AM |



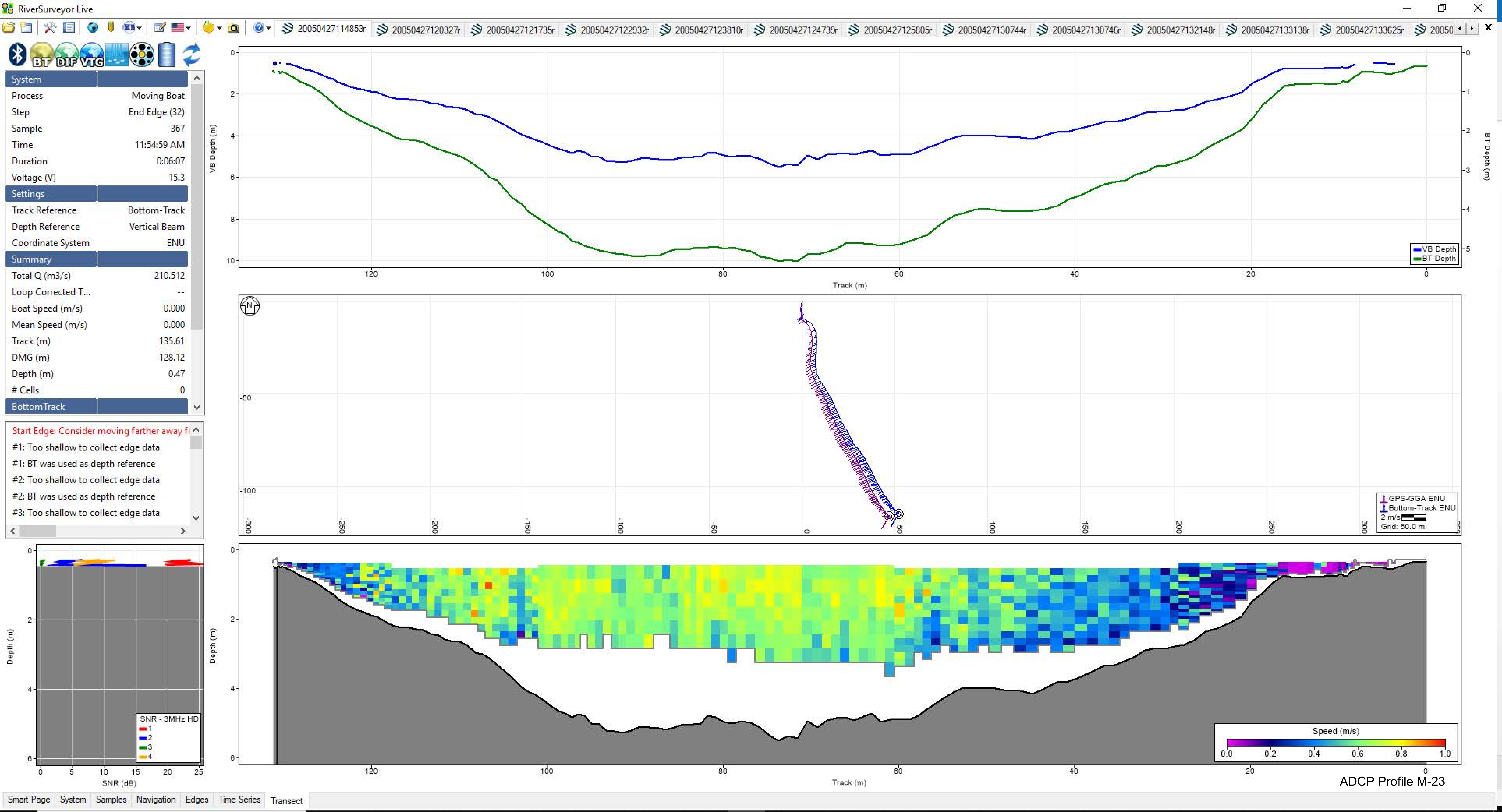

ADCP Profile M-21

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-22 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 353518.012, 5424157.134 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.95 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:14 AM |



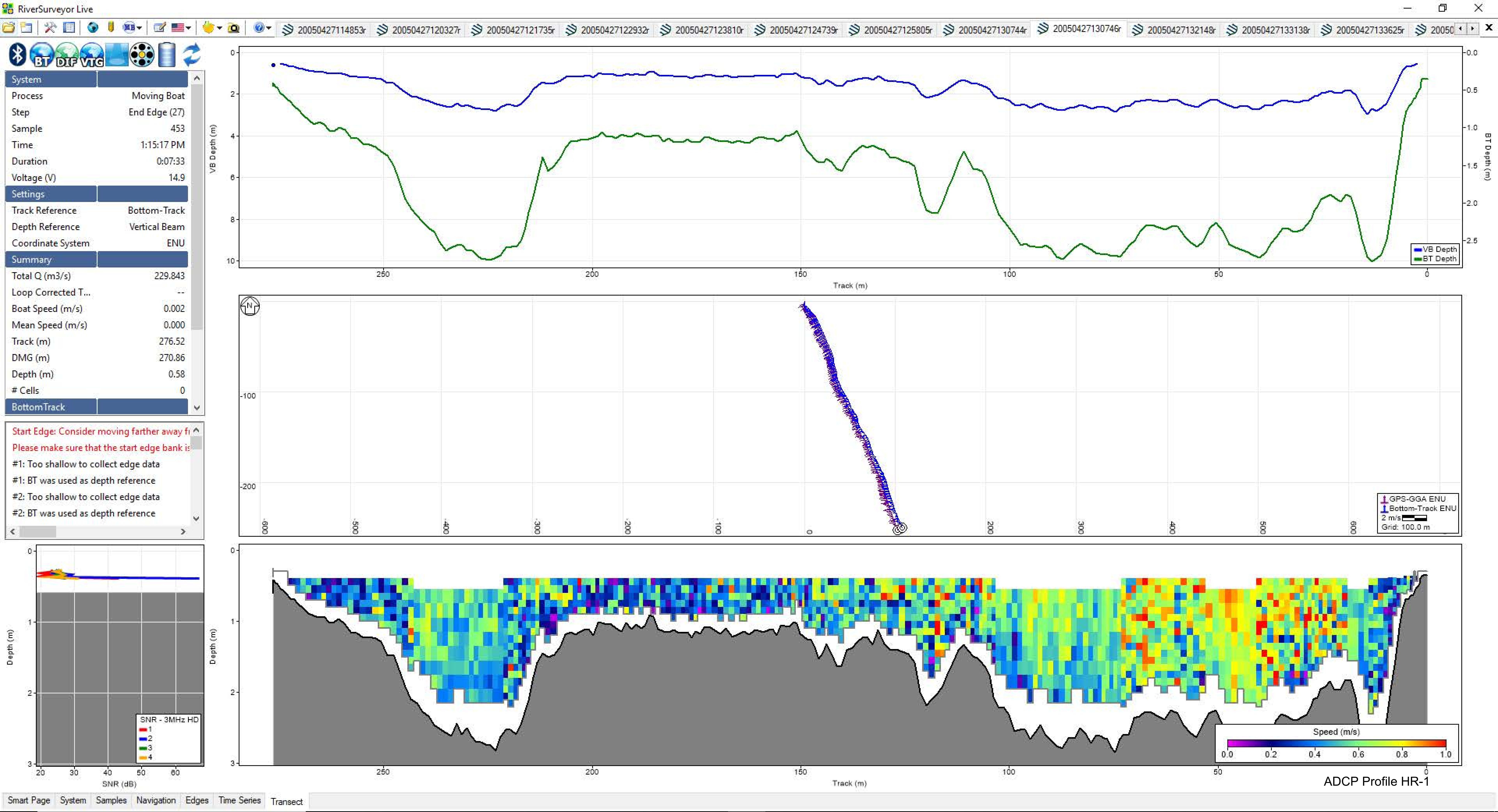

ADCP Profile M-22

| | | | |
|---|---|---|---|
| **X-Section ID:** | M-23 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 353987.768, 5424592.452 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.108 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:01 AM |



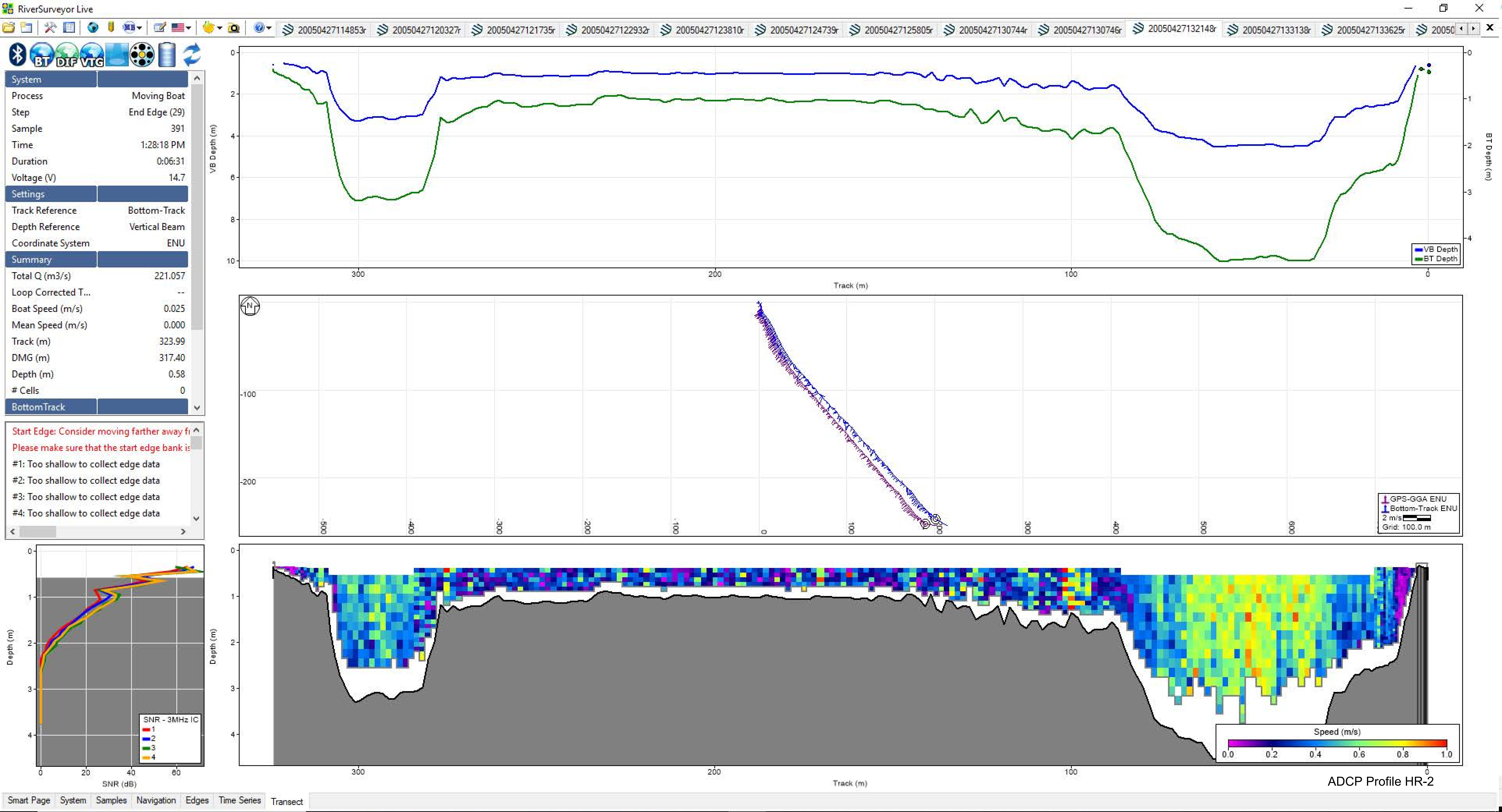

ADCP Profile M-23

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-1 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 354288.099, 5424619.517 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.12 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:52 PM |



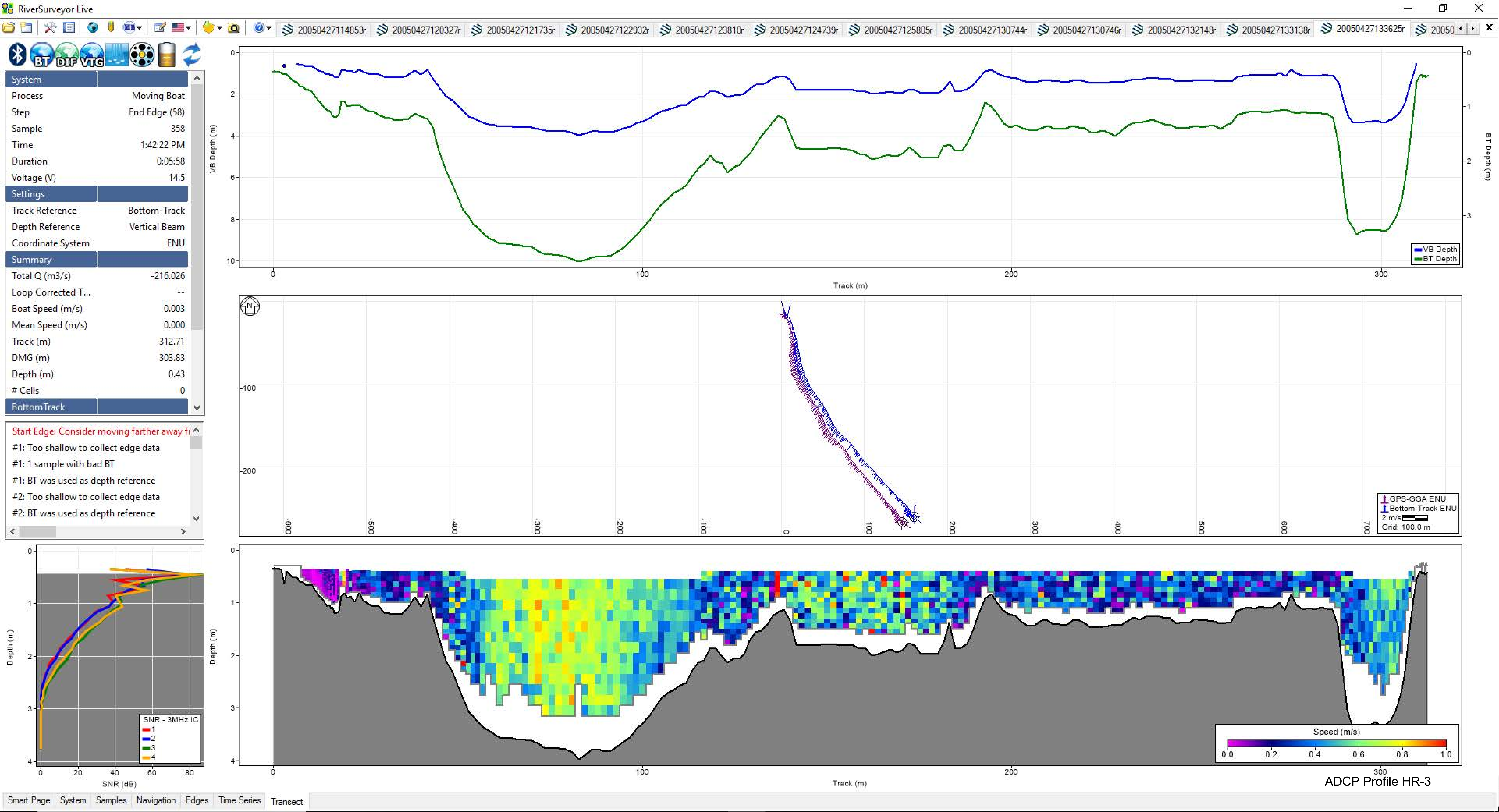
ADCP Profile HR-1

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-2 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 354623.410, 5424774.524 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.12 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:03 PM |



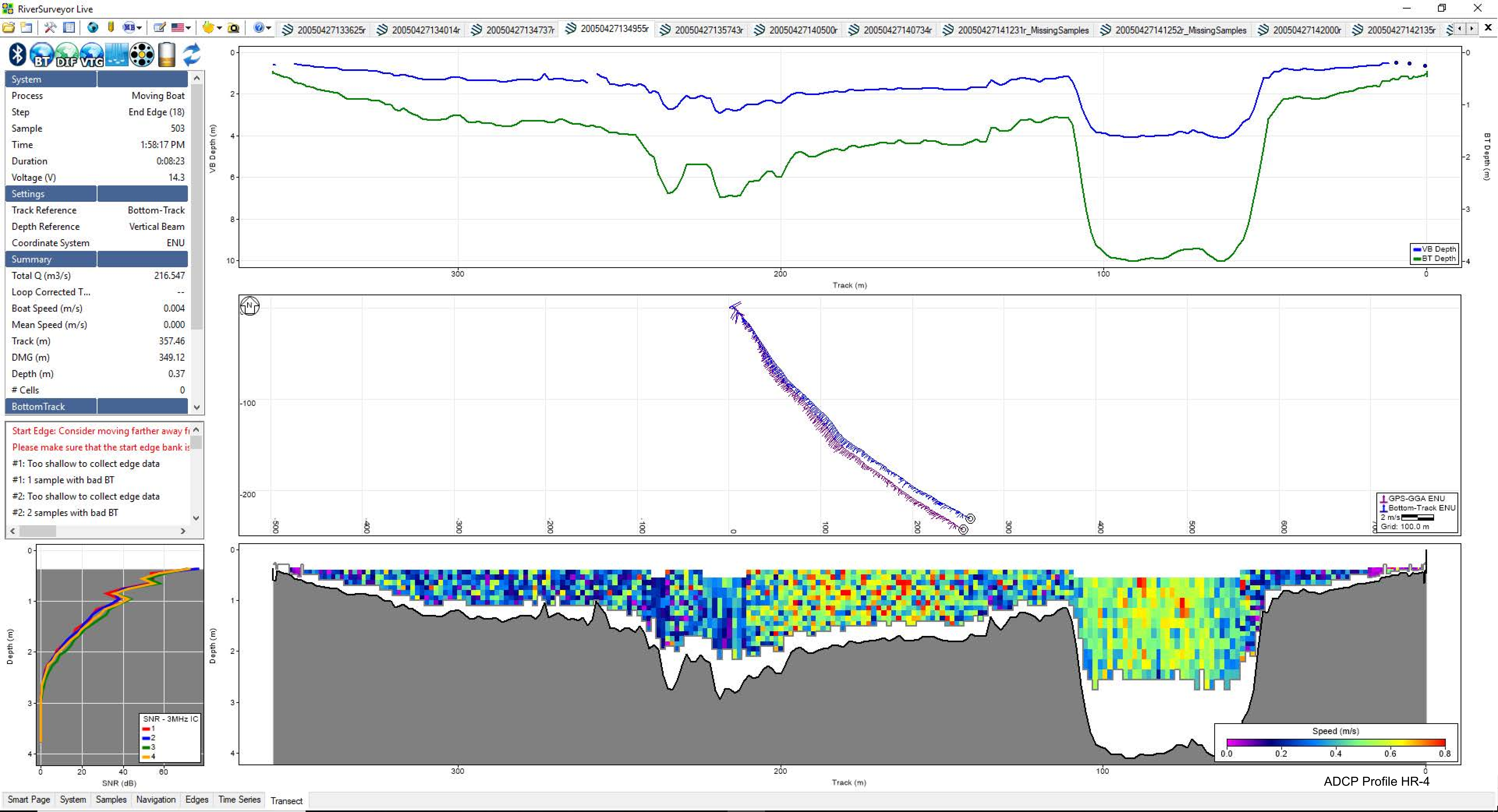

ADCP Profile HR-2

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-3 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 355034.302, 5425205.301 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.18 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:19 PM |



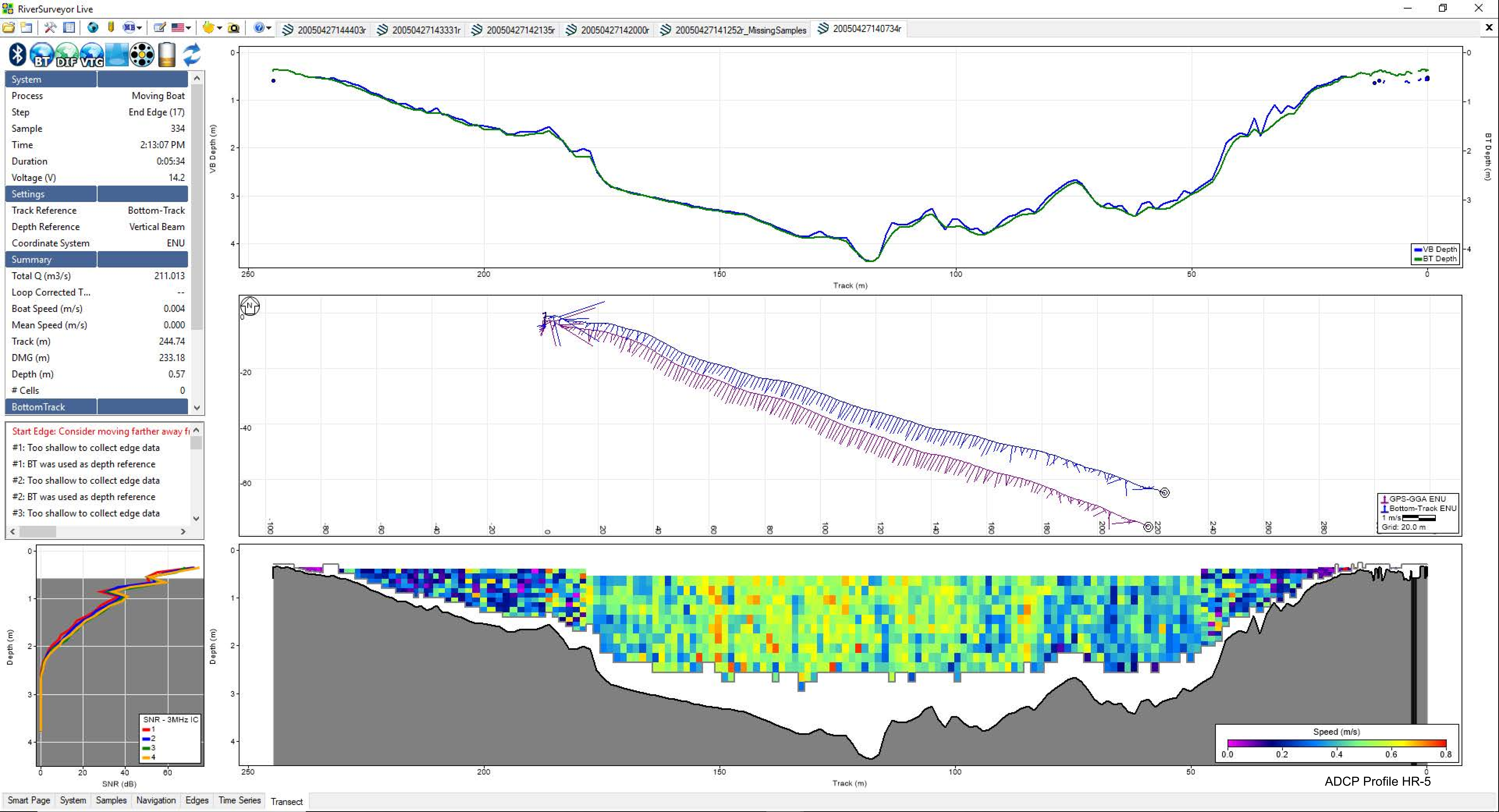

ADCP Profile HR-3

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-4 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 355471.719, 5425649.785 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.25 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:32 PM |



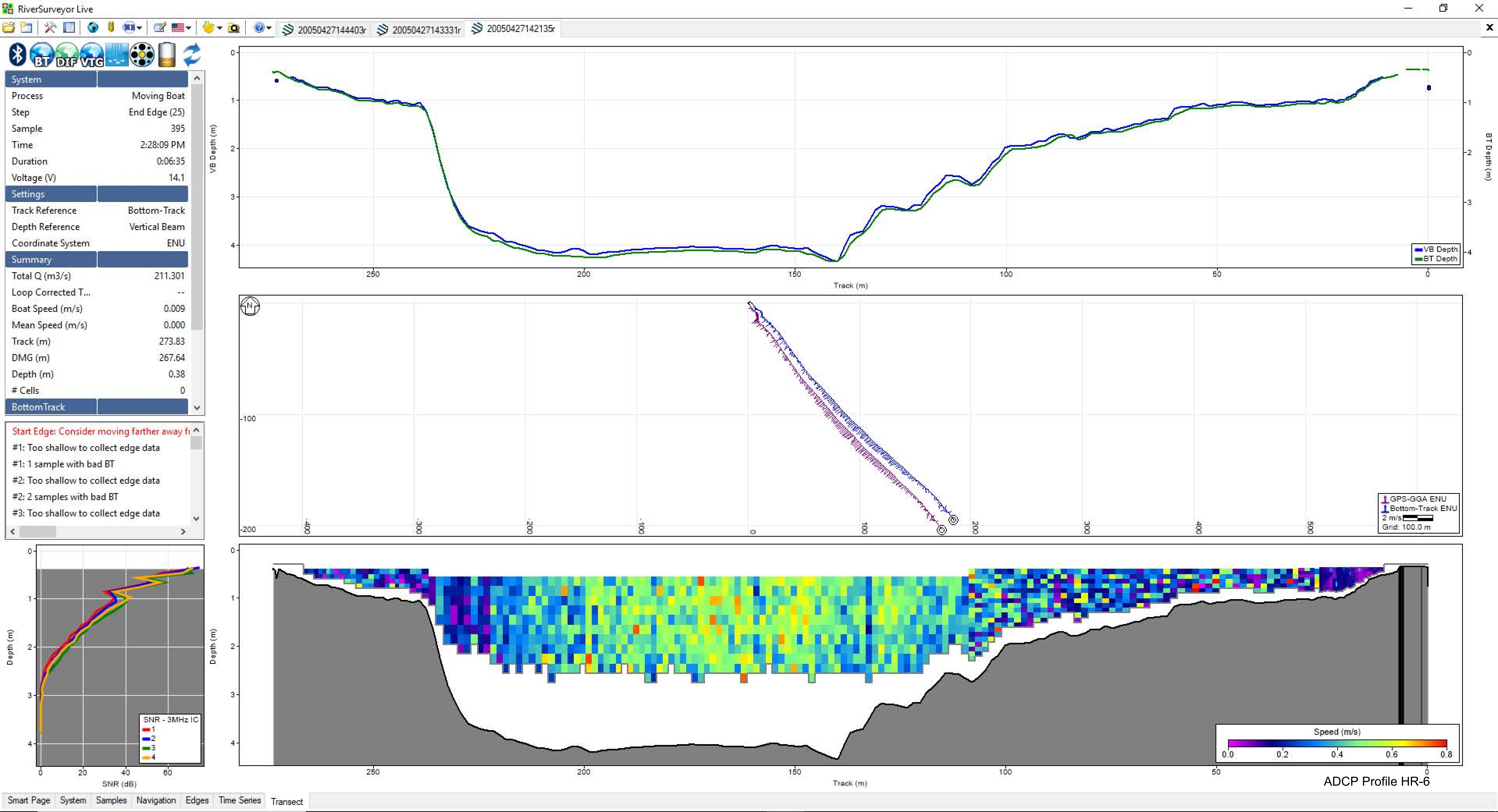

ADCP Profile HR-4

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-5 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 355931.598, 5426175.281 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.21 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:54 PM |



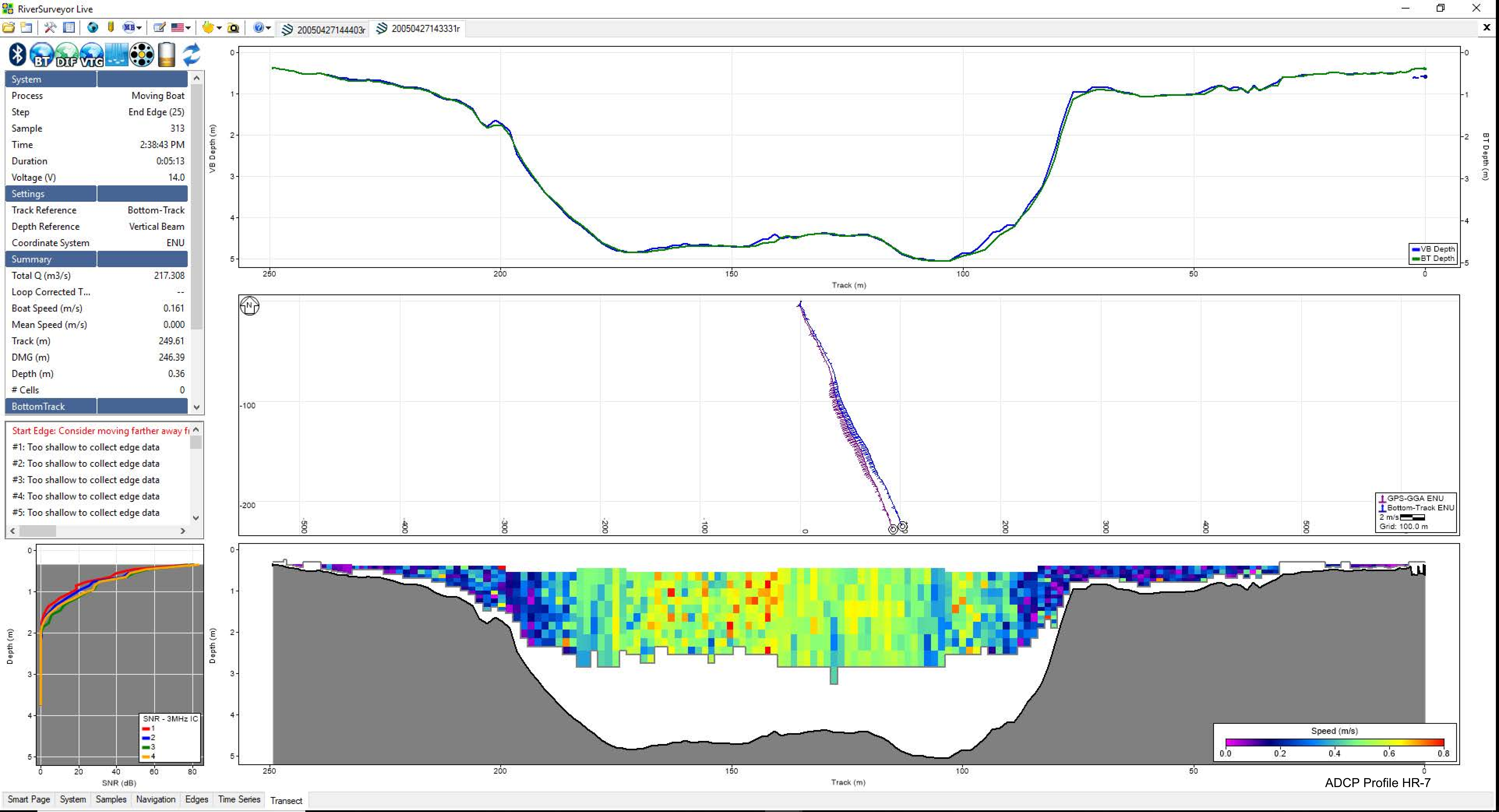
ADCP Profile HR-5

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | HR-6 | | | | |
| **Name of Stream:** | Humber River | | | | |
| **GPS coordinates:** | 356240.5256, 5426562.576 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | | 2.21 | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | | Irregular, winding or sluggish | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | | Little vegetation | |
| | Gravel, cobble and occasional boulders | | X | Some vegetation | |
| | Cobbles with frequent large boulders | | | Dense vegetation | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | | **Right Bank** | | |
| | Light brush/trees | | X | Light brush/trees | |
| | Medium brush/trees | | | Medium brush/trees | |
| X | Heavy brush/trees | | | Heavy brush/trees | |
| **Left Flood Plain** | | | **Right Flood Plain** | | |
| | No to sparse vegetation | | | No to sparse vegetation | |
| X | Medium to dense grass | | | Medium to dense grass | |
| | Medium to dense brush | | X | Medium to dense brush | |
| | Medium to dense trees | | | Medium to dense trees | |
| **Pictures (check)** | | | X | Picture looking toward left bank | |
| | | | X | Picture looking toward right bank | |
| | | | X | Picture looking downstream | |
| | | | X | Picture looking upstream | |
| **Date of Survey:** | **Dec. 6 2018** | | **Surveyed by :** | | GP & JM |
| **Time Started:** | | | **Time Completed:** | | 3:03 PM |



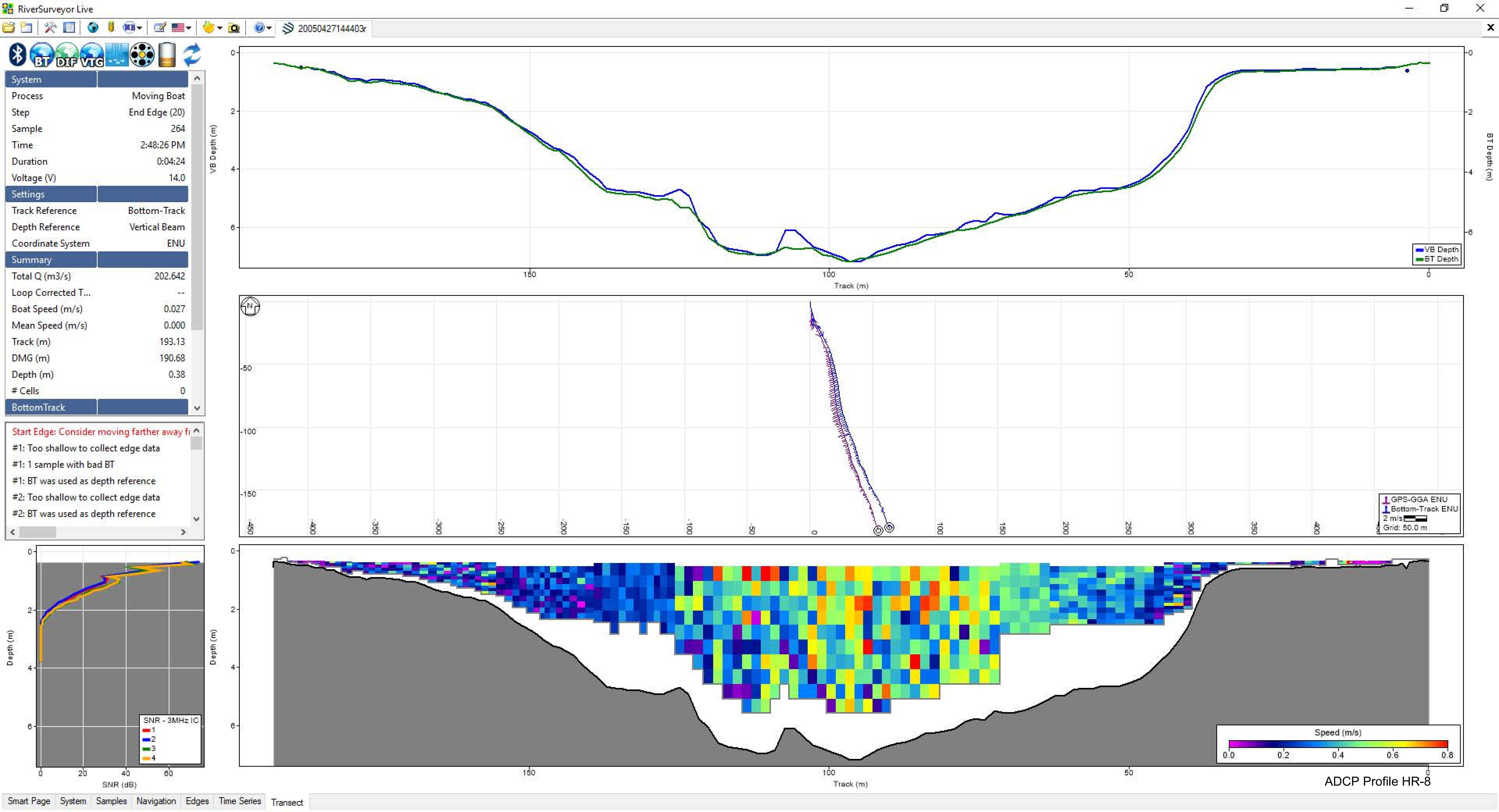

ADCP Profile HR-6

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-7 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 356578.2767, 5426695.988 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.26 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 3:31 PM |



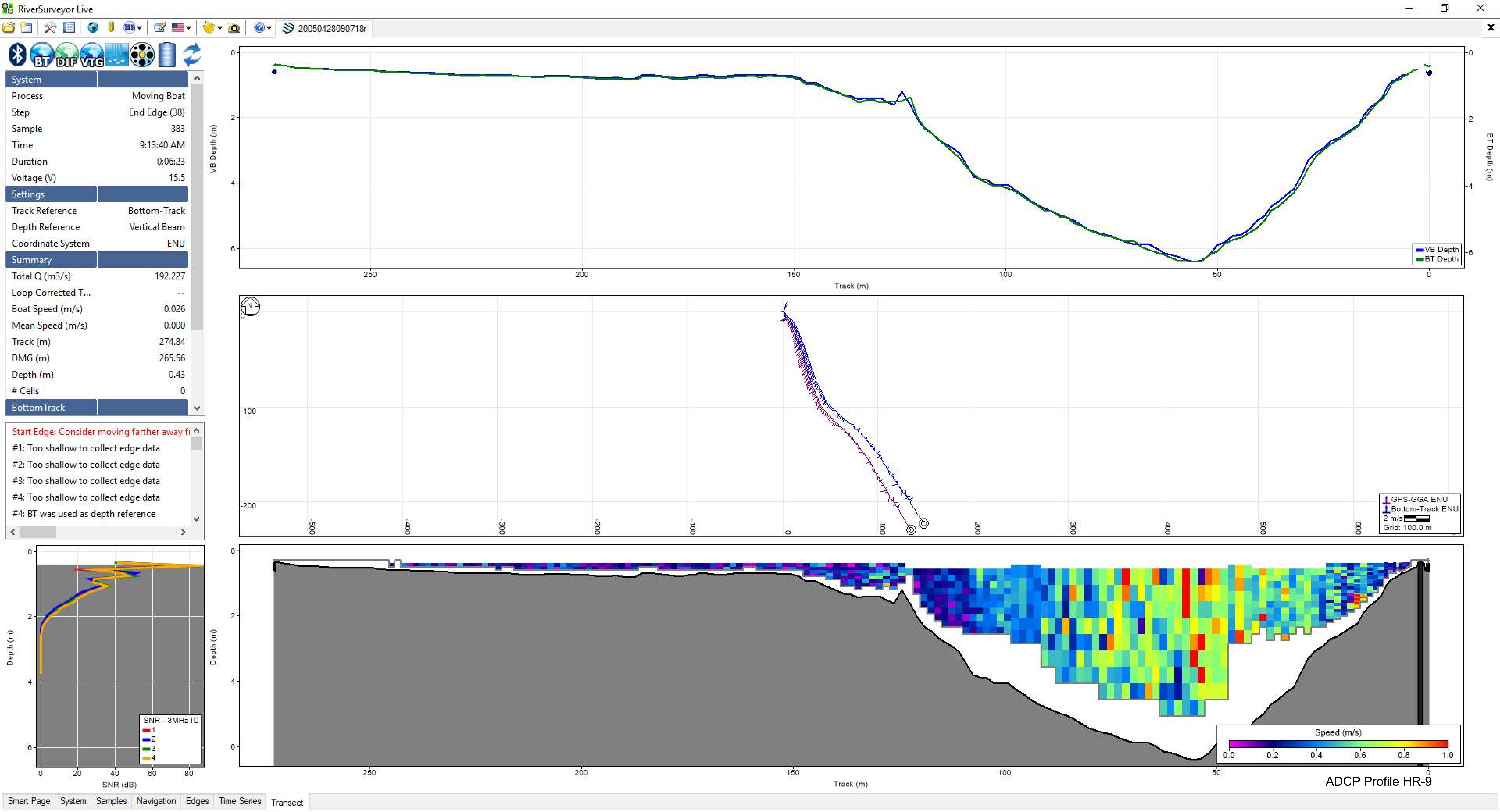

ADCP Profile HR-7

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-8 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 356935.0979, 5426749.876 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.22 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | | Picture looking toward right bank |
| | | | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 6 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 3:31 PM |



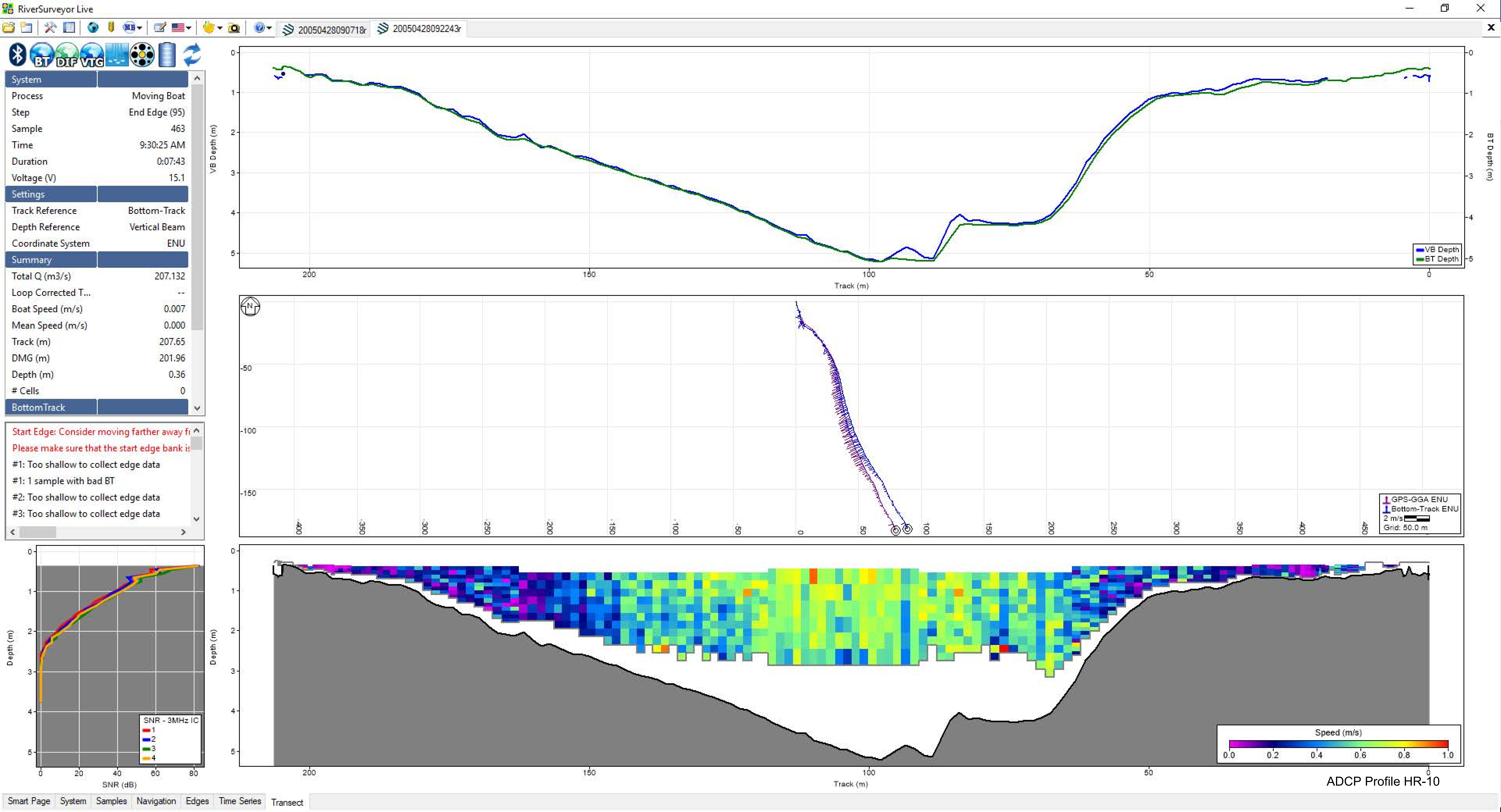
ADCP Profile HR-8

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-9 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 357455.8573, 5427019.8805 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 1.988 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 9:48 AM |



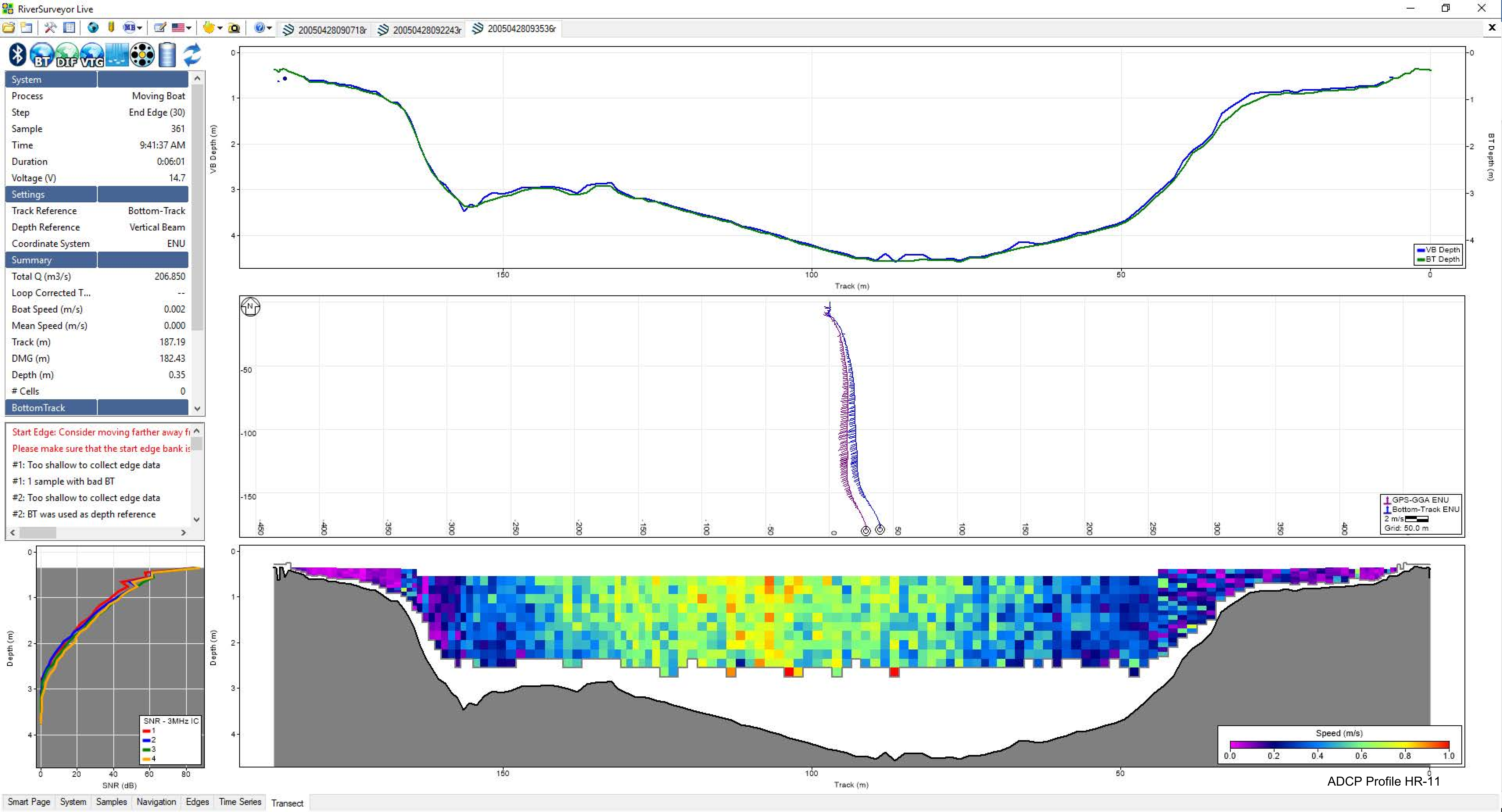
ADCP Profile HR-9

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-10 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 357675.0099, 5427318.9241 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.03 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| X | Other - **Some logs present on right side looking D/S** | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:09 AM |



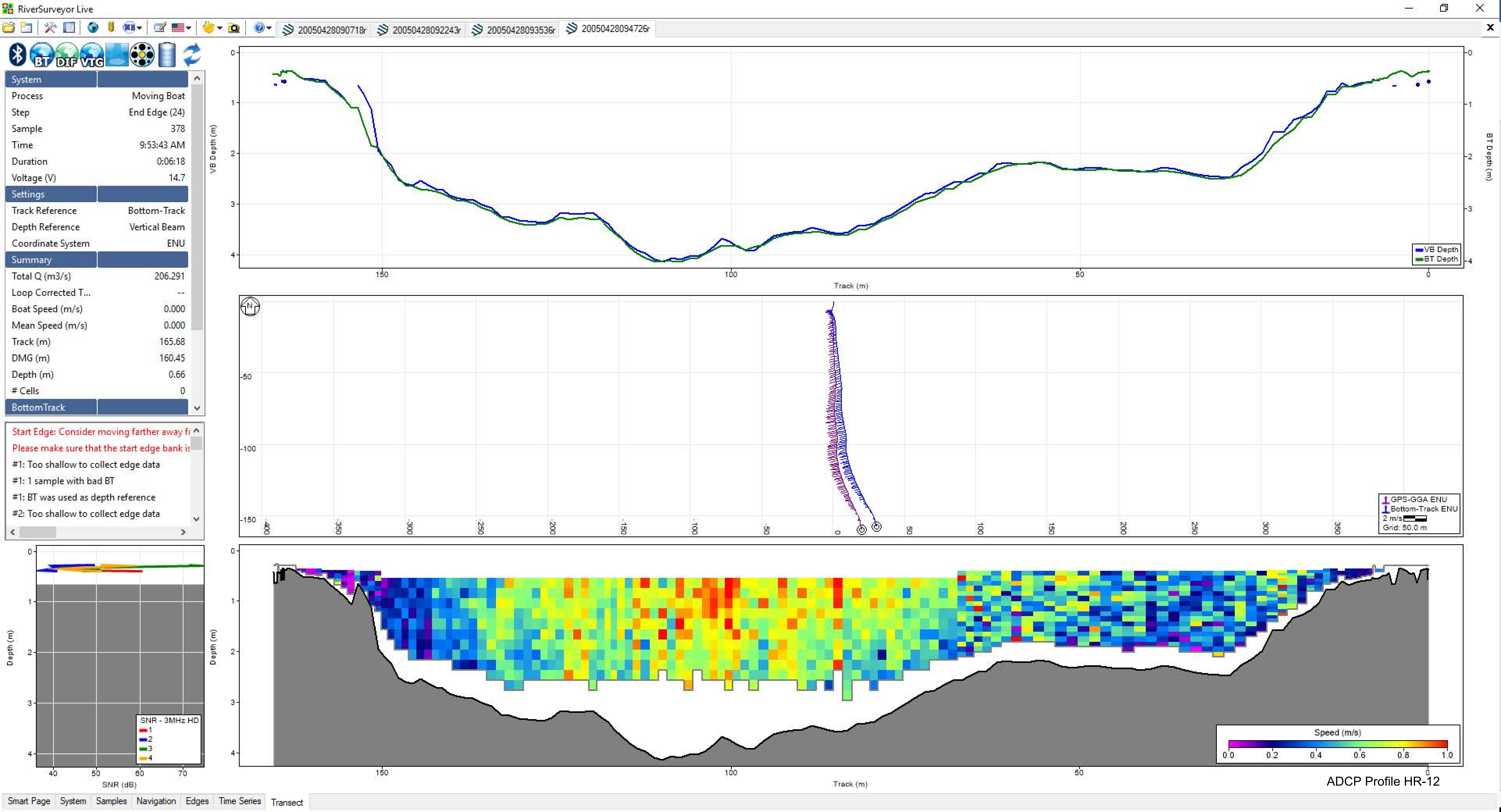
ADCP Profile HR-10

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-11 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 357997.0155, 5427420.802 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.07 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:21 AM |



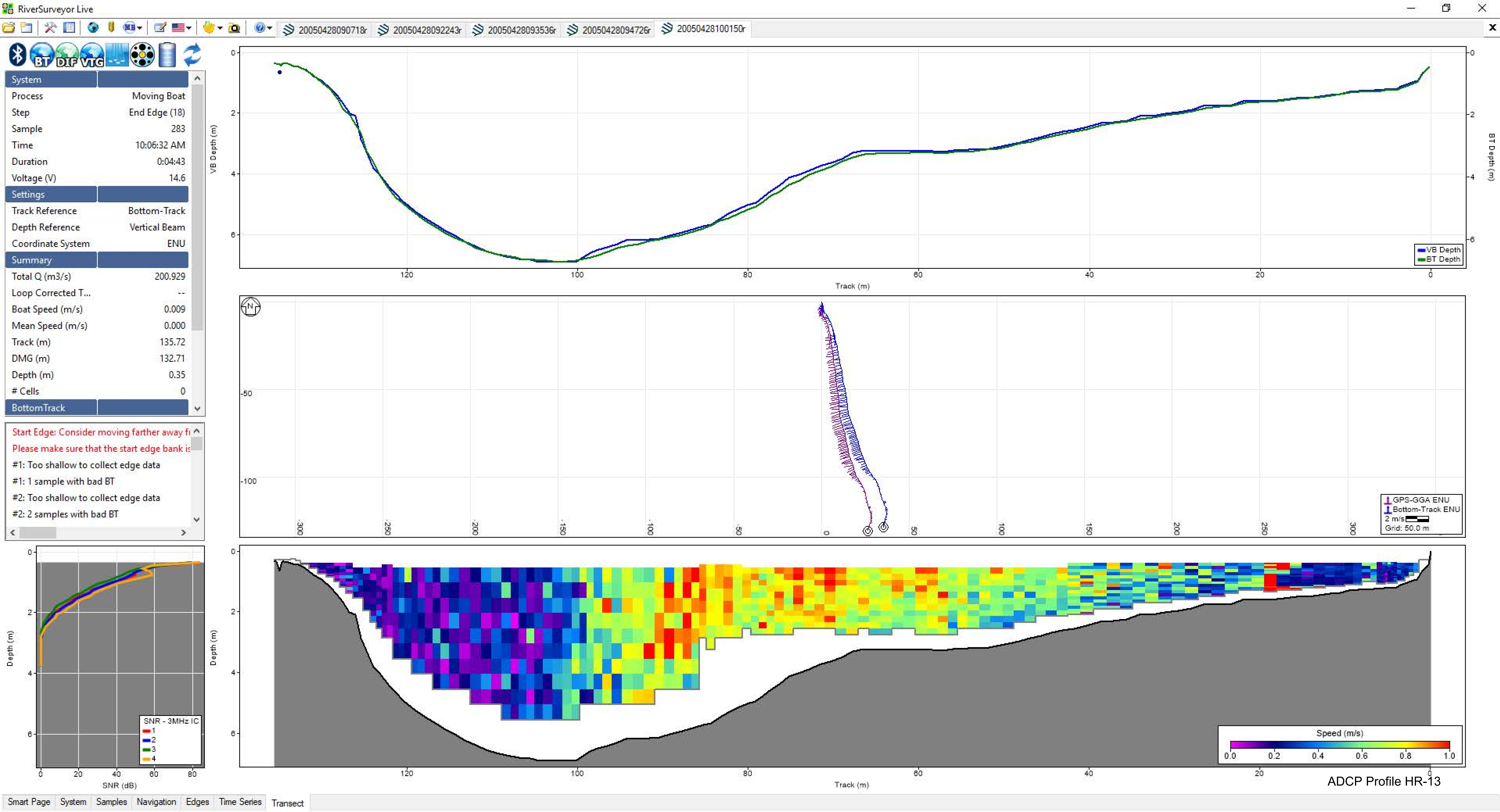

ADCP Profile HR-11

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-12 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 358298.0917, 5427464.269 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.05 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Brook on right bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:30 AM |

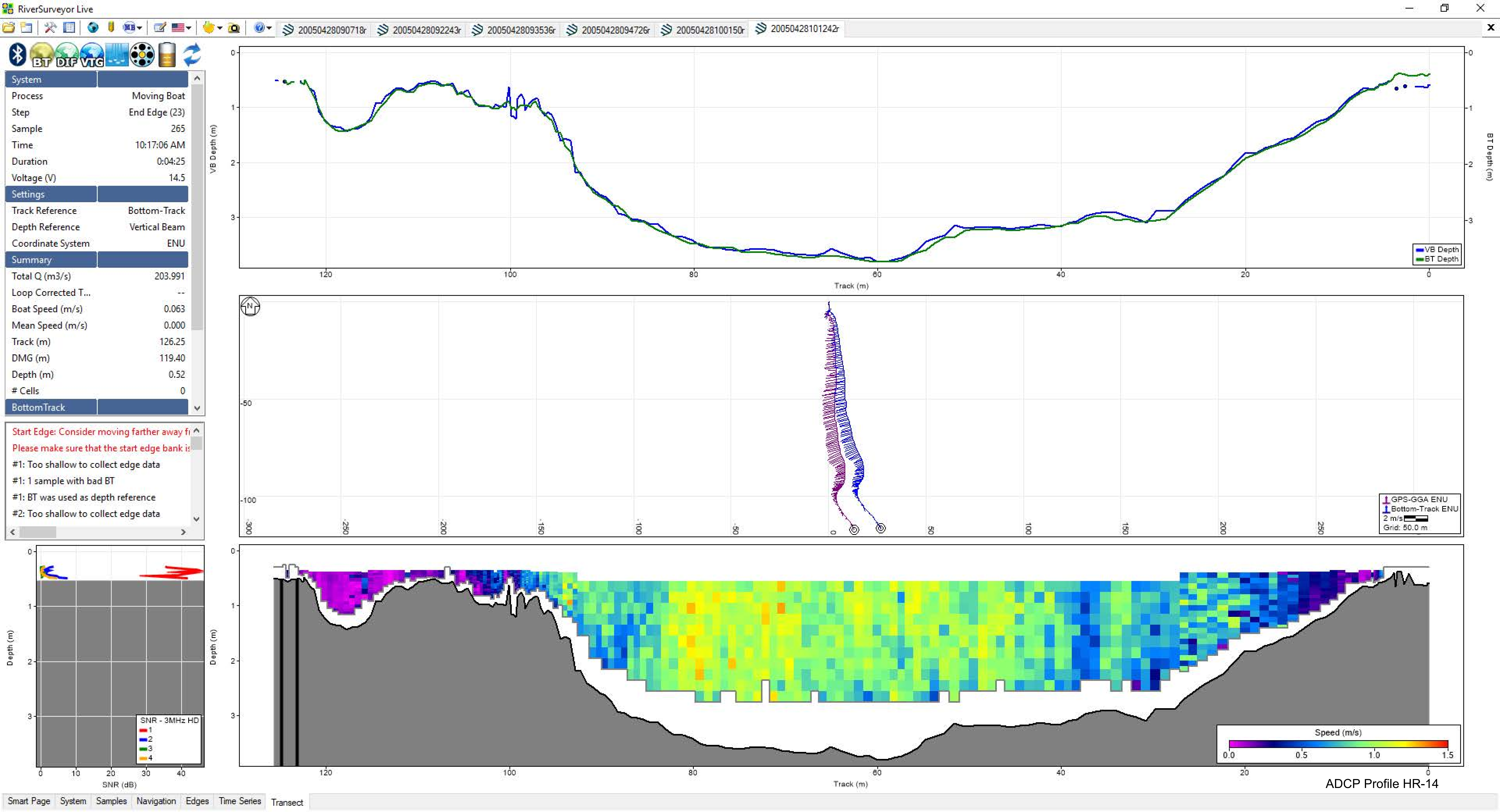



ADCP Profile HR-12

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-13 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 358647.3613, 5427464.574 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.06 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Highway on left flood plain, house on right** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:43 AM |

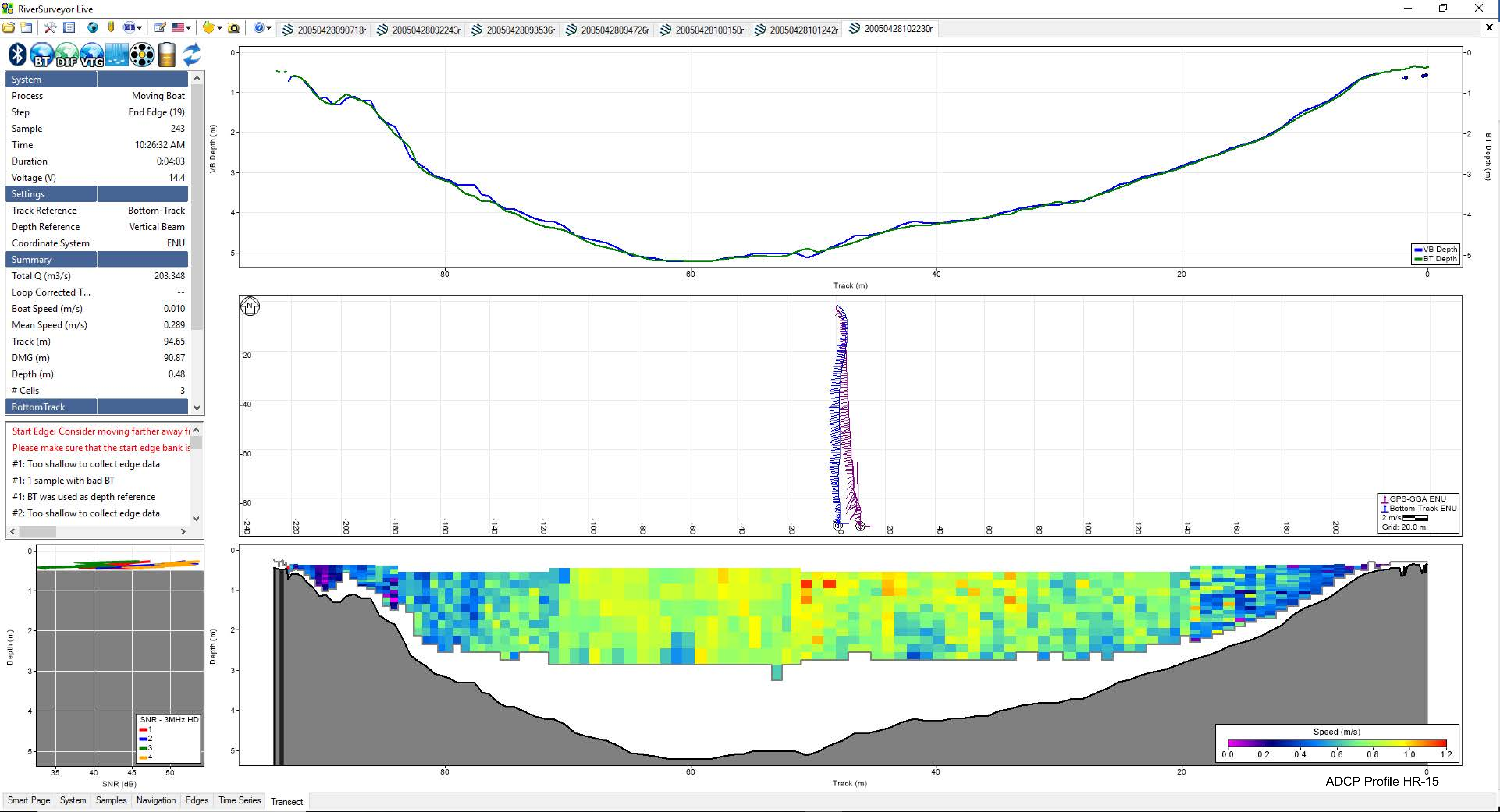

RiverSurveyor Live
20050428090718r
20050428092243r
20050428093536r
20050428094726r
20050428100150r
System
Process Moving Boat
Step End Edge (18)
Sample 283
Time 10:06:32 AM
Duration 0:04:43
Voltage (V) 14.6
Settings
Track Reference Bottom-Track
Depth Reference Vertical Beam
Coordinate System ENU
Summary
Total Q (m3/s) 200.929
Loop Corrected T... --
Boat Speed (m/s) 0.009
Mean Speed (m/s) 0.000
Track (m) 135.72
DMG (m) 132.71
Depth (m) 0.35
# Cells 0
BottomTrack
Start Edge: Consider moving farther away fr
Please make sure that the start edge bank is
#1: Too shallow to collect edge data
#1: 1 sample with bad BT
#2: Too shallow to collect edge data
#2: 2 samples with bad BT
VB Depth (m)
BT Depth (m)
VB Depth
BT Depth
Track (m)
GPS-GGA ENU
Bottom-Track ENU
2 m/s
Grid: 50.0 m
Depth (m)
SNR - 3MHz IC
SNR (dB)
Speed (m/s)
ADCP Profile HR-13
Smart Page
System
Samples
Navigation
Edges
Time Series
Transect

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-14 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 358905.2908, 5427522.9931 | | |
| **Bridge/culvert ID:** | Humber Village Access Bridge | | |
| **Water level elevation at time of survey (m):** | | 2.1 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Armour stone on right bank, homeowner installed** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:53 AM |



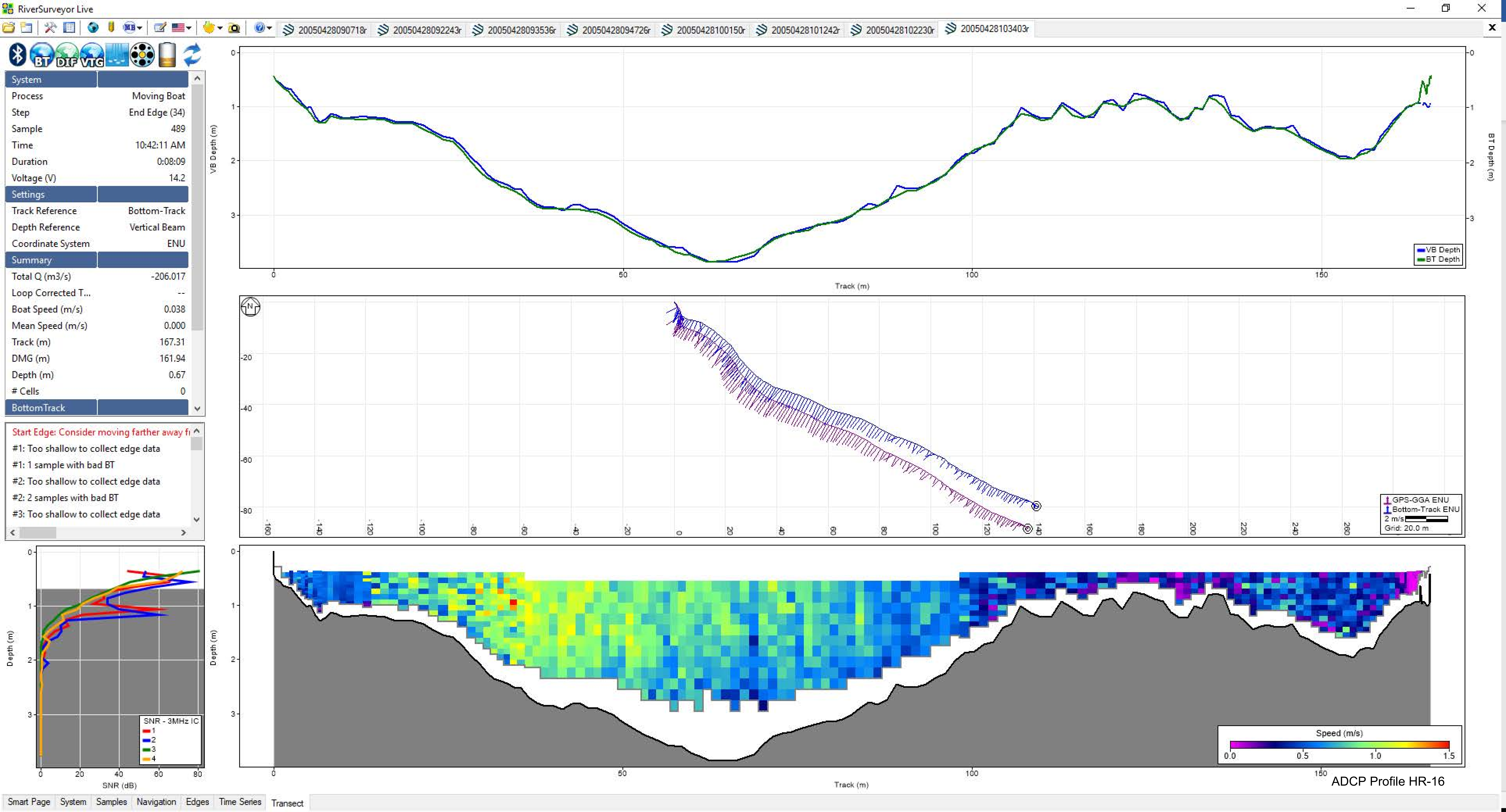
ADCP Profile HR-14

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-15 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 358945.0962, 5427529.949 | | |
| **Bridge/culvert ID:** | Humber Village Access Bridge | | |
| **Water level elevation at time of survey (m):** | | 2.08 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Road on left flood plain** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:03 AM |



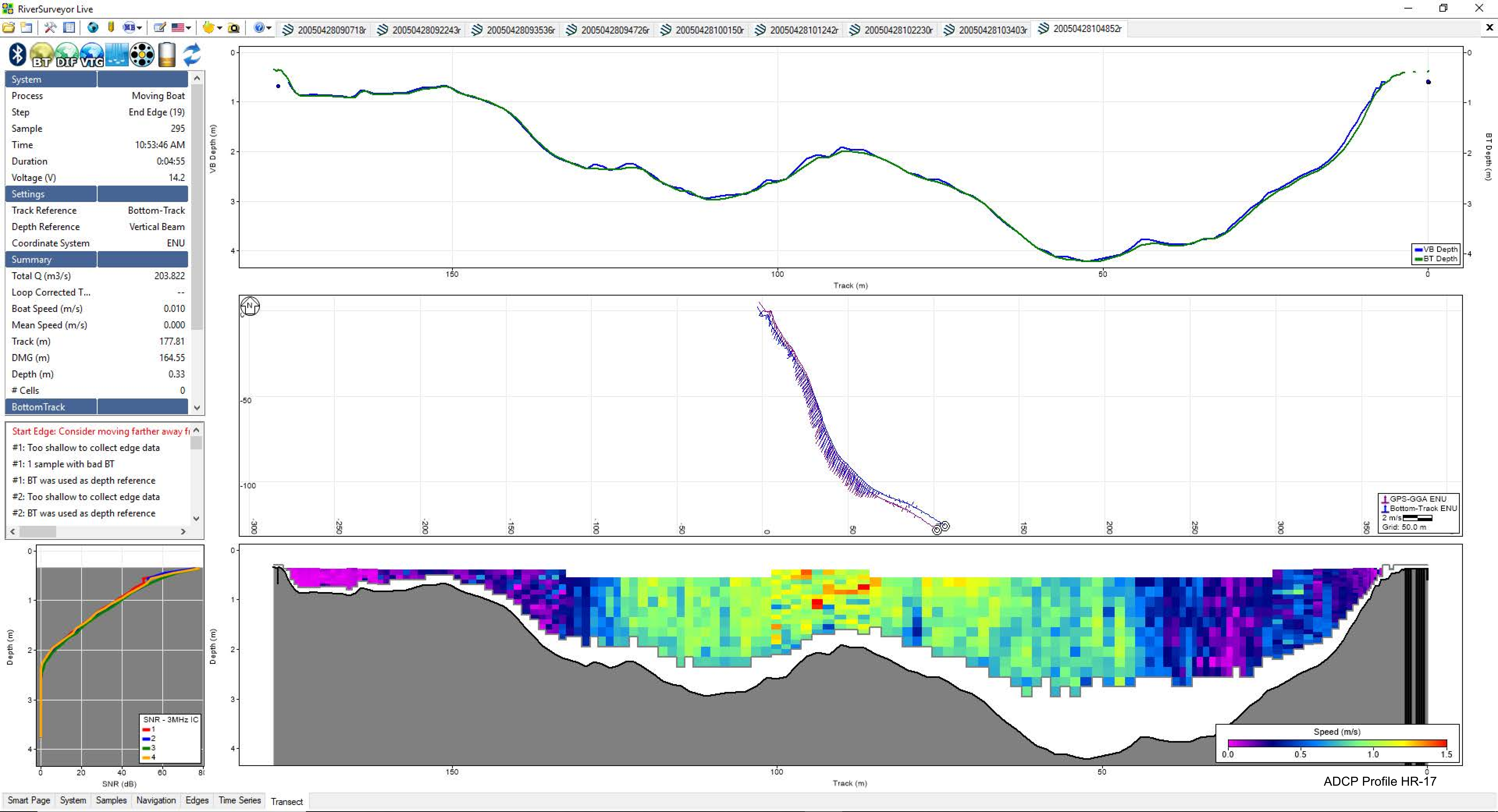
ADCP Profile HR-15

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-16 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 359283.9361, 5427744.588 | | |
| **Bridge/culvert ID:** | Humber Village Access Bridge | | |
| **Water level elevation at time of survey (m):** | | 2.15 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Road on left flood plain** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:18 AM |



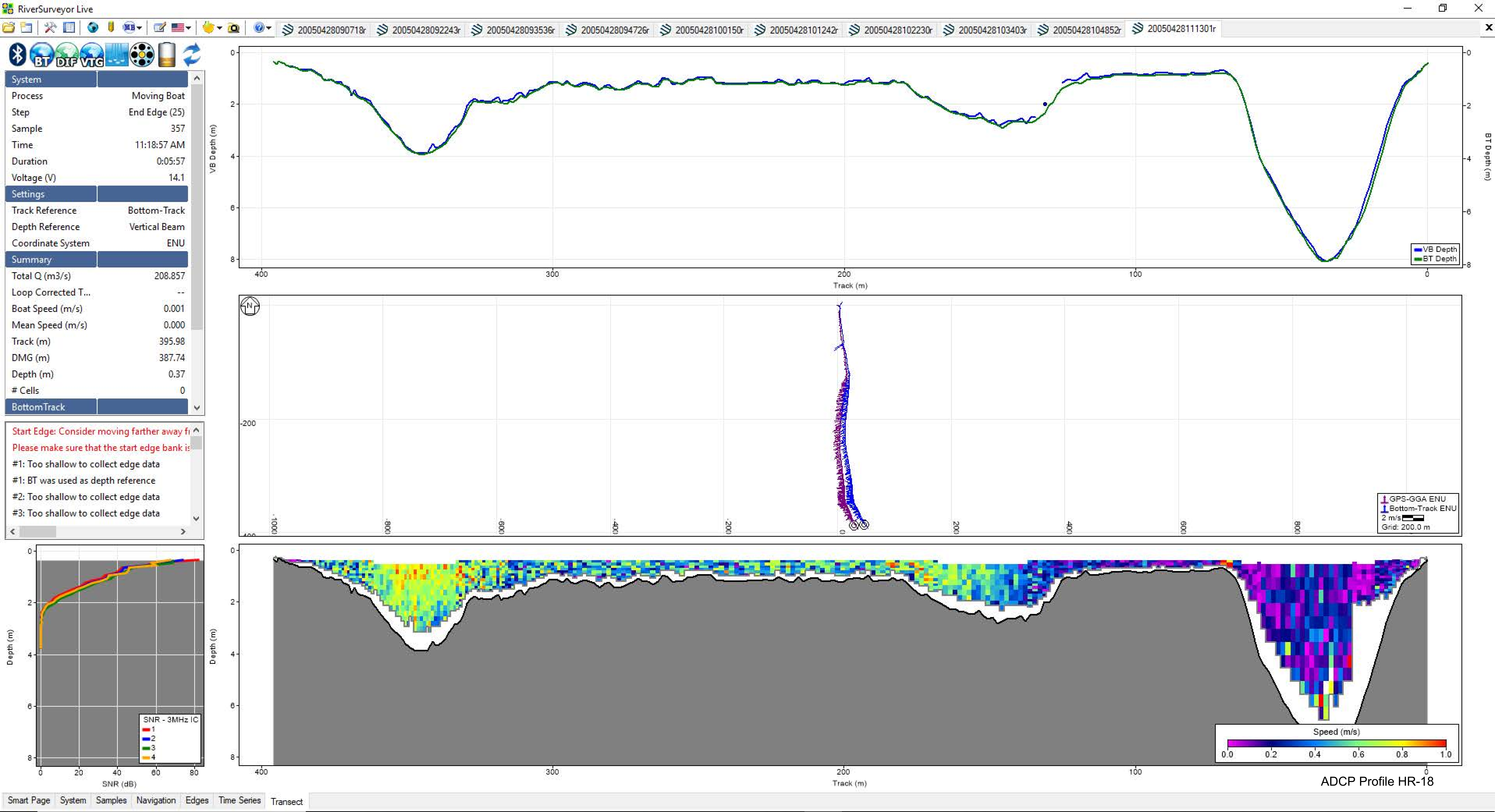

ADCP Profile HR-16

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-17 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 359441.9835, 5428017.1495 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.14 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:31 AM |



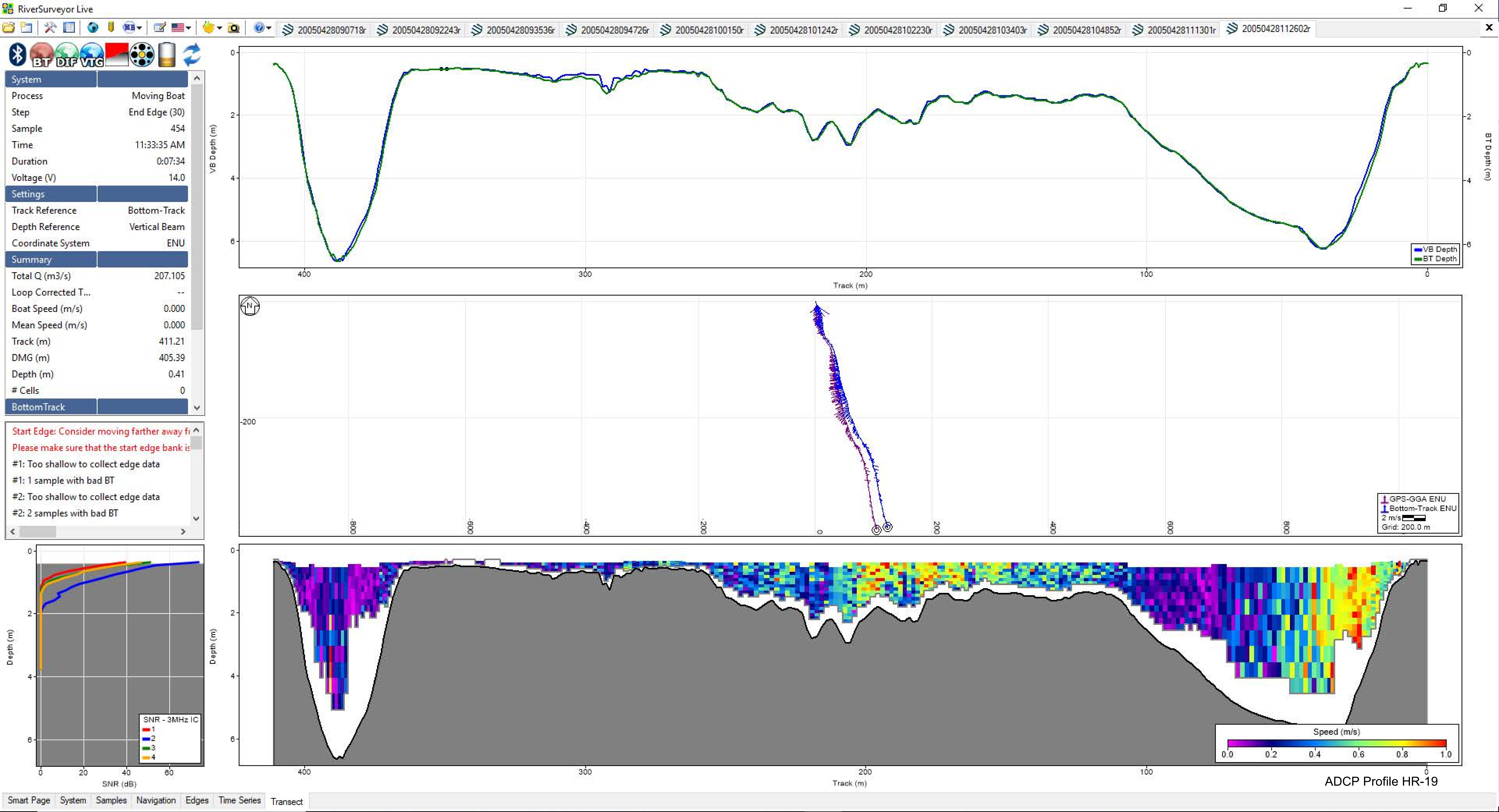

ADCP Profile HR-17

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-18 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 359624.0593, 5428229.27 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.19 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Houses above left bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 11:55 AM |



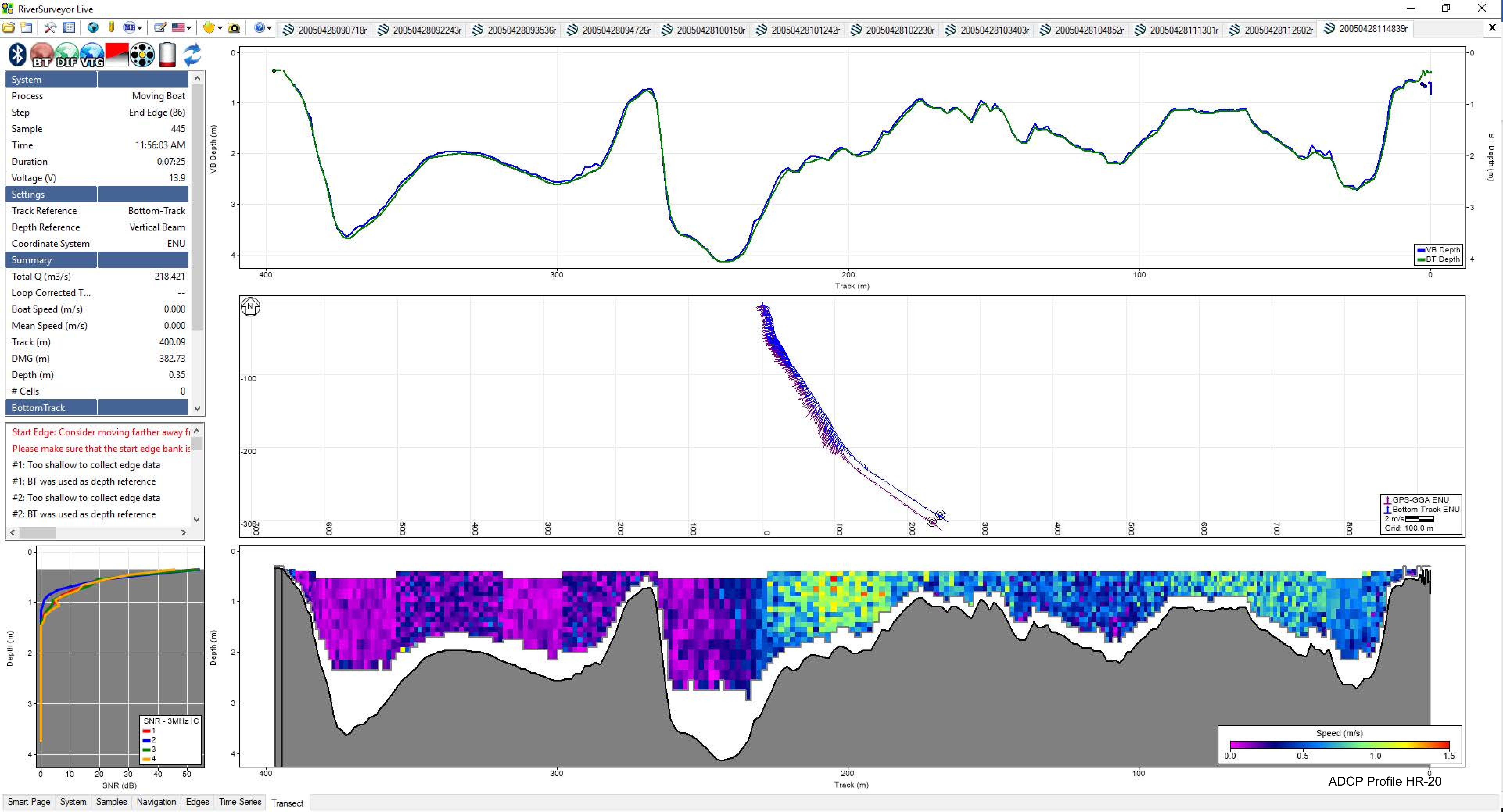

ADCP Profile HR-18

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-19 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 360043.473, 5428196.7018 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.23 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Houses above left bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:19 PM |



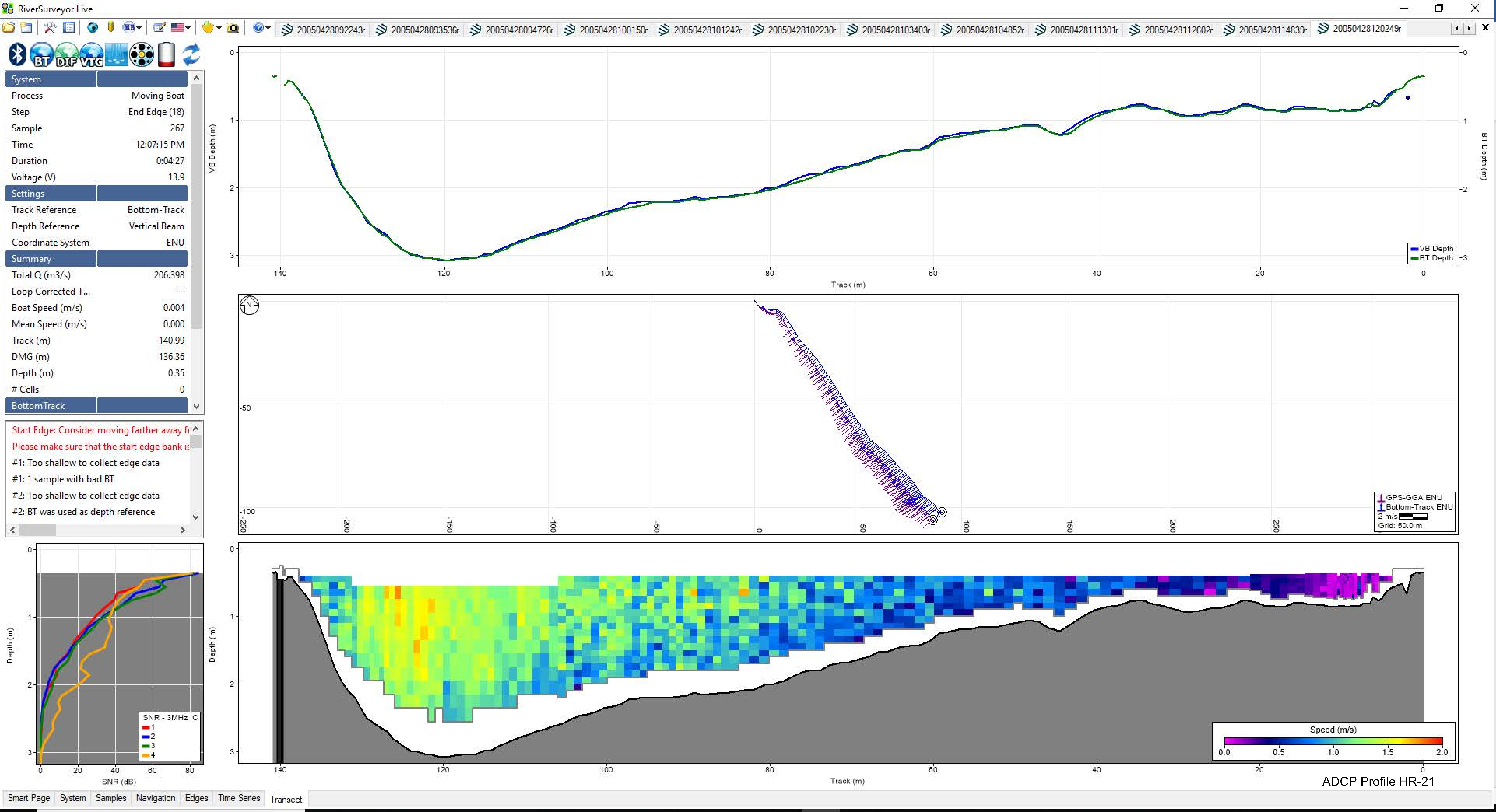

ADCP Profile HR-19

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-20 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 360377.6523, 5428388.98 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.28 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:36 PM |



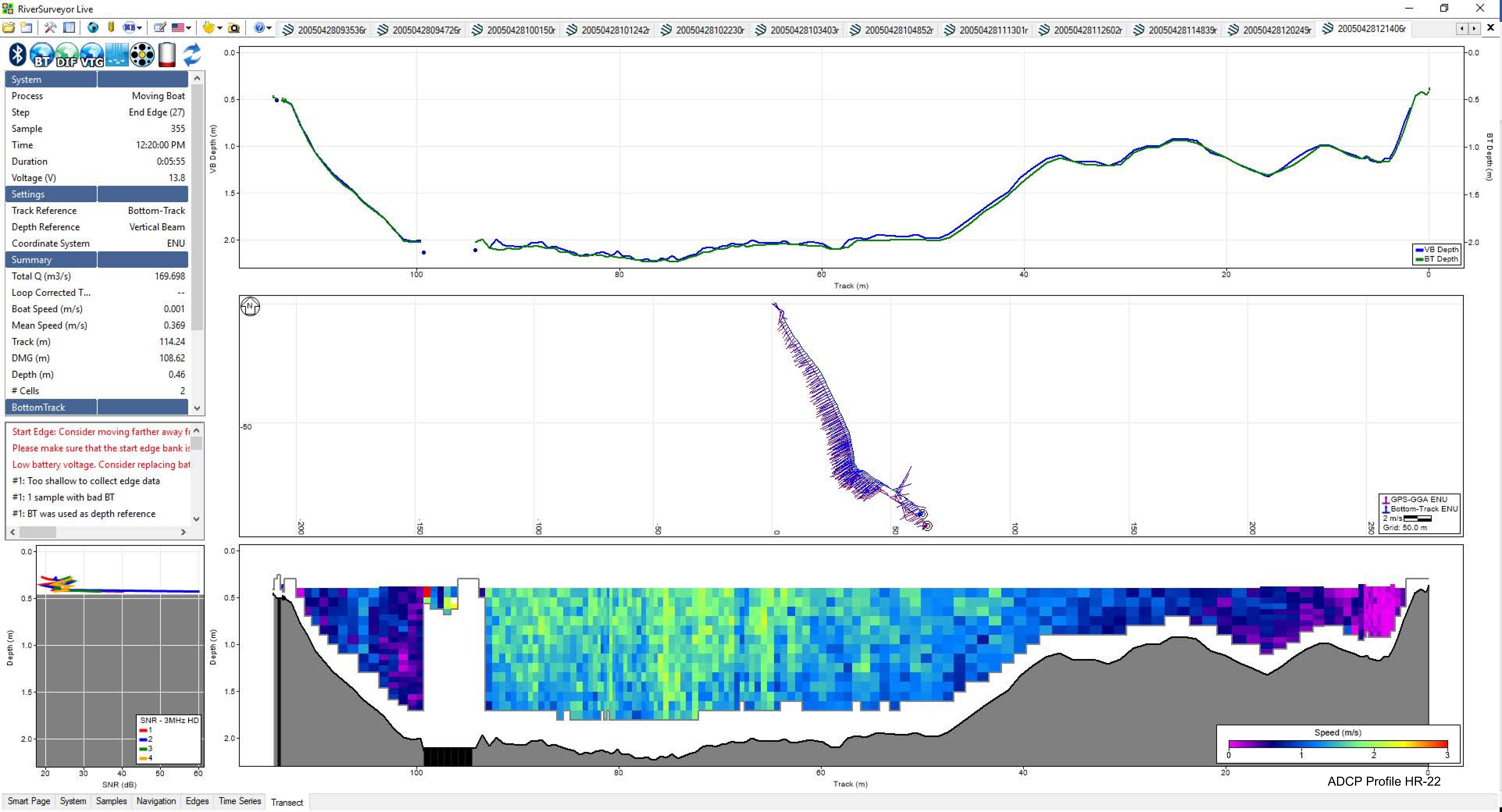
ADCP Profile HR-20

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-21 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 360515.7667, 5428595.0915 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.28 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Houses on left flood plain.** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:44 PM |



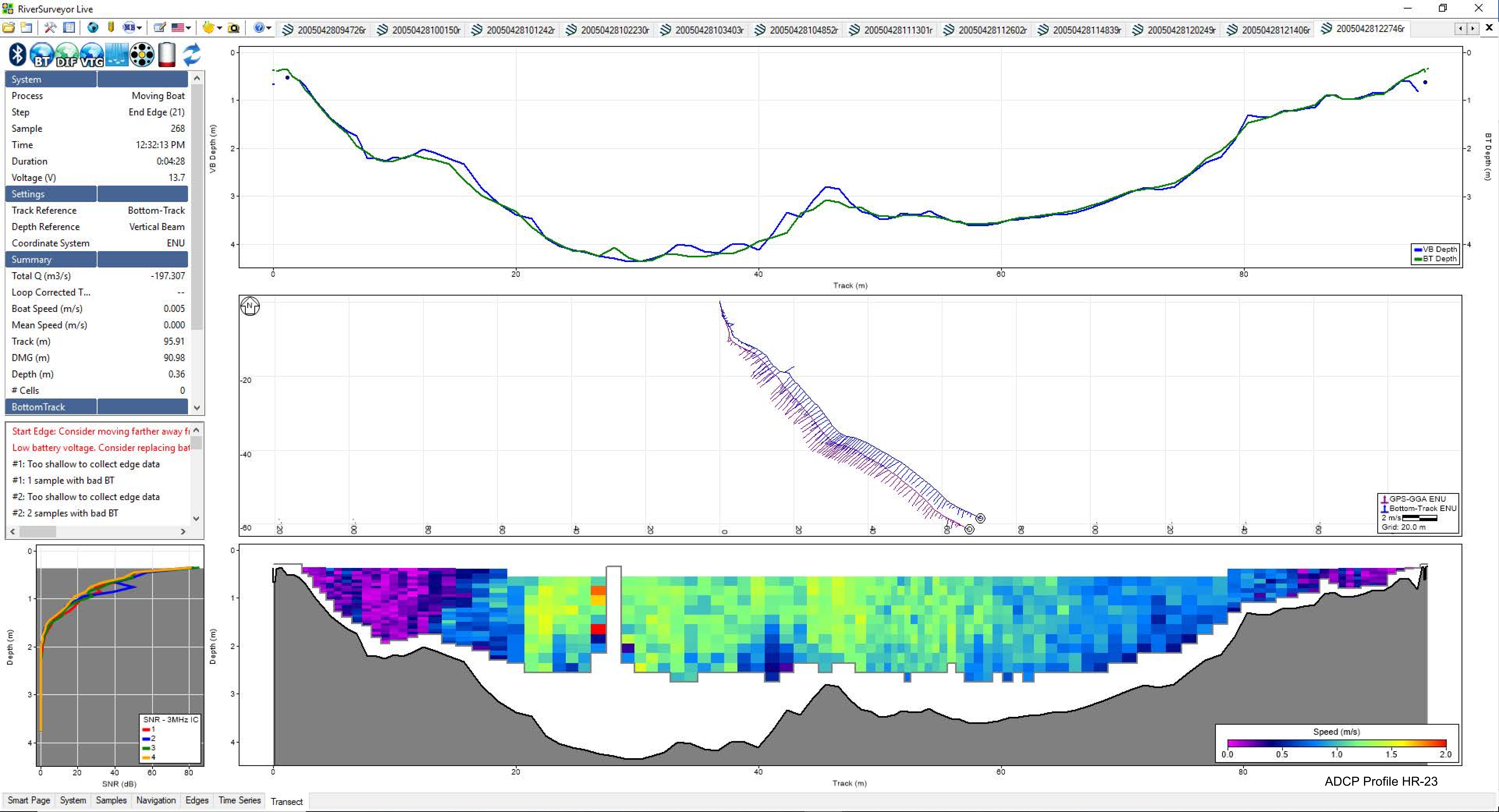

ADCP Profile HR-21

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-22 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 360780.9313, 5428781.4925 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.47 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 12:56 PM |



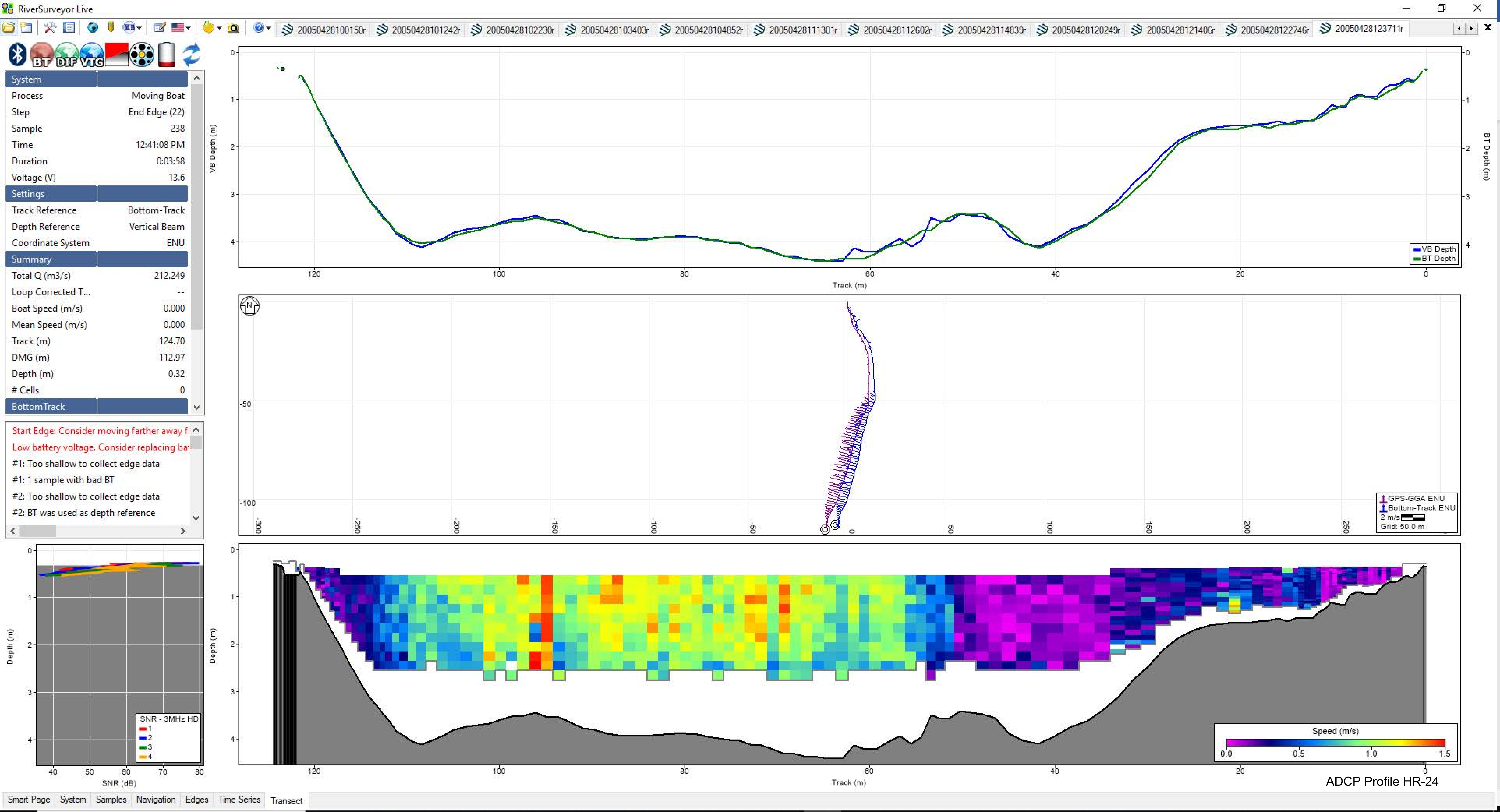

ADCP Profile HR-22

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-23 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 361052.8985, 5429007.106 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.63 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:18 PM |



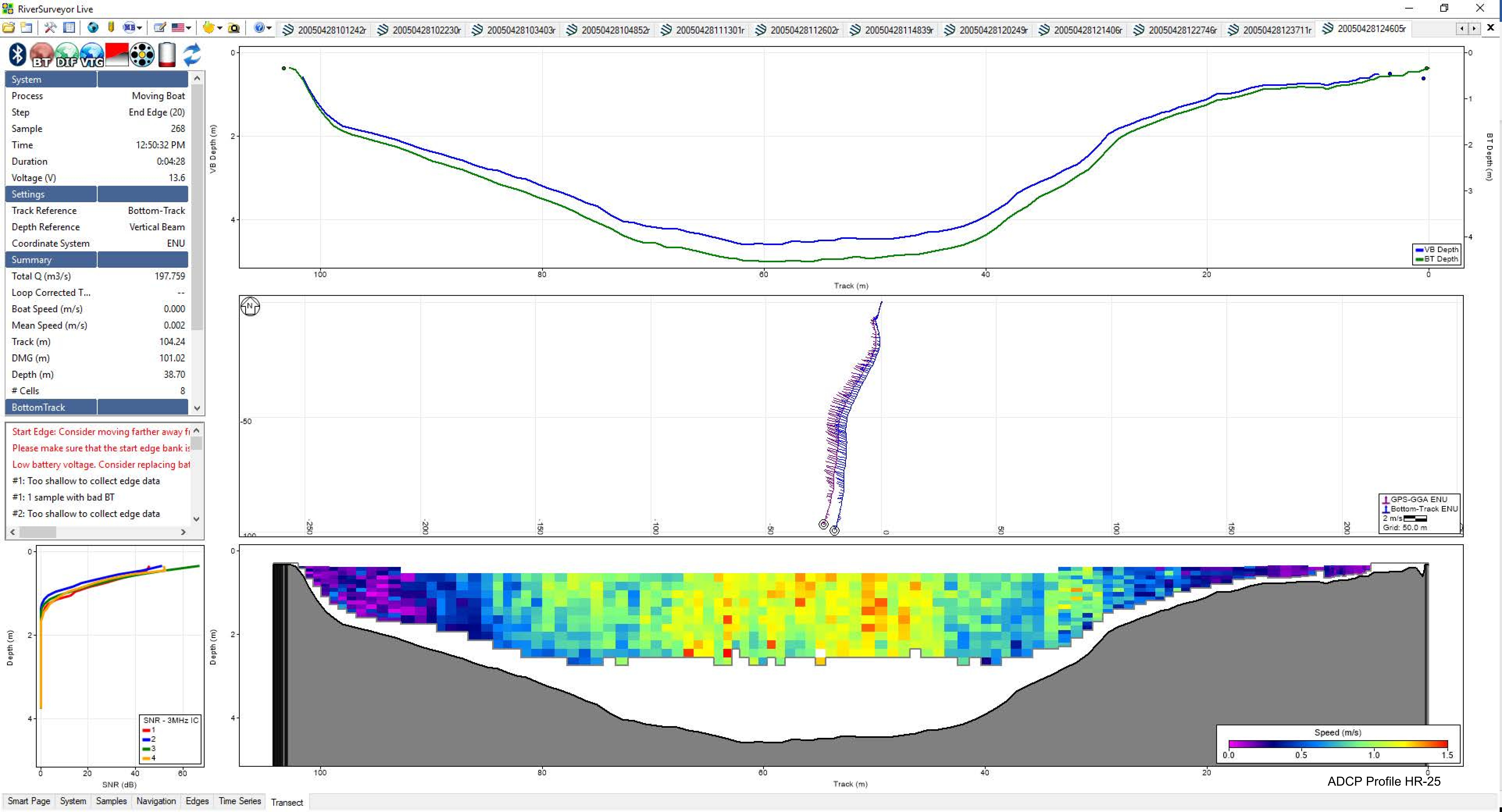

ADCP Profile HR-23

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-24 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 361349.3059, 5429095.132 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.71 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:28 PM |



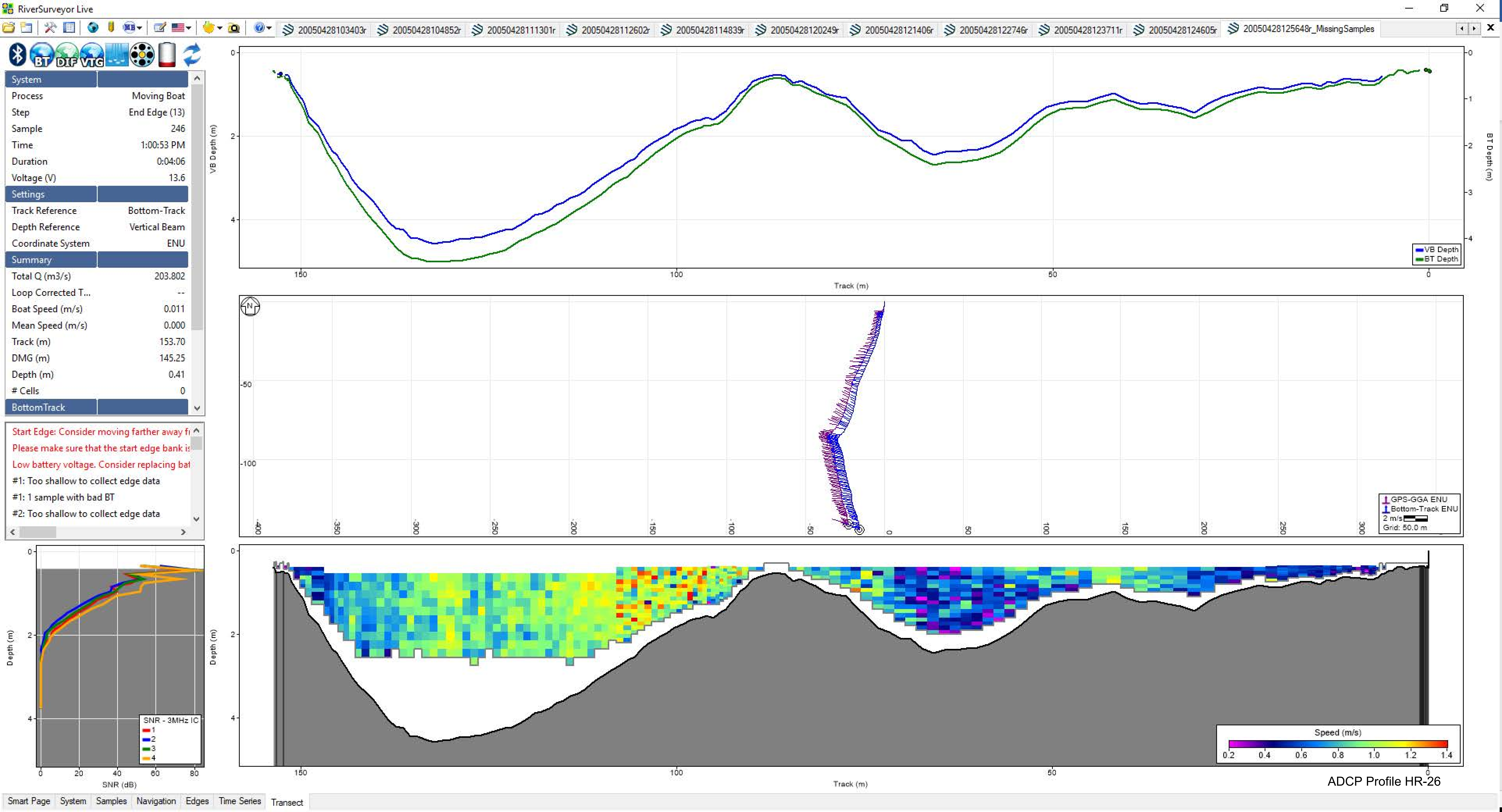

ADCP Profile HR-24

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-25 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 361594.6194, 5428987.7765 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.76 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Farmland above left bank, grassy fields** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:37 PM |



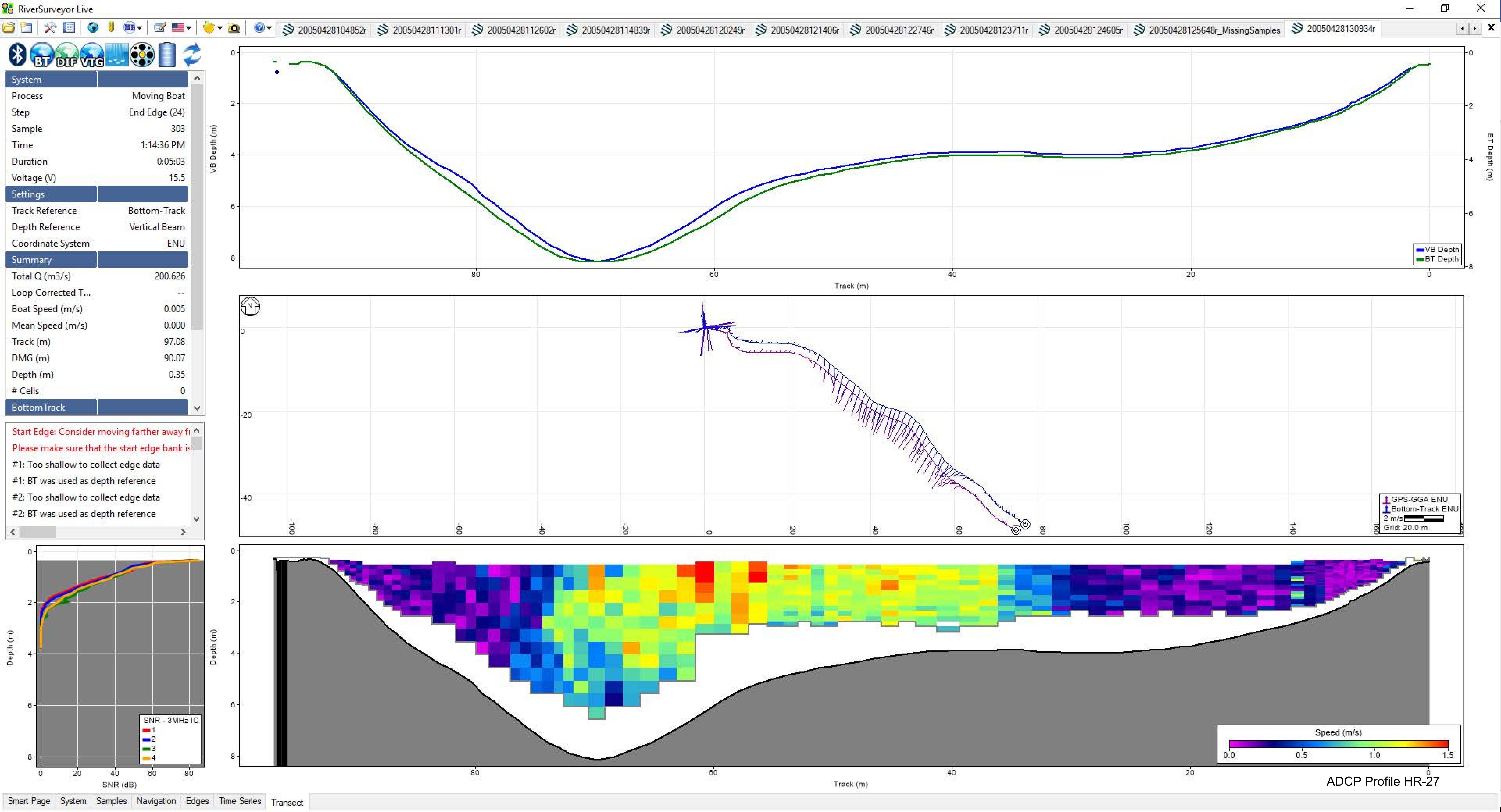

ADCP Profile HR-25

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-26 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 361847.6332, 5428894.952 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.82 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Farmland above left bank, grassy fields** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:37 PM |



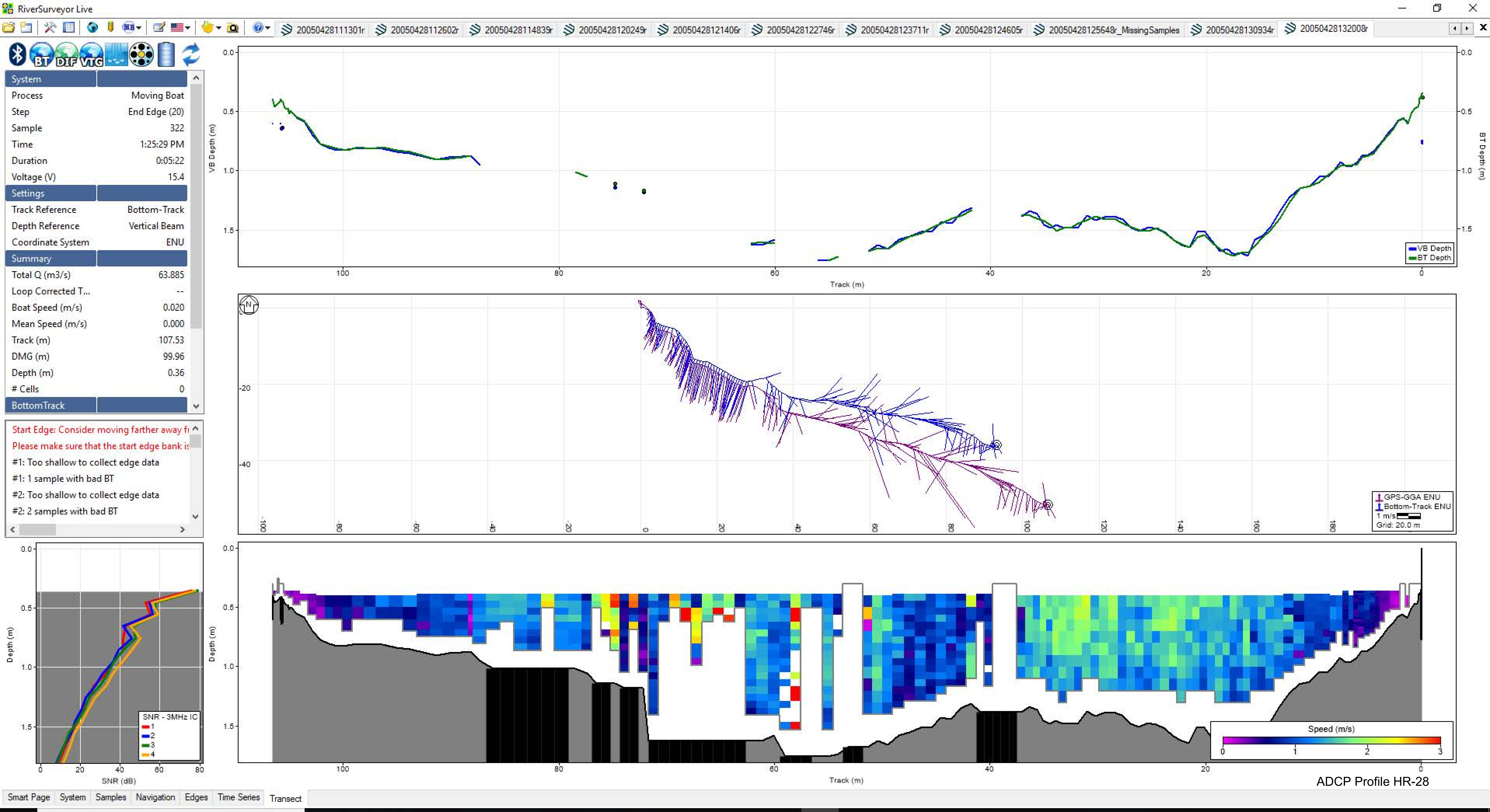

ADCP Profile HR-26

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-27 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 362114.3216, 5429087.2795 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.85 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Small brook on left bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 1:52 PM |



ADCP Profile HR-27

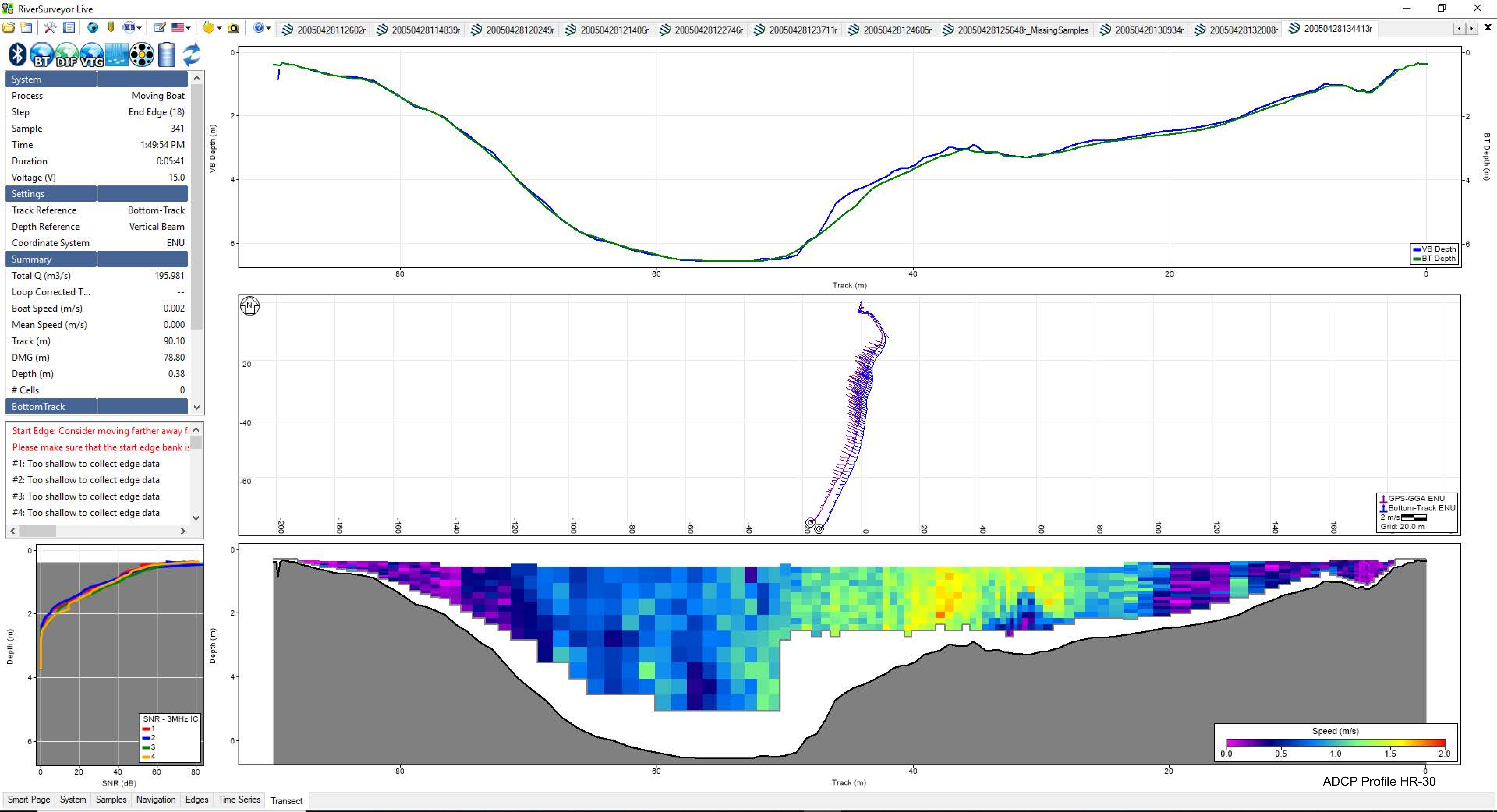
| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-28 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 362235.1328, 5429301.3075 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.86 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: Home on left flood plain** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:02 PM |




ADCP Profile HR-28

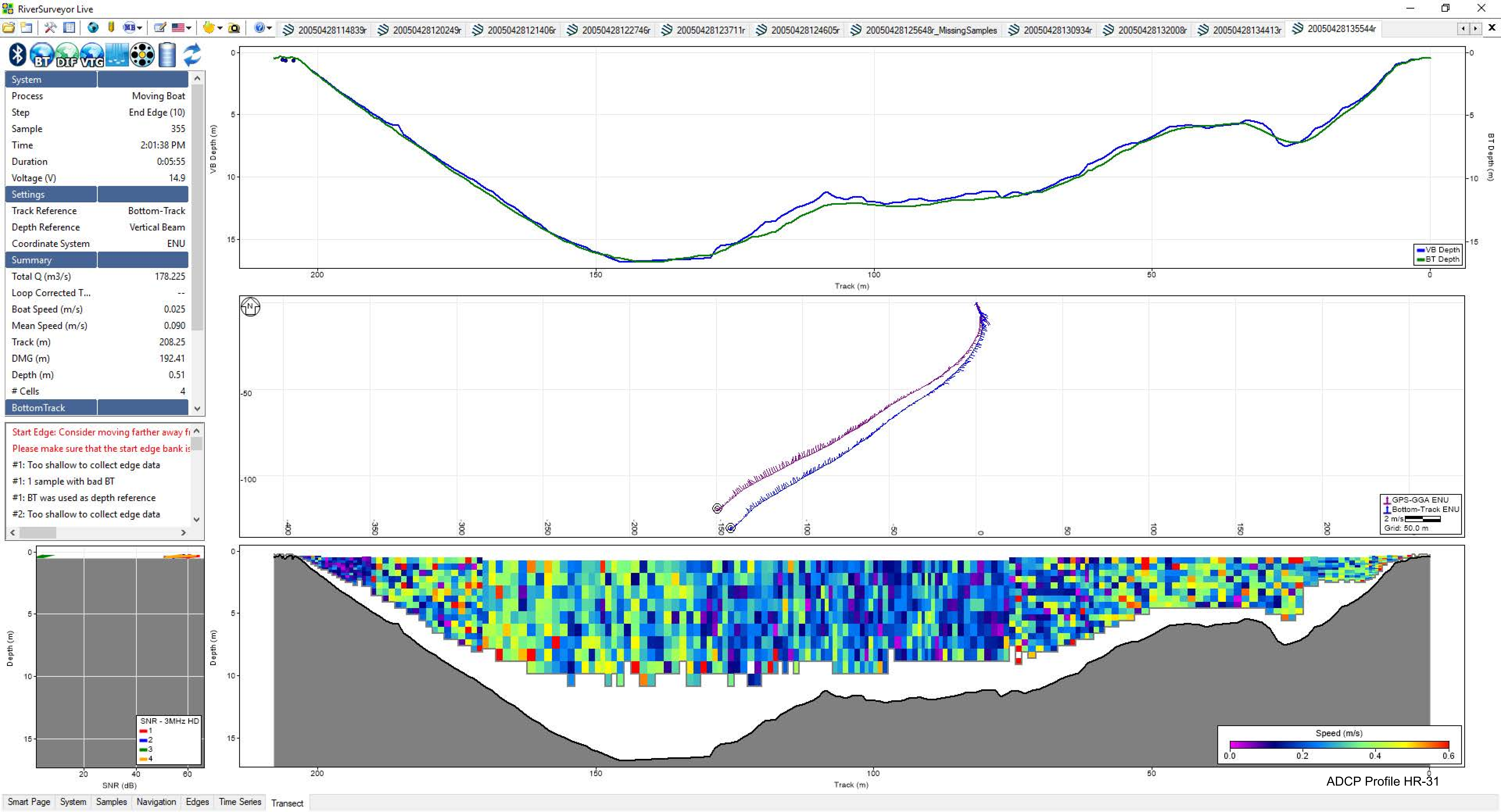
| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-29 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | - | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | - | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | | |
| | | | |
| | | X | Video looking upstream |
| | | X | Picture looking upstream |
| **Notes: Inaccessible by boat due to rapids, observations from shore on foot. Farmland above left bank** | | | |
| **Date of Survey:** | **Dec. 13 2018** | **Surveyed by :** | GP & AP |
| **Time Started:** | | **Time Completed:** | 9:30 AM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-30 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 362916.7975, 5429950.5058 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.36 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Farmland above left bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:26 PM |



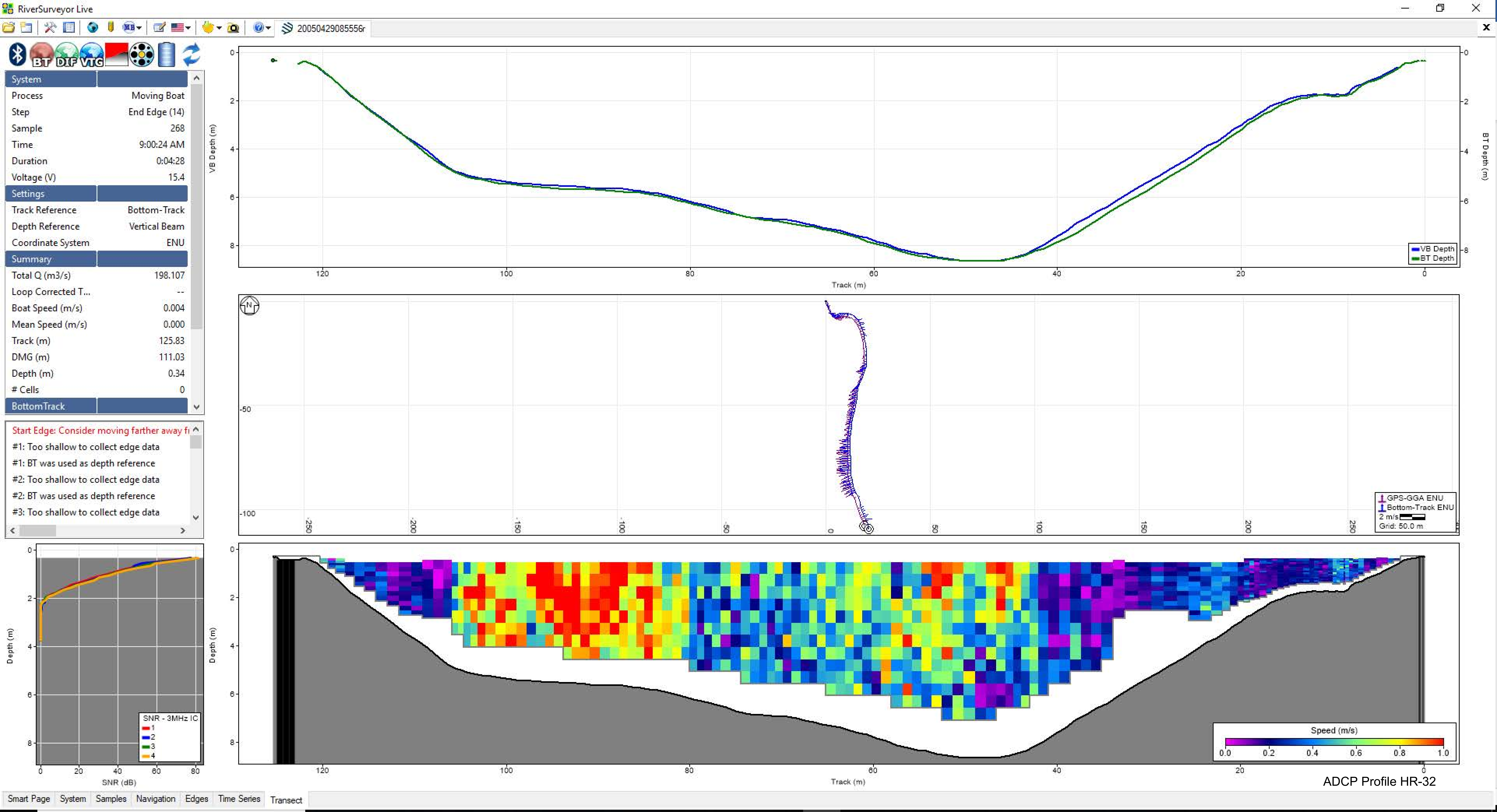
ADCP Profile HR-30

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-31 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 363125.2659, 5429741.3034 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.49 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Farmland above left bank, golf course above right bank** | | | |
| **Date of Survey:** | **Dec. 7 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 2:37 PM |



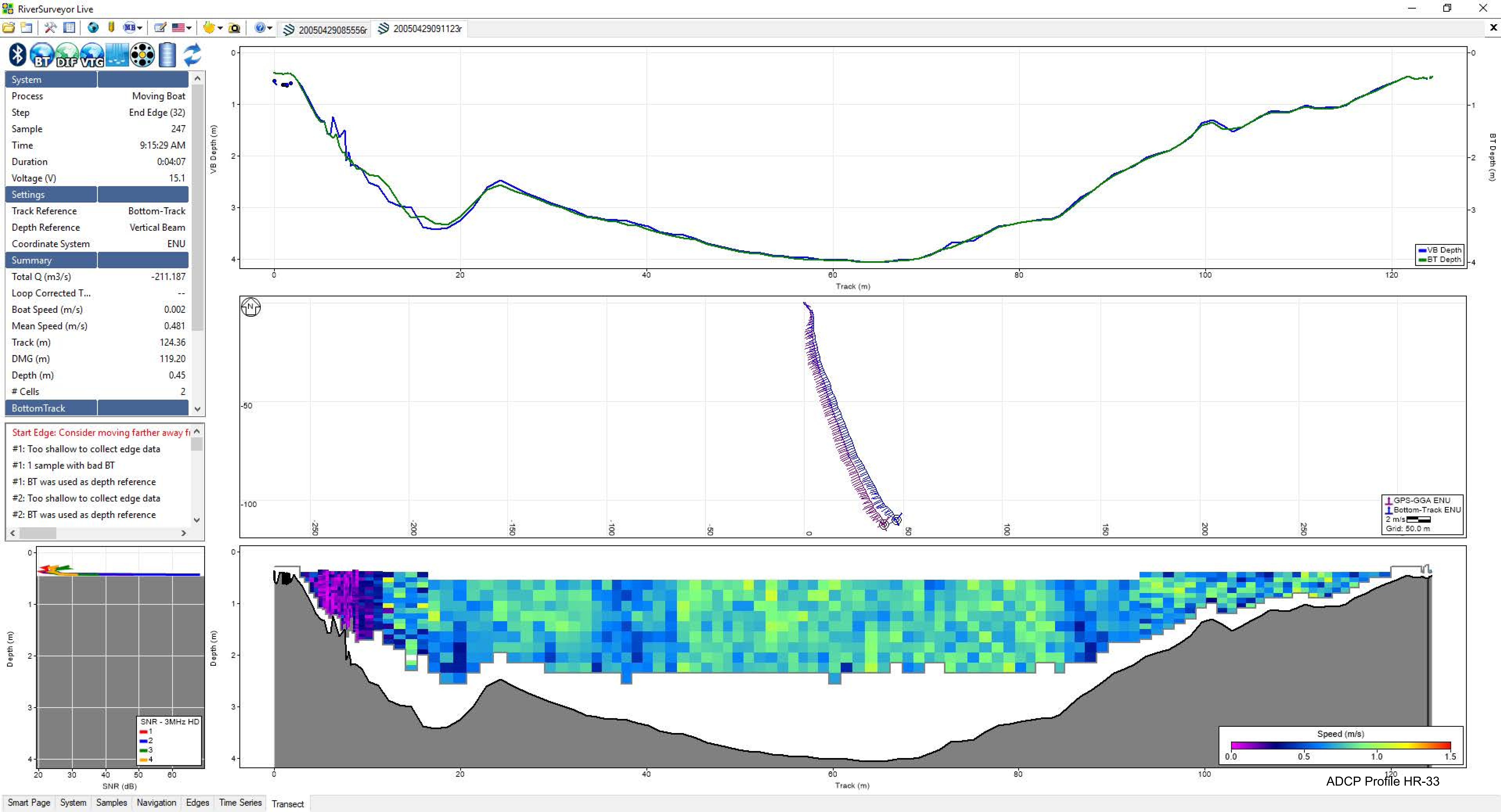

ADCP Profile HR-31

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-32 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 363410.1418, 5429690.4967 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.43 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Houses above left bank, golf course above right bank** | | | |
| **Date of Survey:** | **Dec. 8 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 9:34 AM |



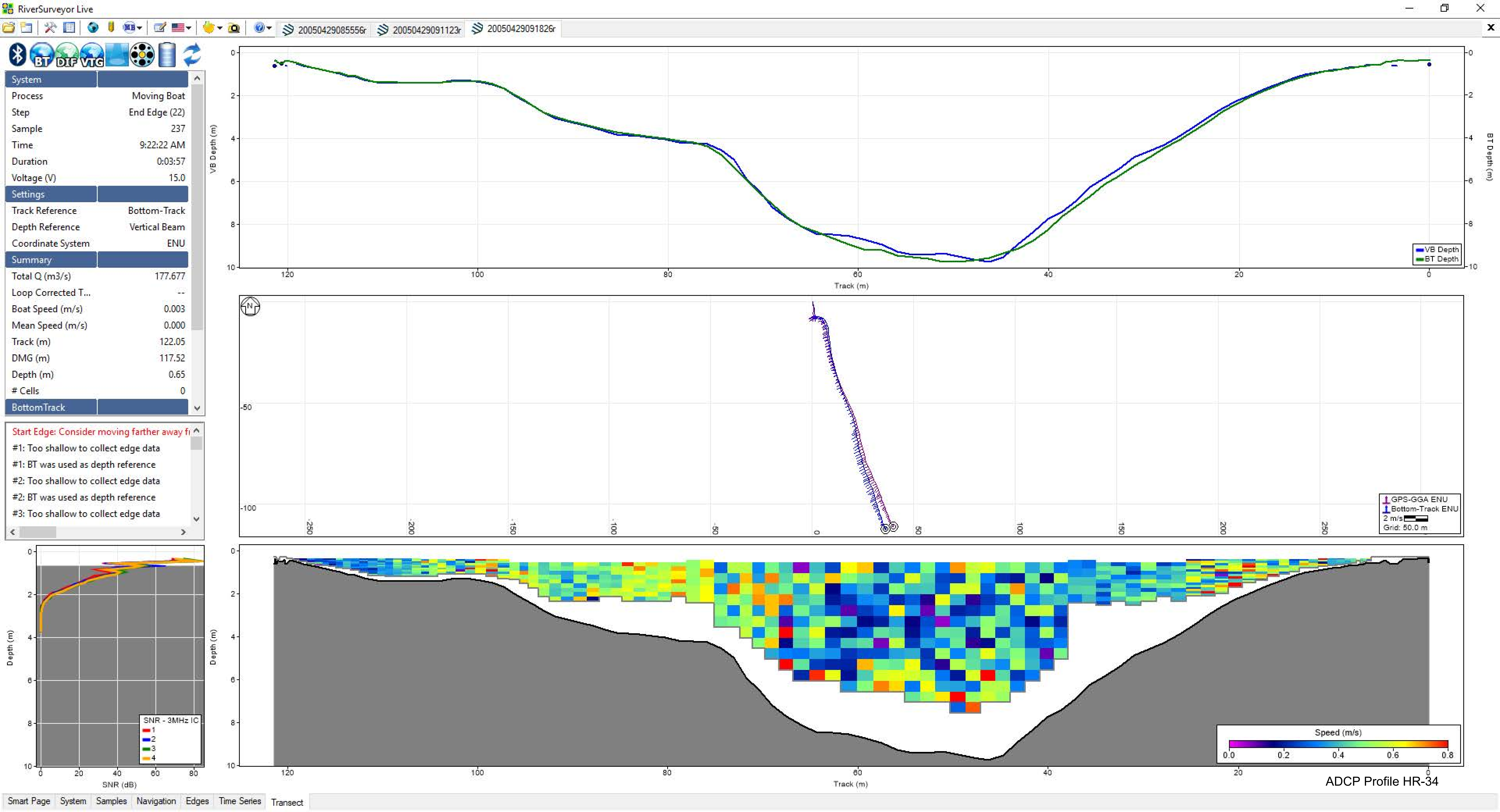

ADCP Profile HR-32

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-33 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 363707.9067, 5429782.1562 | | |
| **Bridge/culvert ID:** | Humber Valley Resort Bridge | | |
| **Water level elevation at time of survey (m):** | | 4.53 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Transmission line on both banks/flood plains, banks around bridge built up. Roadway above left bank** | | | |
| **Date of Survey:** | **Dec. 8 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 9:51 AM |



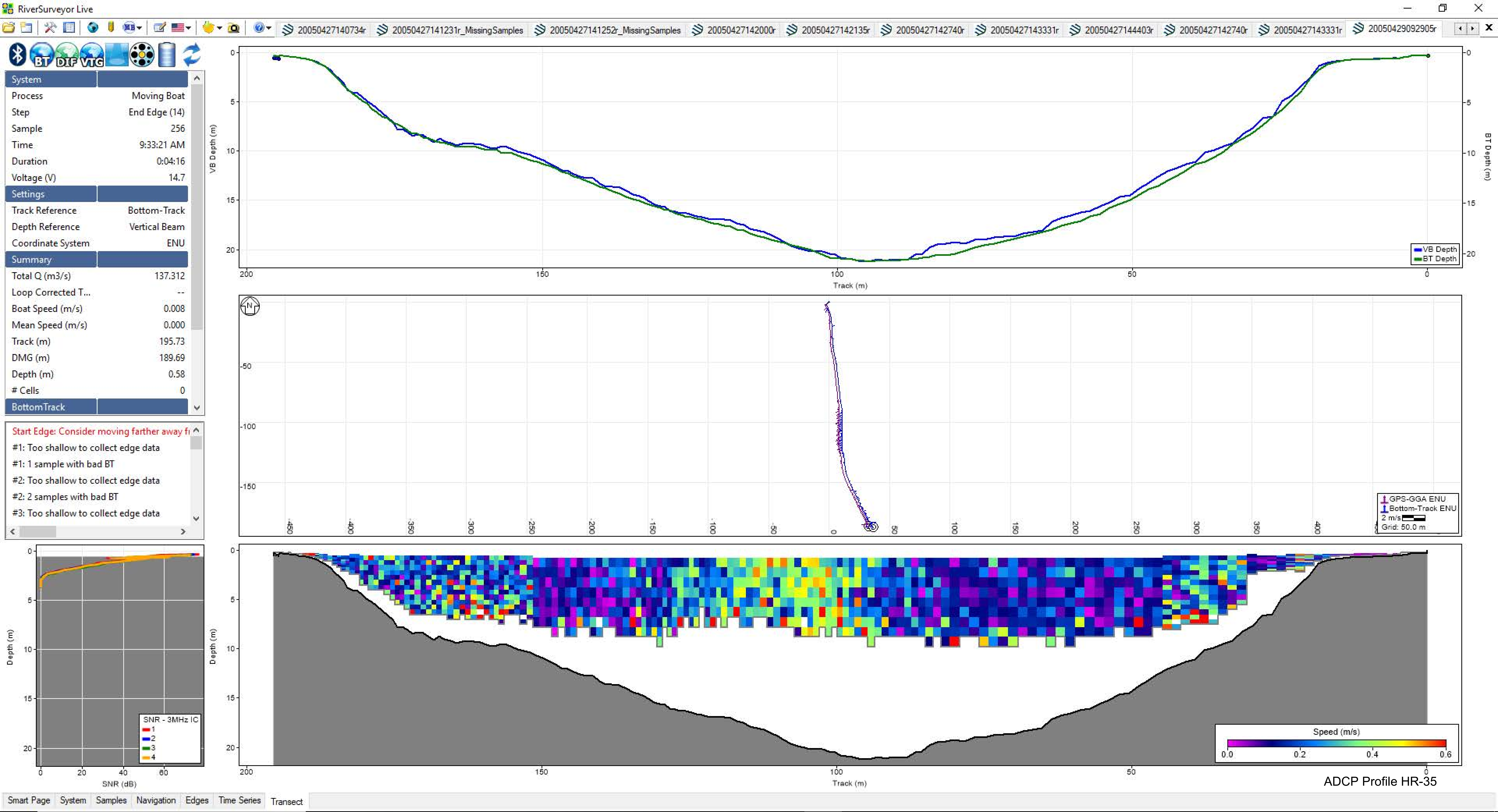
ADCP Profile HR-33

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-34 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 363758.4102, 5429803.6305 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.56 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Boat launch on left bank** | | | |
| **Date of Survey:** | **Dec. 8 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:06 AM |



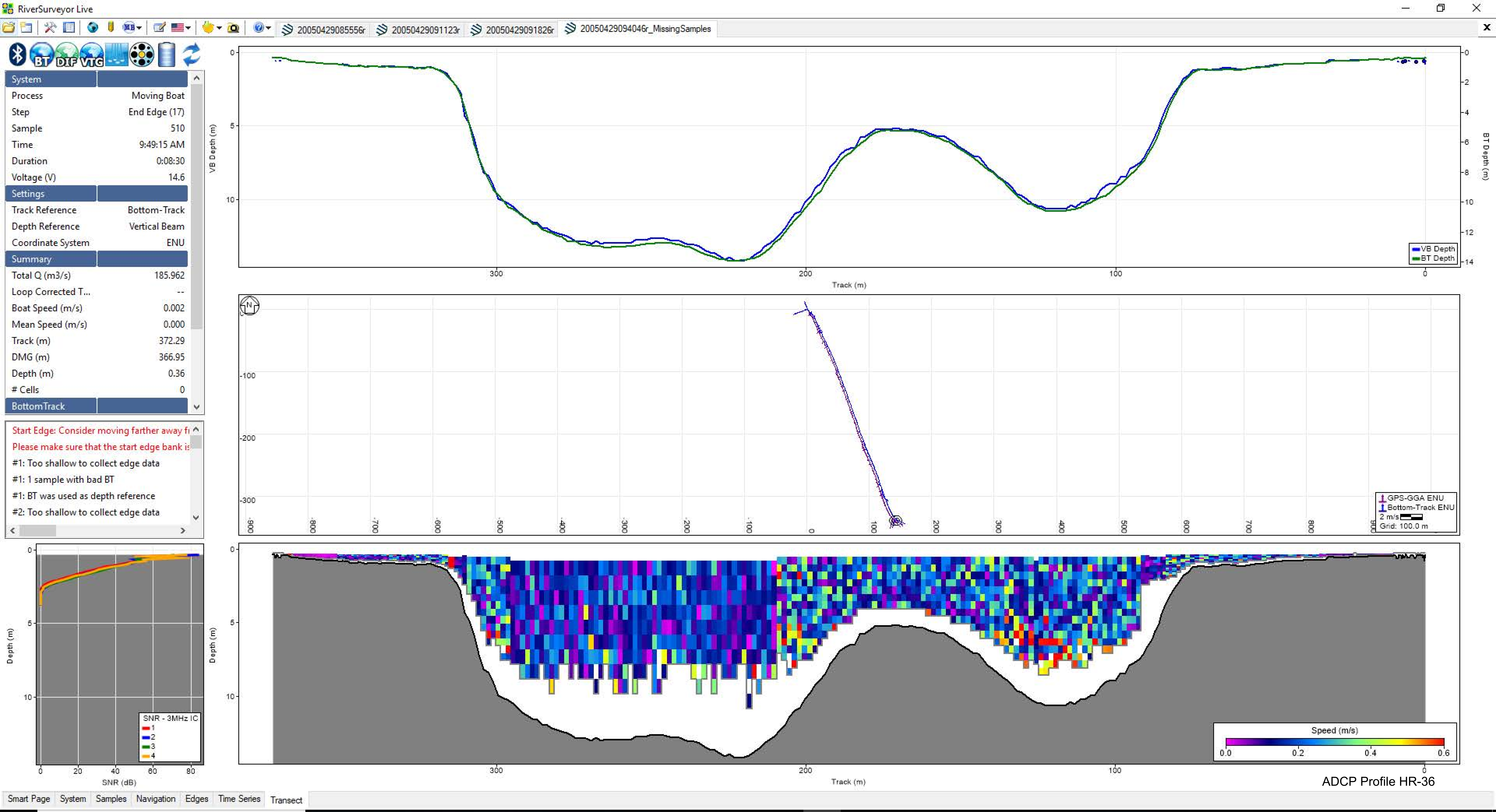

ADCP Profile HR-34

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-35 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 364067.7473, 364067.7473 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.53 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| X | Other: Significant logs at either shore | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Houses/Cabins on both banks** | | | |
| **Date of Survey:** | **Dec. 8 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:14 AM |




ADCP Profile HR-35

| | | | |
|---|---|---|---|
| **X-Section ID:** | HR-36 | | |
| **Name of Stream:** | Humber River | | |
| **GPS coordinates:** | 364409.9741, 5430154.209 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 4.56 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| X | Other: Significant logs at either shore | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes:Houses/Cabins on both banks, Boathouse on right bank. Armour stone along boathouse shoreline** | | | |
| **Date of Survey:** | **Dec. 8 2018** | **Surveyed by :** | GP & JM |
| **Time Started:** | | **Time Completed:** | 10:29 AM |




ADCP Profile HR-36

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-1 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 353818.9317,5424047.481 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 2.257 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| X | Gravel, cobble and occasional boulders | X | Some vegetation | | |
| | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | 26-Jul-19 | **Surveyed by :** | | GP | |
| **Time Started:** | 11:58 | **Time Completed:** | | 12:06 PM | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-2 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 353874.7164,5424092.318 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 2.608 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |

| | | | |
|---|---|---|---|
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP |
| **Time Started:** | 11:52 | **Time Completed:** | 11:58 AM |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-3 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 353967.0501,5424098.788 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 2.65 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| X | Gravel, cobble and occasional boulders | X | Some vegetation | | |
| | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| X | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | X | Medium to dense brush | | |
| X-Se | Medium to dense trees | | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **11:35** | **Time Completed:** | | 11:47 AM | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-4 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 354070.437,5424069.424 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 3.645 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | X | No vegetation |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Concrete retaining wall/barrier |
| X | Medium brush/trees | | |
| | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP |
| **Time Started:** | **11:28** | **Time Completed:** | 11:35 AM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-4 - 45 m downstream | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 354025.4519,5424081.546 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 3.05 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | X | No vegetation |
| X | Other: Concrete | | |
| **Left Bank** | | **Right Bank** | |
| X | Concrete retaining wall/barrier | X | Concrete retaining wall/barrier |
| | | | |
| | | | |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |

**Note: Approximately 45 m downstream of S-4 there is a concrete hydraulic structure (small spillway).**

| | | | |
|---|---|---|---|
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP |
| **Time Started:** | | **Time Completed:** | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-5 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354137.98,5424067.301 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 4.166 | | | |
| **Channel Alignment Condition** | | | | | |
| | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation | | |
| X | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | X | No vegetation | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Concrete retaining wall | | |
| | Medium brush/trees | | | | |
| | Heavy brush/trees | | | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | X | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **11:20** | **Time Completed:** | | 11:26 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-6 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354174.6496,5424075.451 | | | | |
| **Bridge/culvert ID:** | (downstream of Steady Brook bridge) | | | | |
| **Water level elevation at time of survey (m):** | | 4.267 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation | | |
| X | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| | Light brush/trees | X | Concrete retaining wall | | |
| X | Medium brush/trees | | | | |
| | Heavy brush/trees | | | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | X | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X-Se | Medium to dense trees | | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **11:15** | **Time Completed:** | | 11:20 AM | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-7 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 354186.164,5424060.85 | | |
| **Bridge/culvert ID:** | Upstream of Steady Brook bridge | | |
| **Water level elevation at time of survey (m):** | | 4.68 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP |
| **Time Started:** | **11:05** | **Time Completed:** | 11:12 AM |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-8 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354214.1193,5424051.772 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 5.232 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| | Light brush/trees | | Light brush/trees | | |
| X | Medium brush/trees | X | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **11:04** | **Time Completed:** | | 11:10 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-9 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354282.9625,5424043.095 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 6.384 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| | Light brush/trees | X | Light brush/trees | | |
| X | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| X | Medium to dense grass | X | Medium to dense grass | | |
| X | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **10:50** | **Time Completed:** | | 10:55 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-10 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354326.7837,5423999.234 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 7.345 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | | **Surveyed by :** | | GP | |
| **Time Started:** | | **Time Completed:** | | 10:50 AM | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-11 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 354349.5198,5423949.496 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 7.892 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP |
| **Time Started:** | **10:30** | **Time Completed:** | 10:40 AM |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-12 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354366.302,5423936.035 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 8.36 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| X | Medium to dense brush | X | Medium to dense brush | | |
| | Medium to dense trees | | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **10:20** | **Time Completed:** | | 10:30 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-13 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354374.863,5423901.529 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 8.859 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| X | Medium to dense brush | | Medium to dense brush | | |
| | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | 26-Jul-19 | **Surveyed by :** | | GP | |
| **Time Started:** | **10:04** | **Time Completed:** | | 10:10 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-14 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354379.8026,5423884.296 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 9.83 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| | Earth material (sand, silt, etc.) | X | Little vegetation | | |
| X | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | | Picture looking toward left bank | | |
| | | | Picture looking toward right bank | | |
| | | | Picture looking downstream | | |
| | | | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP & SE | |
| **Time Started:** | **8:20** | **Time Completed:** | | 8:25 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-15 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354397.9875,5423846.791 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 11.72 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| | Earth material (sand, silt, etc.) | X | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | **8:35** | **Time Completed:** | | 8:40 AM | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-16 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | 12.881 | | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| Note: XS is 15 m downstream of the bridge to Marblewood Village | | | |
| **Pictures (check)** | | | Picture looking toward left bank |
| | | | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | GP & SE |
| **Time Started:** | | **Time Completed:** | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | S-17 | | |
| **Name of Stream:** | Steady Brook | | |
| **GPS coordinates:** | 354422.8352,5423799.402 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 12.915 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| X | Cobbles with frequent large boulders | | Dense vegetation |
| X | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | 26-Jul-19 | **Surveyed by :** | GP & SE |
| **Time Started:** | | **Time Completed:** | 9:05 AM |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-18 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354415.3544,5423779.209 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 12.938 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | | Picture looking toward left bank | | |
| | | | Picture looking toward right bank | | |
| | | | Picture looking downstream | | |
| | | | Picture looking upstream | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | | **Time Completed:** | | 9:50 AM | |

| | | | | | |
|---|---|---|---|---|---|
| **X-Section ID:** | S-19 | | | | |
| **Name of Stream:** | Steady Brook | | | | |
| **GPS coordinates:** | 354415.1819,5423771.457 | | | | |
| **Bridge/culvert ID:** | | | | | |
| **Water level elevation at time of survey (m):** | | 12.91 | | | |
| **Channel Alignment Condition** | | | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish | | |
| **Substrate (can check more than one)** | | | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation | | |
| | Gravel, cobble and occasional boulders | X | Some vegetation | | |
| X | Cobbles with frequent large boulders | | Dense vegetation | | |
| X | Bedrock | | | | |
| | Other (please describe) | | | | |
| **Left Bank** | | **Right Bank** | | | |
| X | Light brush/trees | X | Light brush/trees | | |
| | Medium brush/trees | | Medium brush/trees | | |
| | Heavy brush/trees | | Heavy brush/trees | | |
| **Left Flood Plain** | | **Right Flood Plain** | | | |
| | No to sparse vegetation | | No to sparse vegetation | | |
| | Medium to dense grass | | Medium to dense grass | | |
| | Medium to dense brush | | Medium to dense brush | | |
| X | Medium to dense trees | X | Medium to dense trees | | |
| **Pictures (check)** | | X | Picture looking toward left bank | | |
| | | X | Picture looking toward right bank | | |
| | | X | Picture looking downstream | | |
| | | X | Picture looking upstream | | |
| **Note: bedrock on both sides of Steady Brook, steep walls and cannot extend topographic survey into overbank.** | | | | | |
| **Date of Survey:** | **26-Jul-19** | **Surveyed by :** | | GP | |
| **Time Started:** | 9:50 | **Time Completed:** | | 9:55 AM | |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-1 | Date: | 15-Nov-19 |
| Location | Northing: | 5249707 | Easting: | 454817 | |

Downstream:

Right Bank:

Upstream:

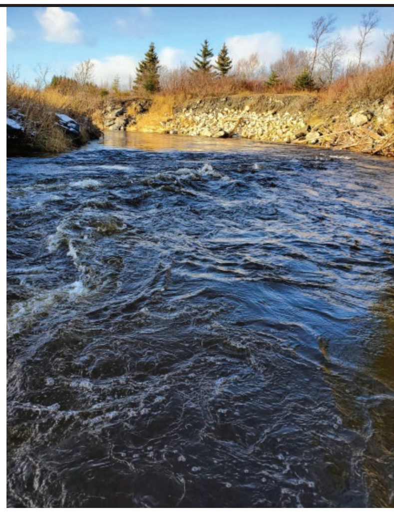
Left Bank:

| | |
|---|---|
| Comments: | Moved this transect to safer crossing area |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-2 | Date: | 15-Nov-19 |
| Location | Northing: | 5429668 | Easting: | 454869 | |

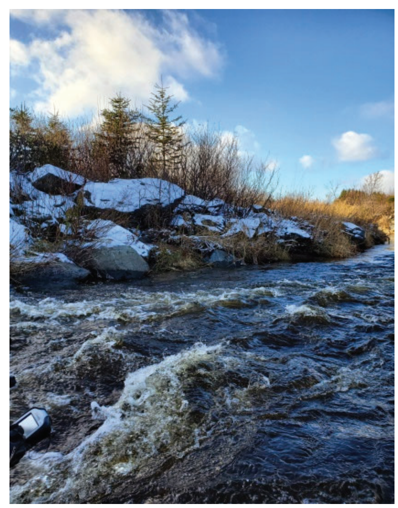
Downstream:



Right Bank:

Upstream:

Left Bank:



| | |
|---|---|
| Comments: | Small section in middle we were unable to get some shots in due to the area being too deep and turbulent to cross |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-3 | Date: | 15-Nov-19 |
| Location | Northing: | 5429613 | Easting: | 454889 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-4 | Date: | 15-Nov-19 |
| Location | Northing: | 5429500 | Easting: | 454876 | |

| Downstream: | Right Bank: |
|---|---|
|  |  |
| **Upstream:** | **Left Bank:** |
|  |  |

Comments:

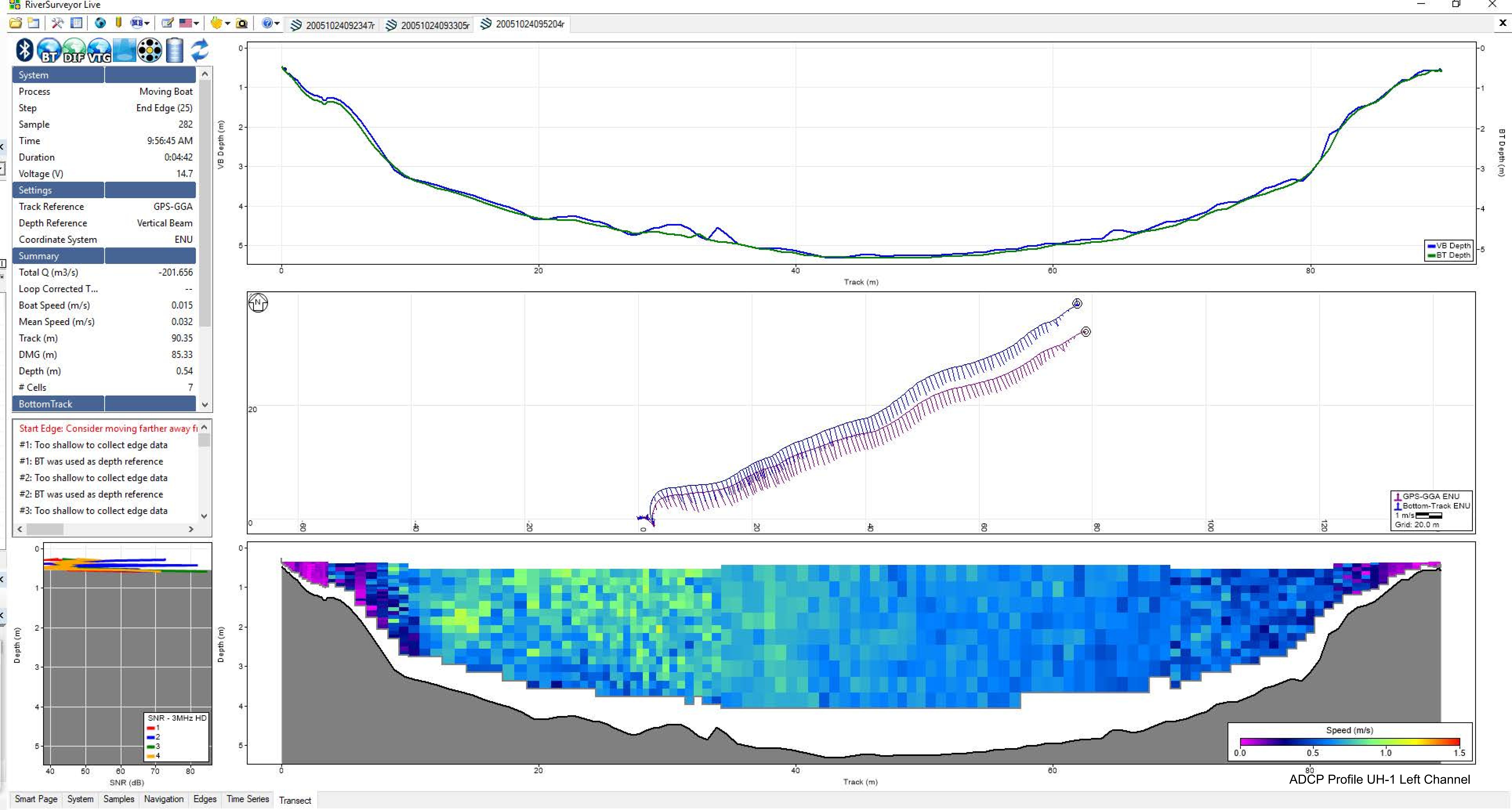
## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Pasadena** | |
| Stream/river name: | South Brook | Location ID: | SO-5 | Date: | 15-Nov-19 |
| Location | Northing: | 5428353 | Easting: | 454990 | |

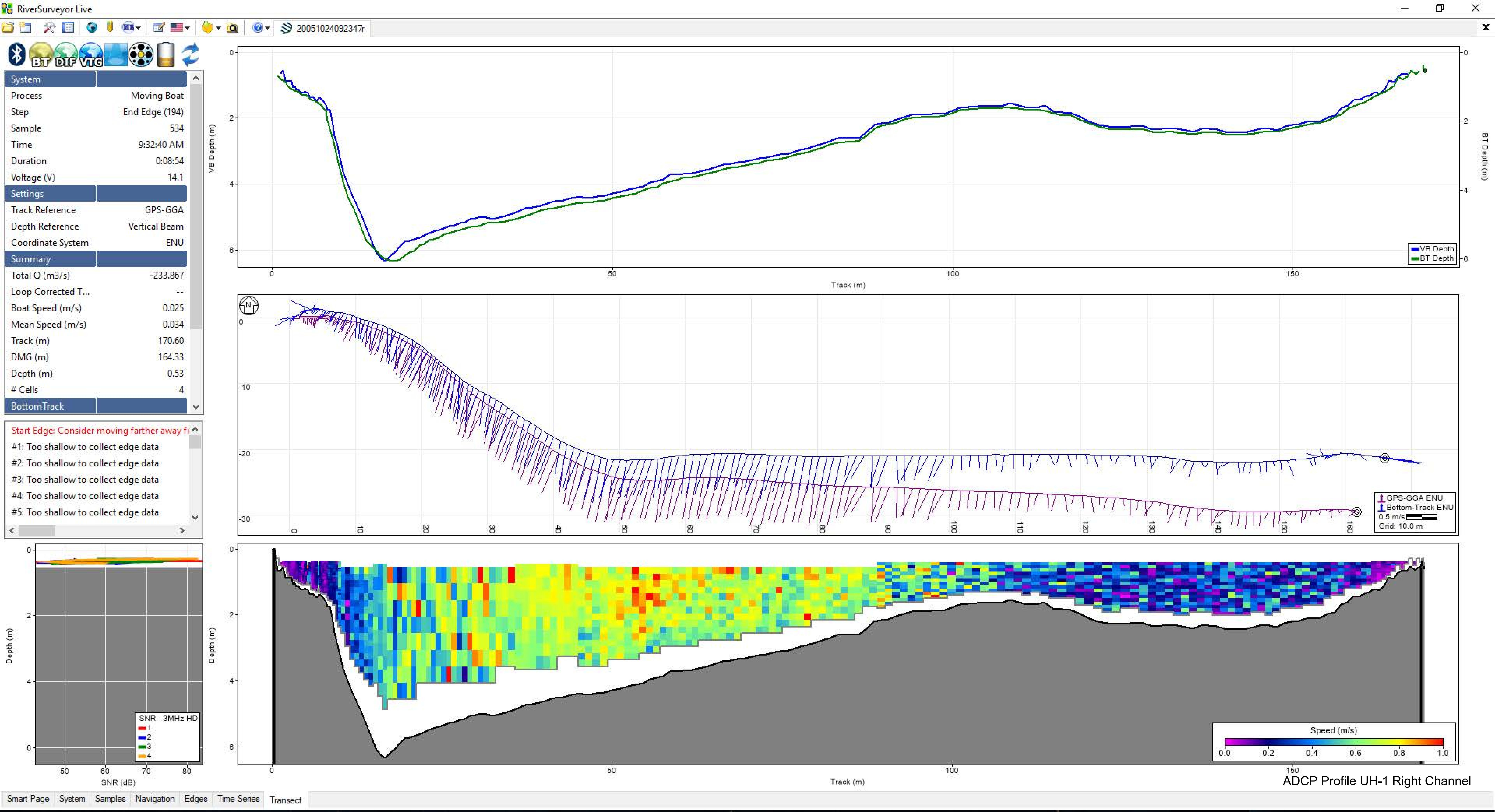
| | |
|---|---|
| Downstream: | Right Bank: |
|  |  |
| Upstream: | Left Bank: |
|  |  |

| | |
|---|---|
| Comments: | Moved this transect to a less turbulent/deep area so we could safely cross. |

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-1 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5450007.749, 197837.1582 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 5.925 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:53 AM |

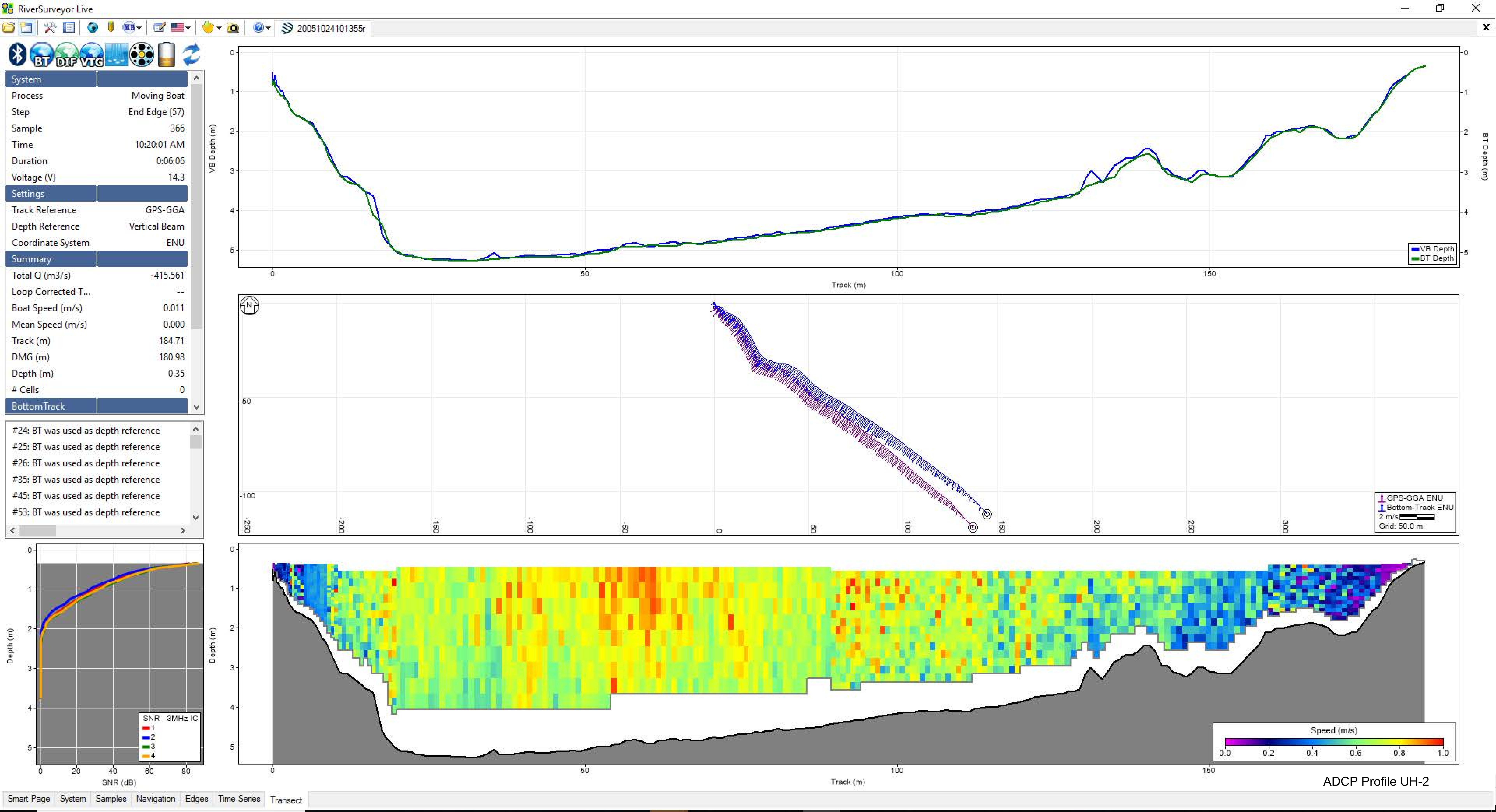


ADCP Profile UH-1 Left Channel



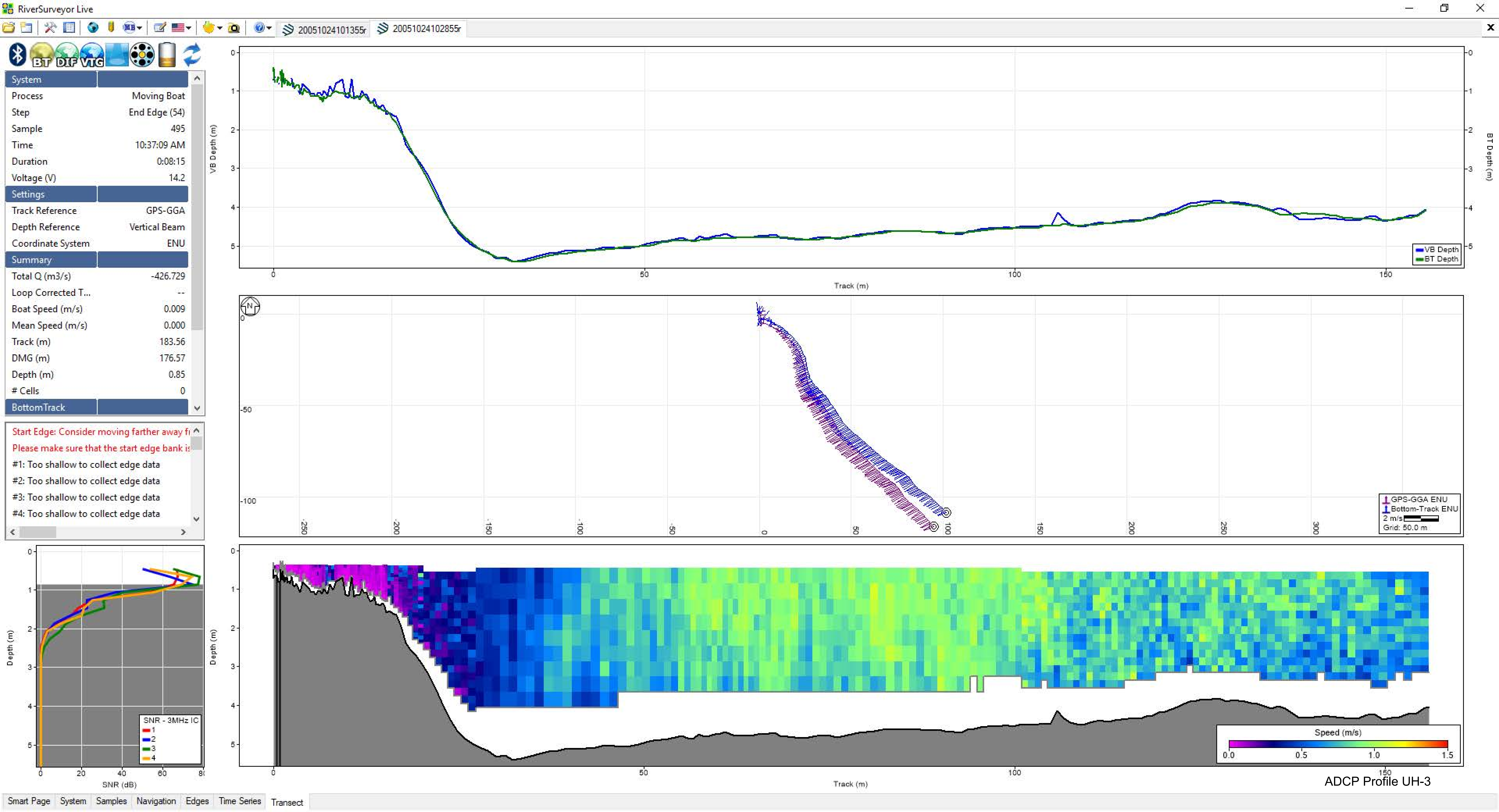
ADCP Profile UH-1 Right Channel

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-2 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5450607.39, 198286.836 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 5.94 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:53 AM |



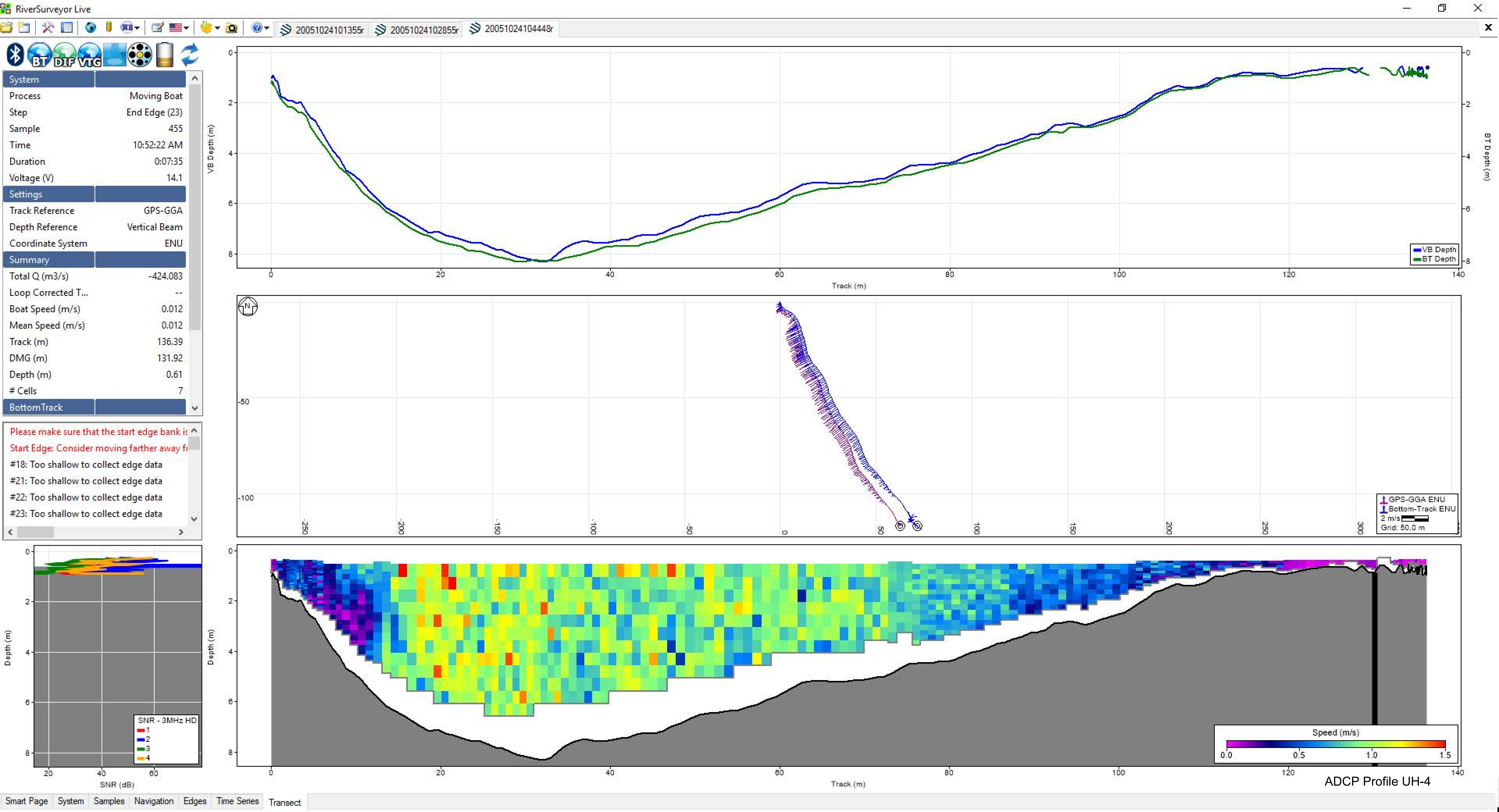

ADCP Profile UH-2

<table>
<tr><td colspan="2">X-Section ID:</td><td colspan="4">UH-3</td></tr>
<tr><td colspan="2">Name of Stream:</td><td colspan="4">Upper Humber River</td></tr>
<tr><td colspan="2">GPS coordinates:</td><td colspan="4">5450947.85, 198689.877</td></tr>
<tr><td colspan="2">Bridge/culvert ID:</td><td colspan="4"></td></tr>
<tr><td colspan="3">Water level elevation at time of survey (m):</td><td colspan="3">5.96</td></tr>
<tr><td colspan="6">Channel Alignment Condition</td></tr>
<tr><td>X</td><td colspan="2">Fairly regular, relatively straight and uniform</td><td></td><td colspan="2">Irregular, winding or sluggish</td></tr>
<tr><td colspan="6">Substrate (can check more than one)</td></tr>
<tr><td>X</td><td colspan="2">Earth material (sand, silt, etc.)</td><td></td><td colspan="2">Little vegetation</td></tr>
<tr><td></td><td colspan="2">Gravel, cobble and occasional boulders</td><td>X</td><td colspan="2">Some vegetation</td></tr>
<tr><td></td><td colspan="2">Cobbles with frequent large boulders</td><td></td><td colspan="2">Dense vegetation</td></tr>
<tr><td></td><td colspan="2">Bedrock</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td colspan="5">Other (please describe)</td></tr>
<tr><td colspan="3">Left Bank</td><td colspan="3">Right Bank</td></tr>
<tr><td></td><td colspan="2">Light brush/trees</td><td></td><td colspan="2">Light brush/trees</td></tr>
<tr><td>X</td><td colspan="2">Medium brush/trees</td><td>X</td><td colspan="2">Medium brush/trees</td></tr>
<tr><td></td><td colspan="2">Heavy brush/trees</td><td></td><td colspan="2">Heavy brush/trees</td></tr>
<tr><td colspan="3">Left Flood Plain</td><td colspan="3">Right Flood Plain</td></tr>
<tr><td></td><td colspan="2">No to sparse vegetation</td><td></td><td colspan="2">No to sparse vegetation</td></tr>
<tr><td></td><td colspan="2">Medium to dense grass</td><td></td><td colspan="2">Medium to dense grass</td></tr>
<tr><td>X</td><td colspan="2">Medium to dense brush</td><td>X</td><td colspan="2">Medium to dense brush</td></tr>
<tr><td></td><td colspan="2">Medium to dense trees</td><td></td><td colspan="2">Medium to dense trees</td></tr>
<tr><td colspan="3" rowspan="4">Pictures (check)</td><td>X</td><td colspan="2">Picture looking toward left bank</td></tr>
<tr><td>X</td><td colspan="2">Picture looking toward right bank</td></tr>
<tr><td>X</td><td colspan="2">Picture looking downstream</td></tr>
<tr><td>X</td><td colspan="2">Picture looking upstream</td></tr>
<tr><td colspan="2">Date of Survey:</td><td>Jun. 04 2019</td><td colspan="2">Surveyed by :</td><td>TR & JM</td></tr>
<tr><td colspan="2">Time Started:</td><td></td><td colspan="2">Time Completed:</td><td>11:16 AM</td></tr>
</table>




ADCP Profile UH-3

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-4 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451091.193, 199060.8512 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 5.95 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| X | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 11:32 AM |



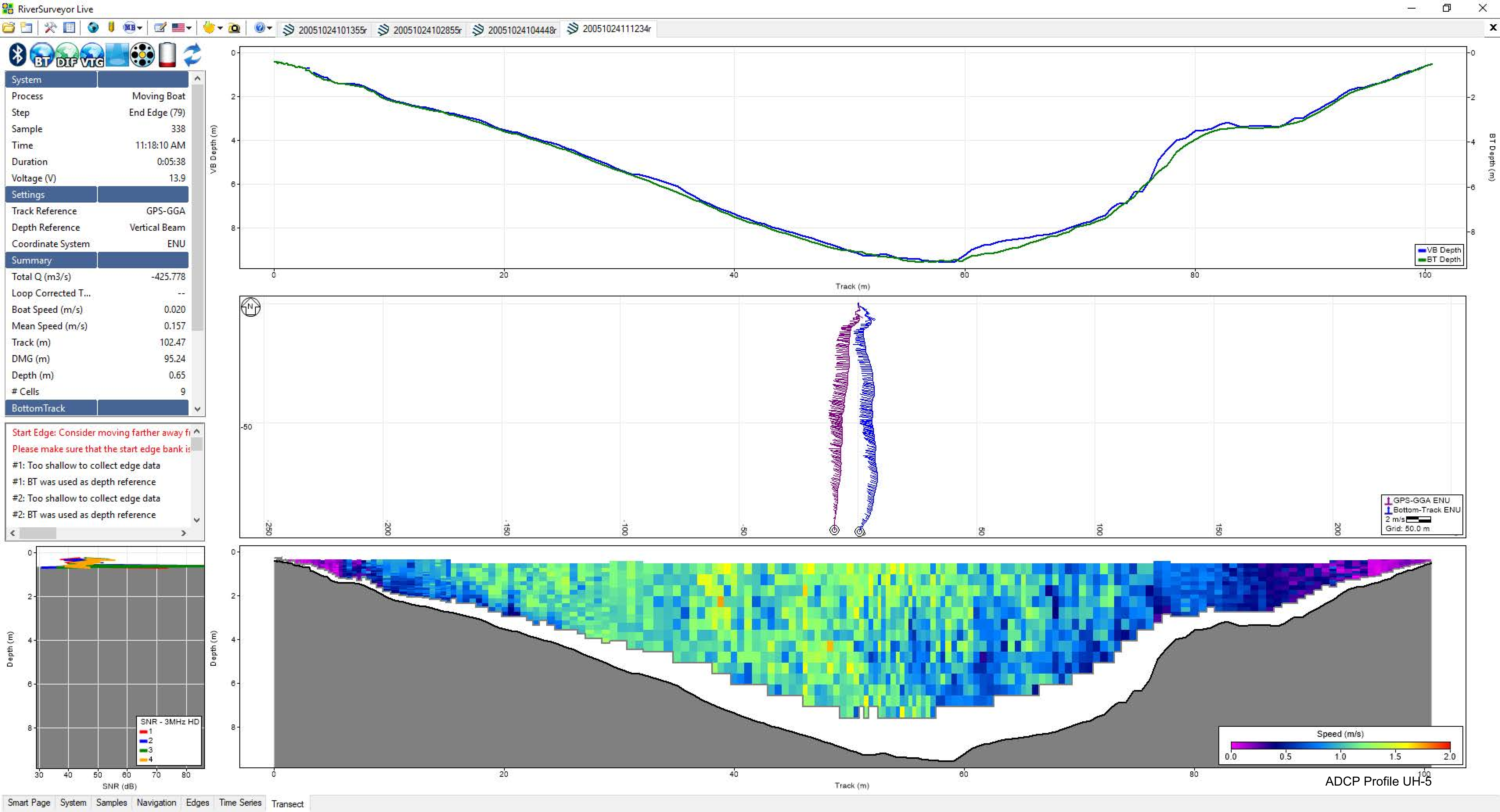

ADCP Profile UH-4

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-5 - Second survey in November of 2019 - 30 m downstream of Nicholsville Bridge | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | | | |
| **Bridge/culvert ID:** | 30 m downstream of Nicholsville bridge | | |
| **Water level elevation at time of survey (m):** | | 5.167 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | Nov-19 | **Surveyed by :** | MG |
| **Time Started:** | | **Time Completed:** | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-5 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451120.988, 199291.4573 | | |
| **Bridge/culvert ID:** | Nicholsville Bridge | | |
| **Water level elevation at time of survey (m):** | | 6 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |

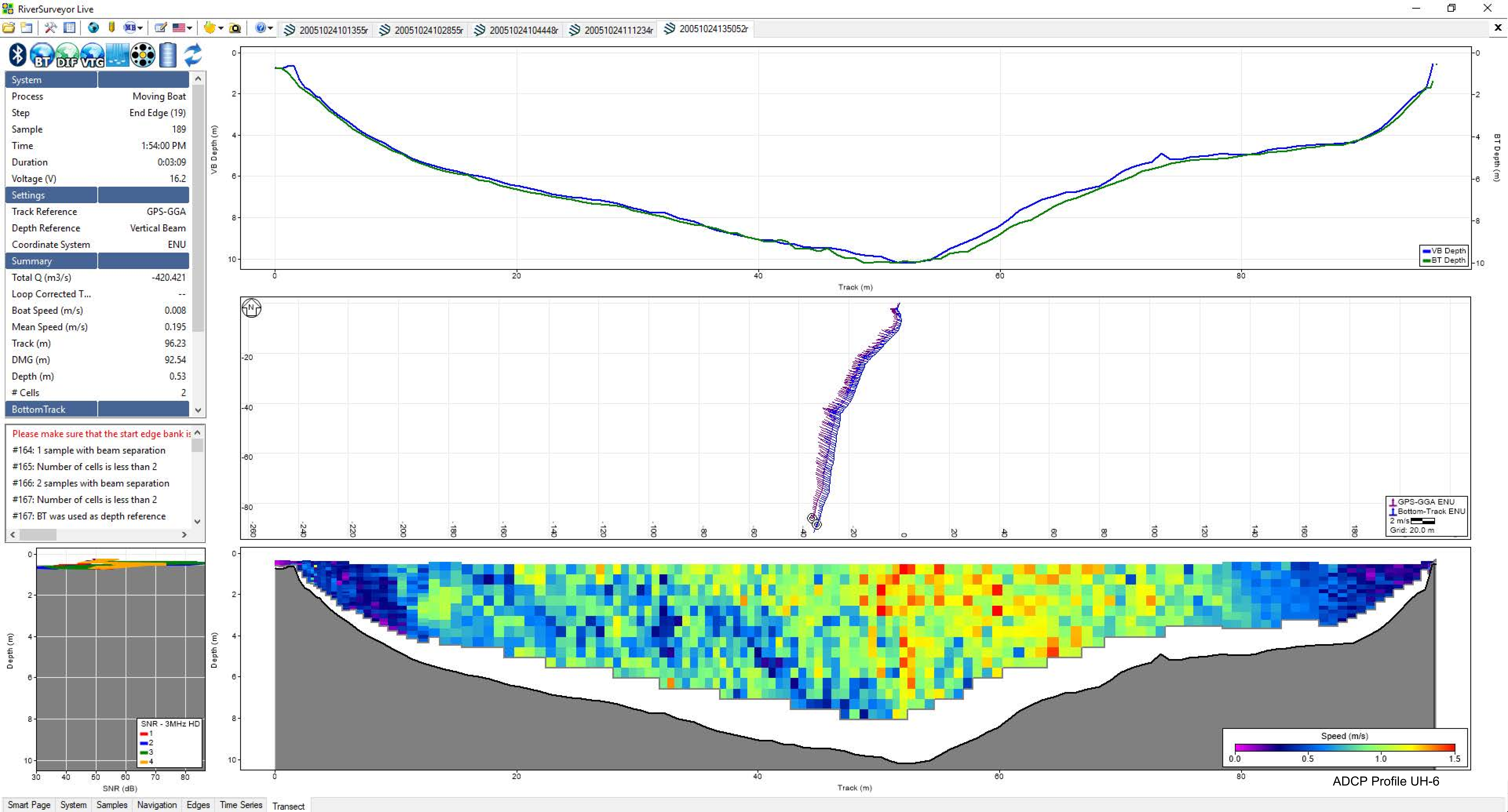
**Note: this initial bathymetric survey (June 2019) was too far upstream of the bridge for modeling purposes. As such a follow-up survey was completed of the downstream side of the bridge in November 2019.**

| | | | |
|---|---|---|---|
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 2:21 PM |



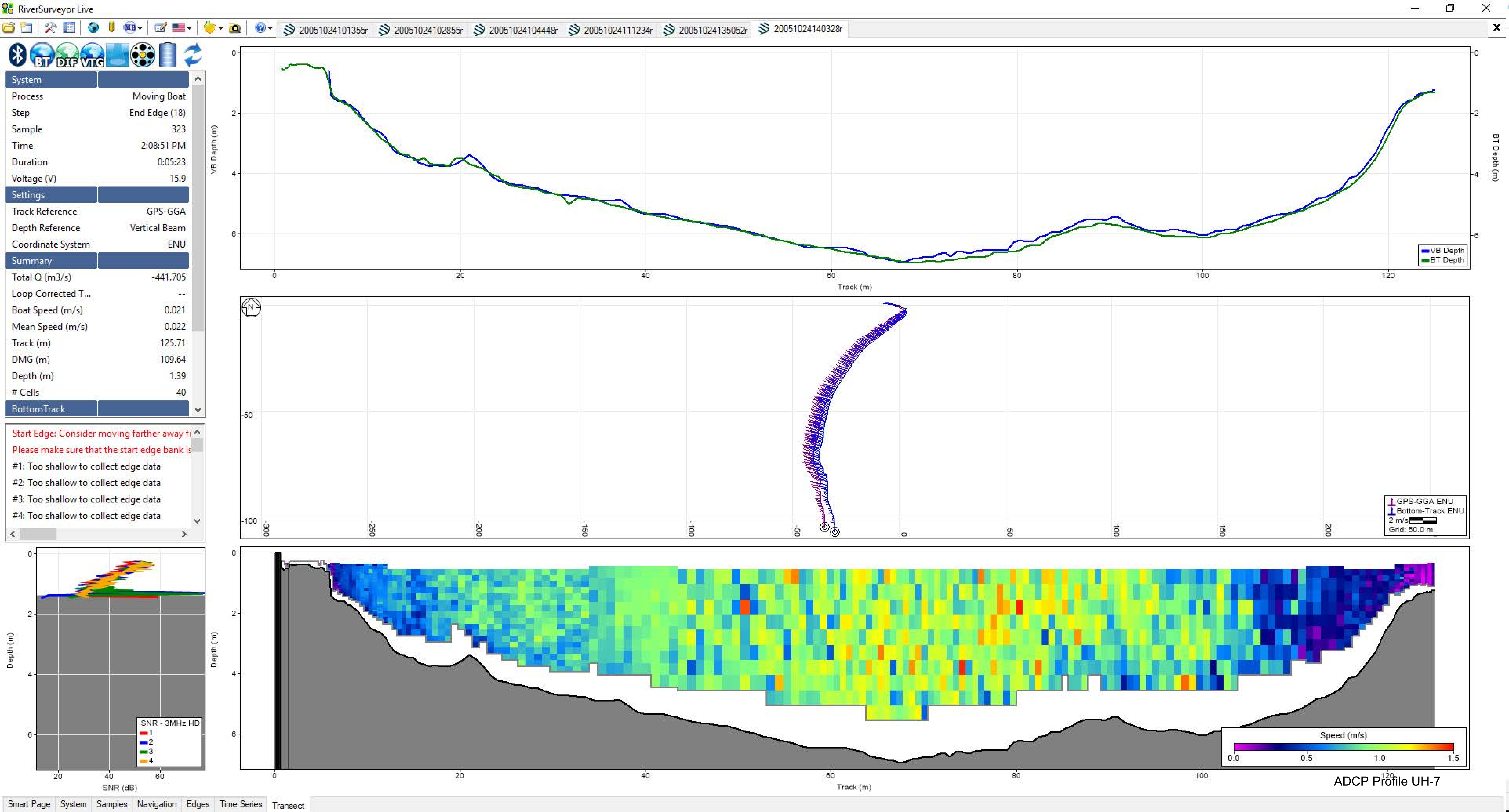
ADCP Profile UH-5

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-6 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451104.795, 199334.8977 | | |
| **Bridge/culvert ID:** | Upstream of Nicholsville Bridge | | |
| **Water level elevation at time of survey (m):** | | 5.997 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 2:33 PM |



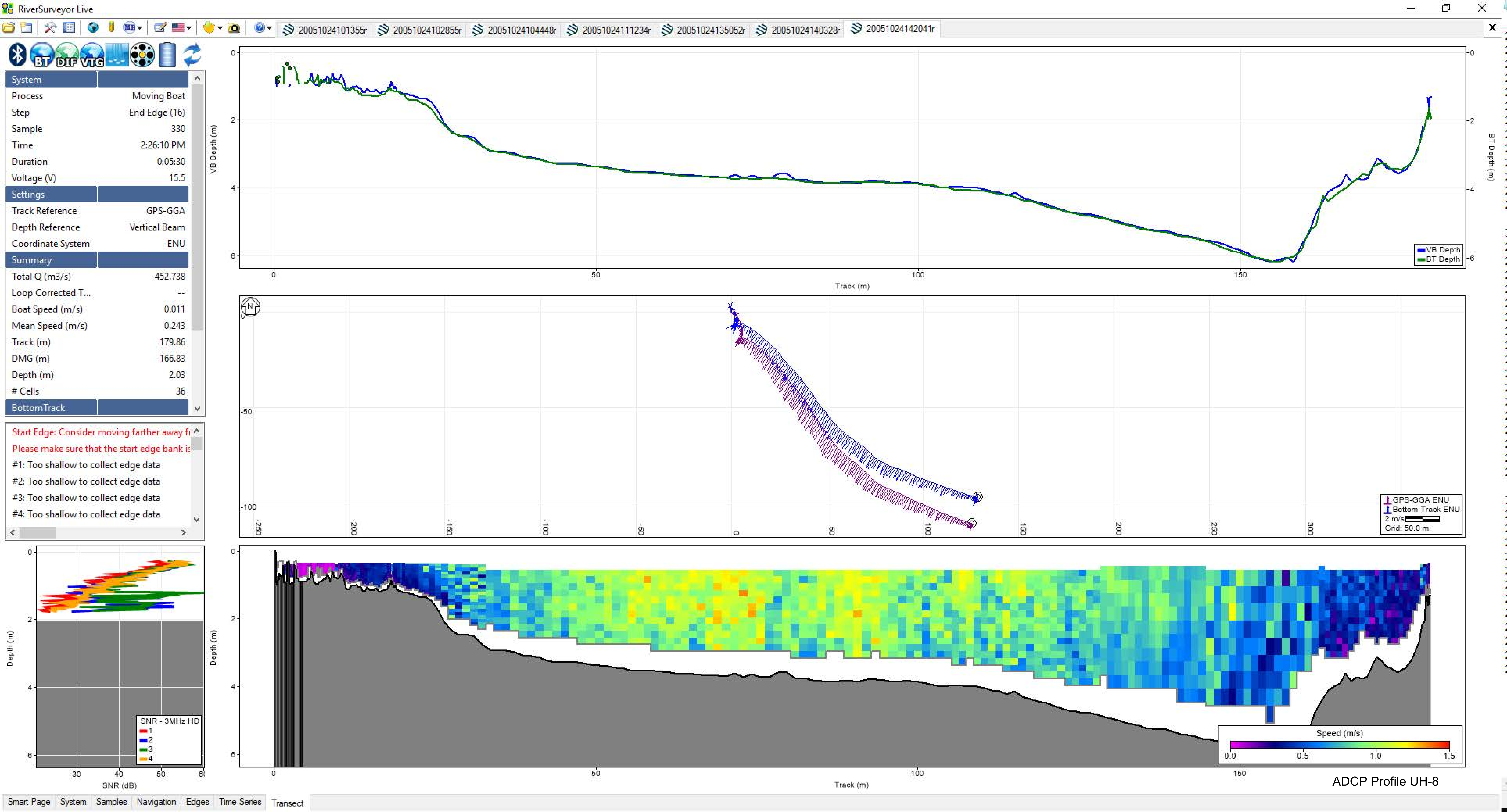
ADCP Profile UH-6

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-7 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5450800.353, 199650.6754 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.02 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 2:48 PM |



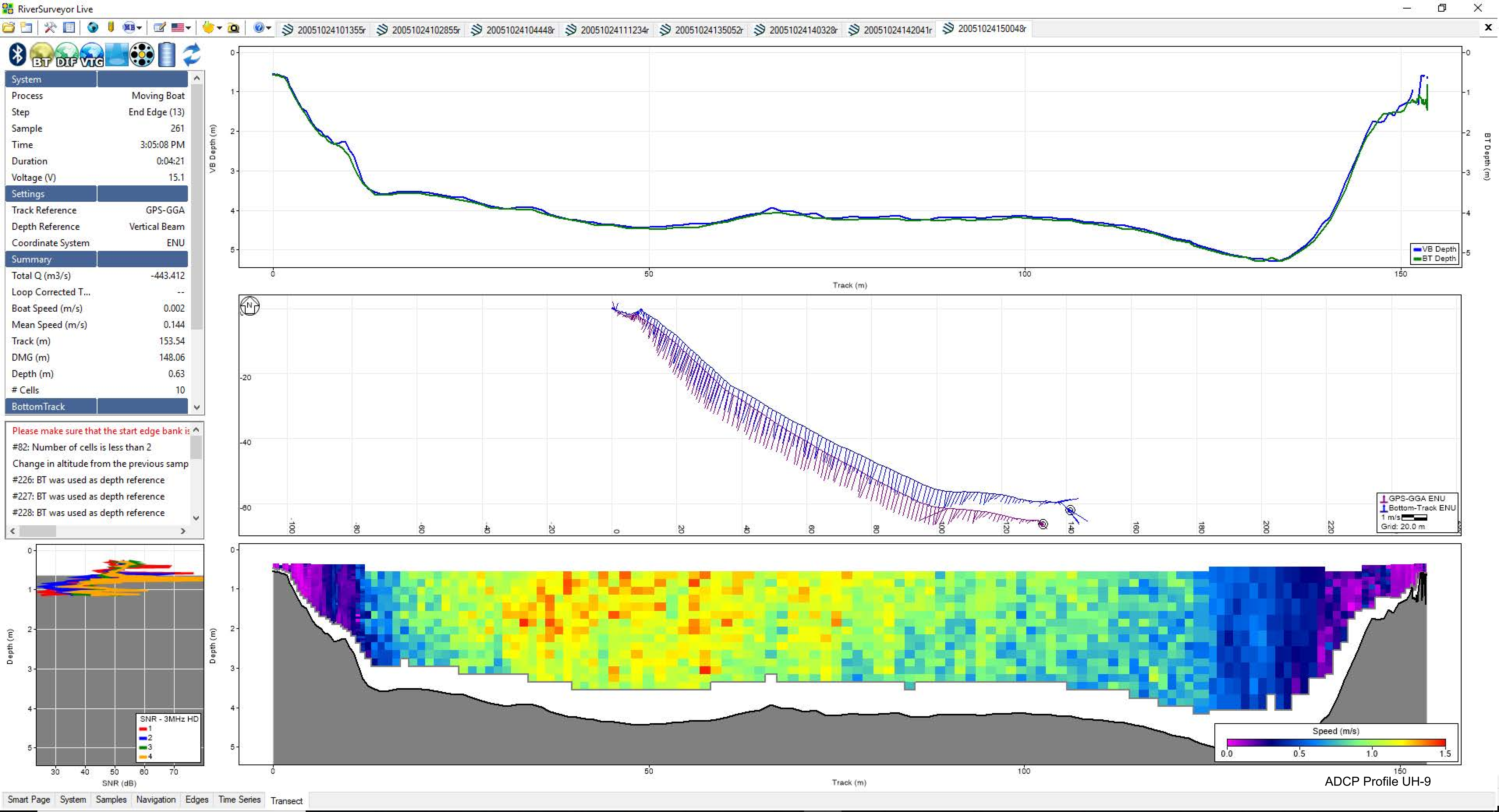
ADCP Profile UH-7

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-8 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5450907.541, 199970.0551 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.03 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 2:57 PM |



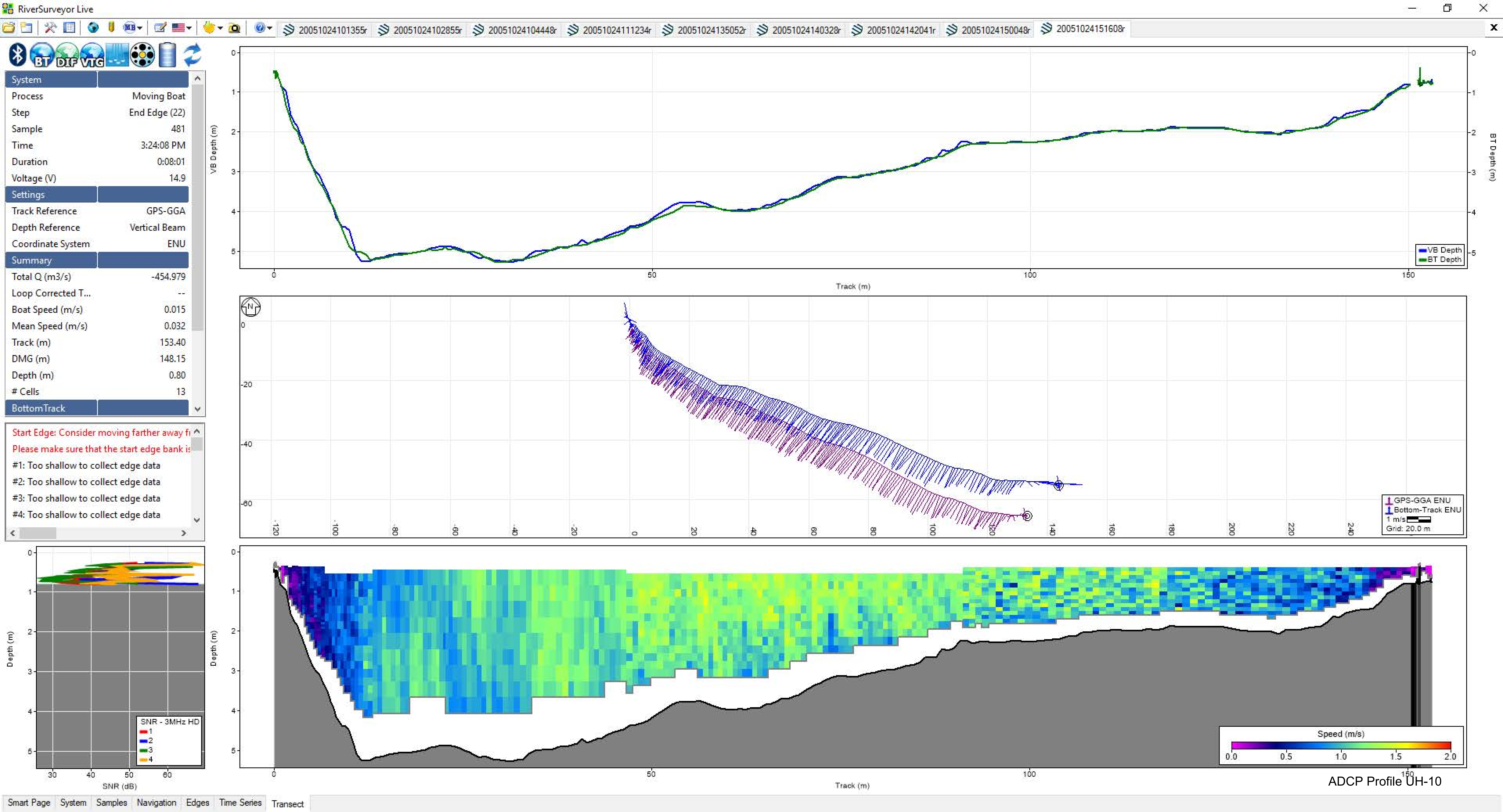
ADCP Profile UH-8

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-9 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451073.498, 200071.5474 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.157 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 3:44 PM |



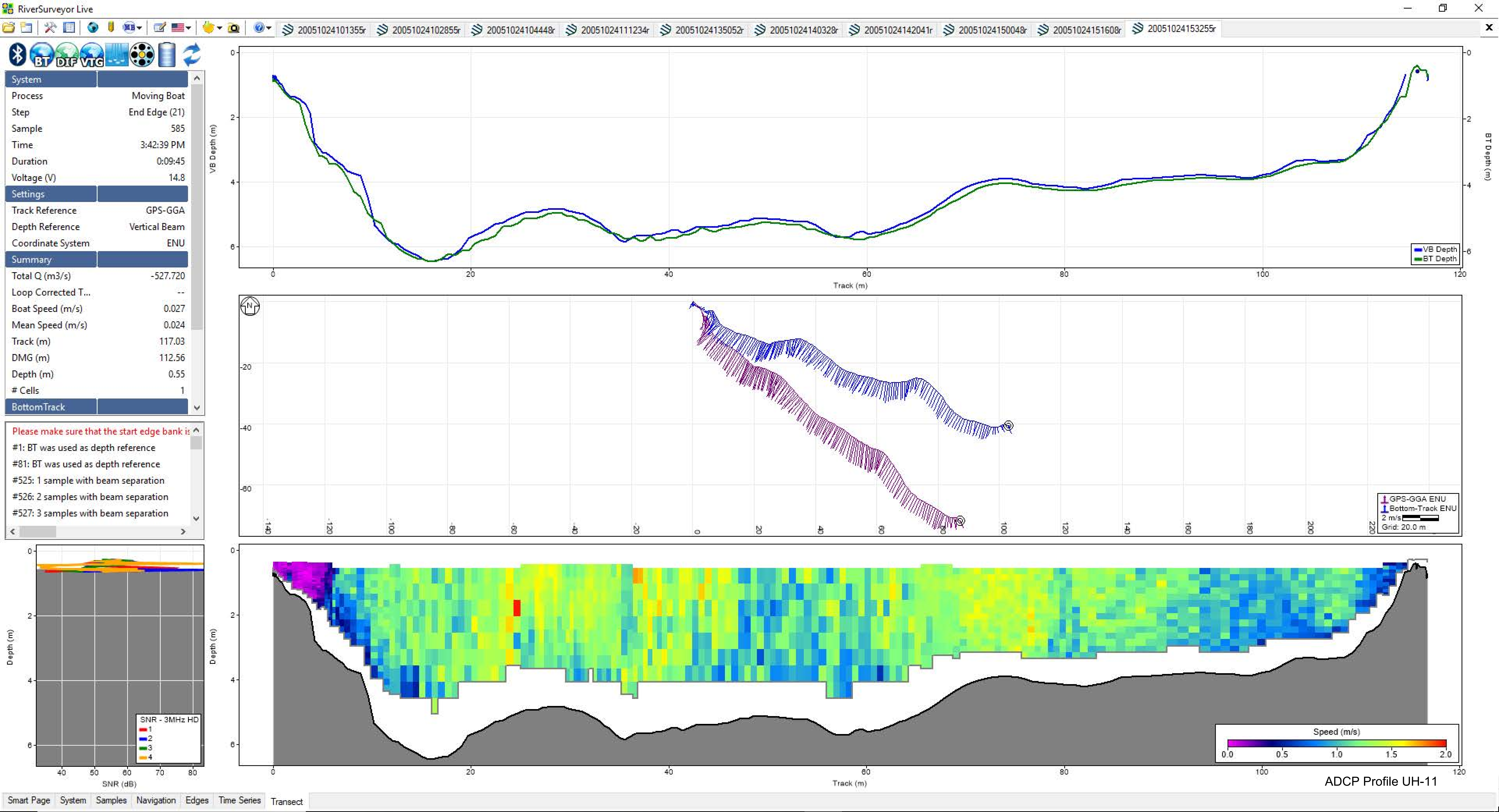
ADCP Profile UH-9

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-10 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451540.449, 200253.0794 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.14 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:04 PM |




ADCP Profile UH-10

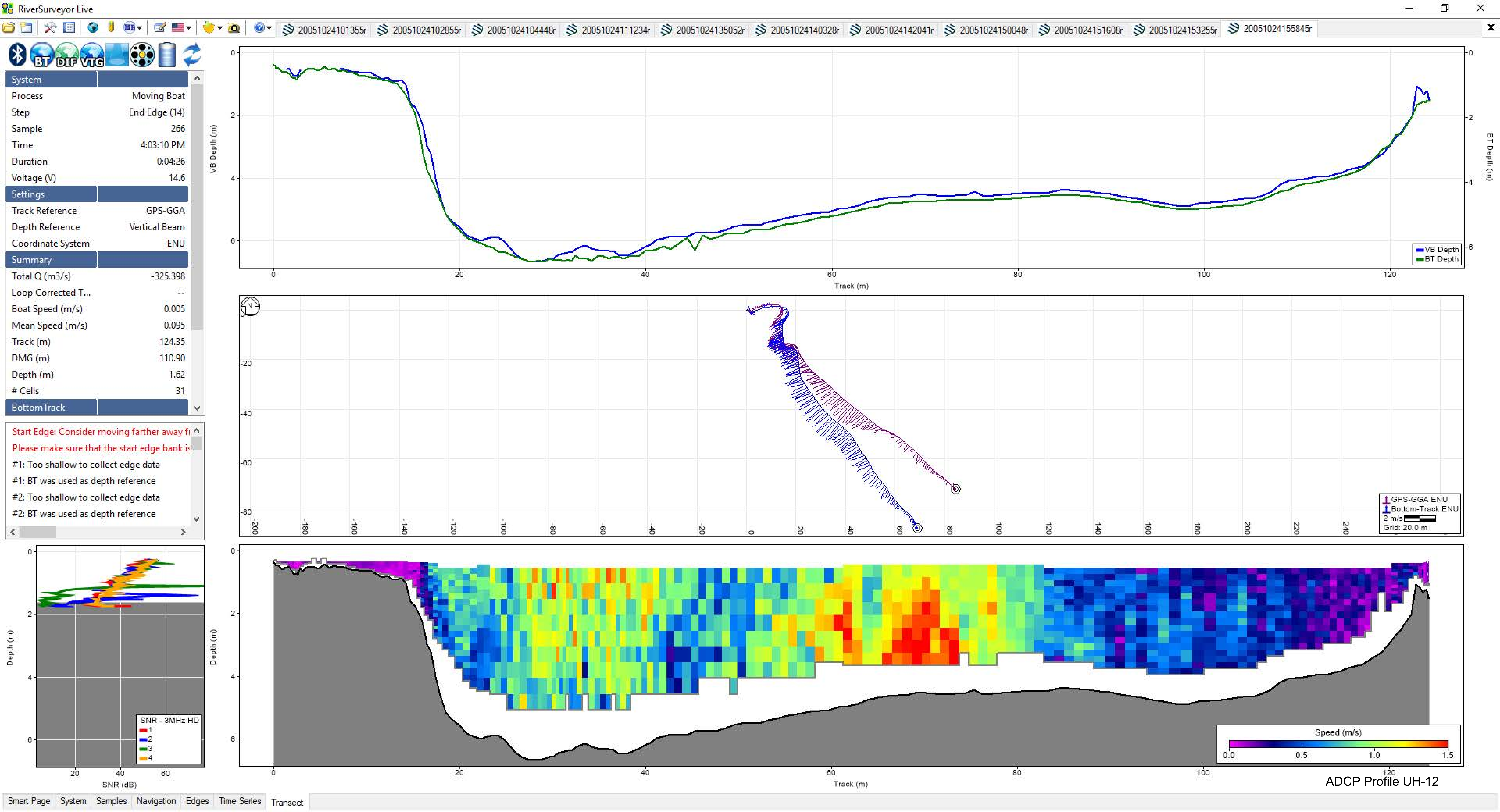
| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-11 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451609.112, 200327.2693 | | |
| **Bridge/culvert ID:** | Downstream of Viking Trail Bridge | | |
| **Water level elevation at time of survey (m):** | | 6.153 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:22 PM |



ADCP Profile UH-11

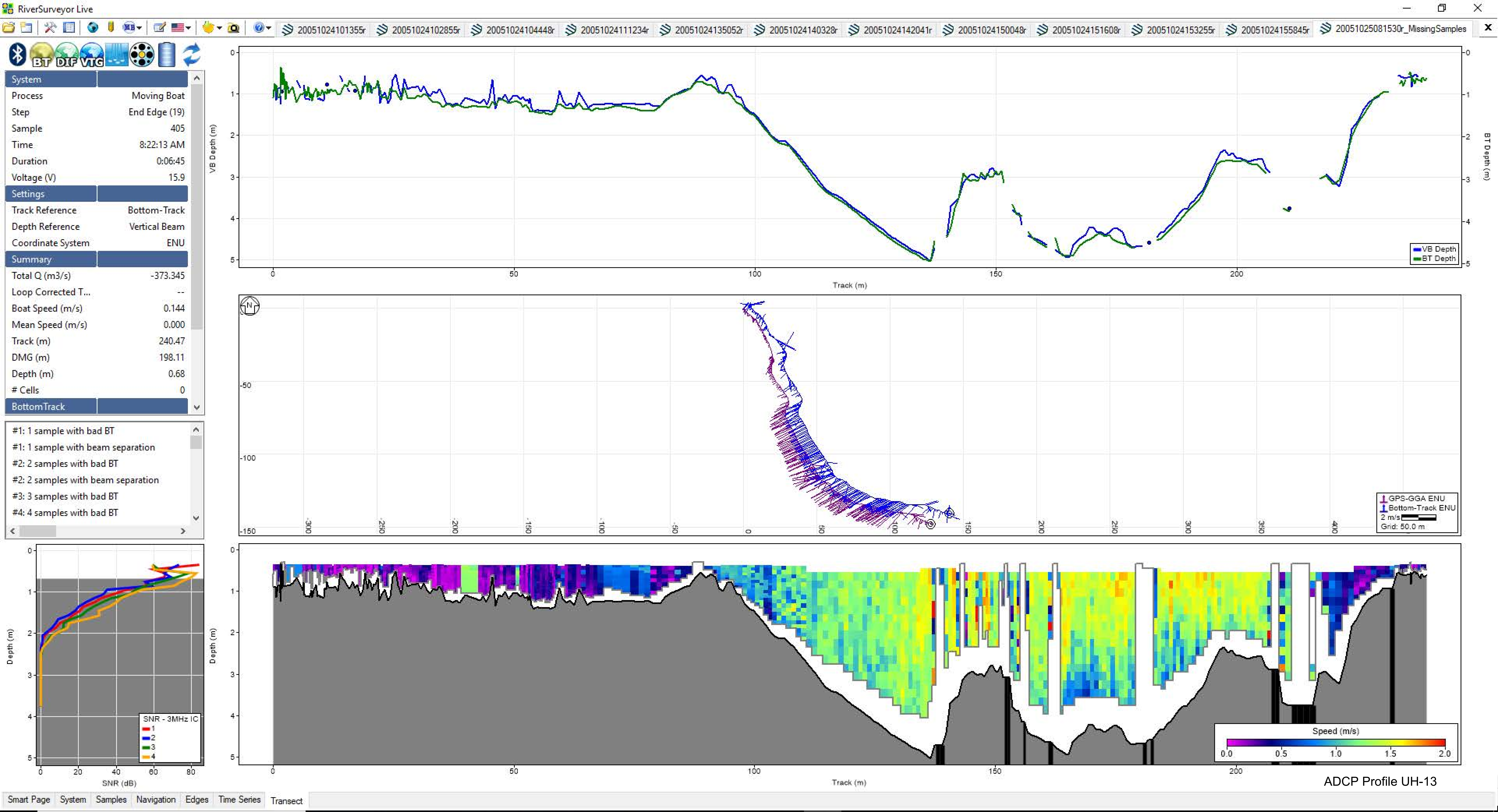
| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-12 - 45 m upstream of bridge surveyed in November 2019 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | | | |
| **Bridge/culvert ID:** | 45 m upstream of viking trail bridge. | | |
| **Water level elevation at time of survey (m):** | | 5.208 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | | Picture looking toward left bank |
| | | | Picture looking toward right bank |
| | | | Picture looking downstream |
| | | | Picture looking upstream |
| **Note: Second survey of UH-12 completed in November of 2019 , further upstream to support HEC-RAS modeling** | | | |
| **Date of Survey:** | **Nov-19** | **Surveyed by :** | MG |
| **Time Started:** | | **Time Completed:** | |

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-12 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451629.463, 200347.8686 | | |
| **Bridge/culvert ID:** | Upstream of vIking trail bridge. | | |
| **Water level elevation at time of survey (m):** | | 6.17 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| X | Medium to dense grass | X | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 04 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:43 PM |



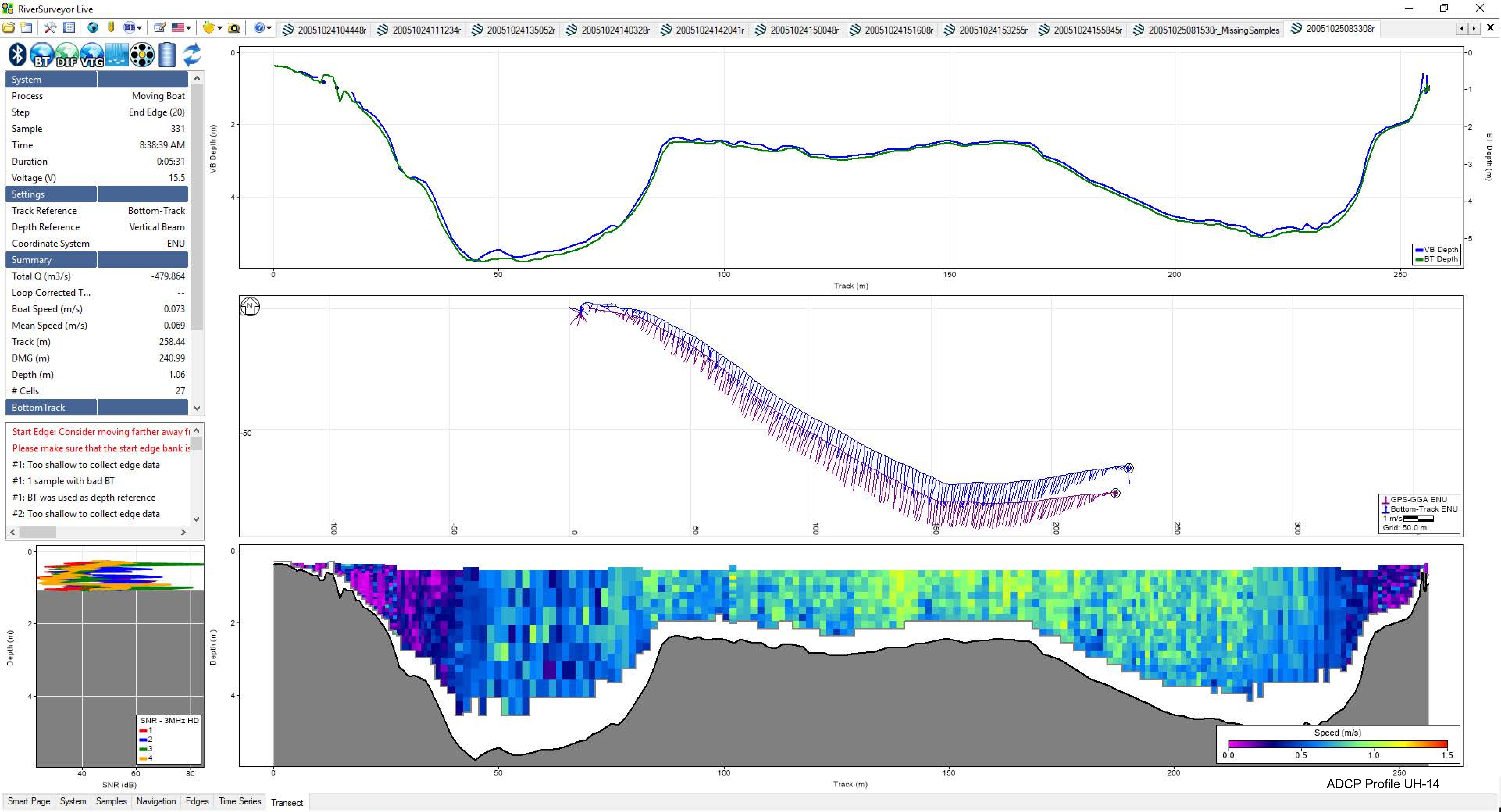
ADCP Profile UH-12

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-13 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5451802.331, 200584.3103 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.3 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:01 AM |



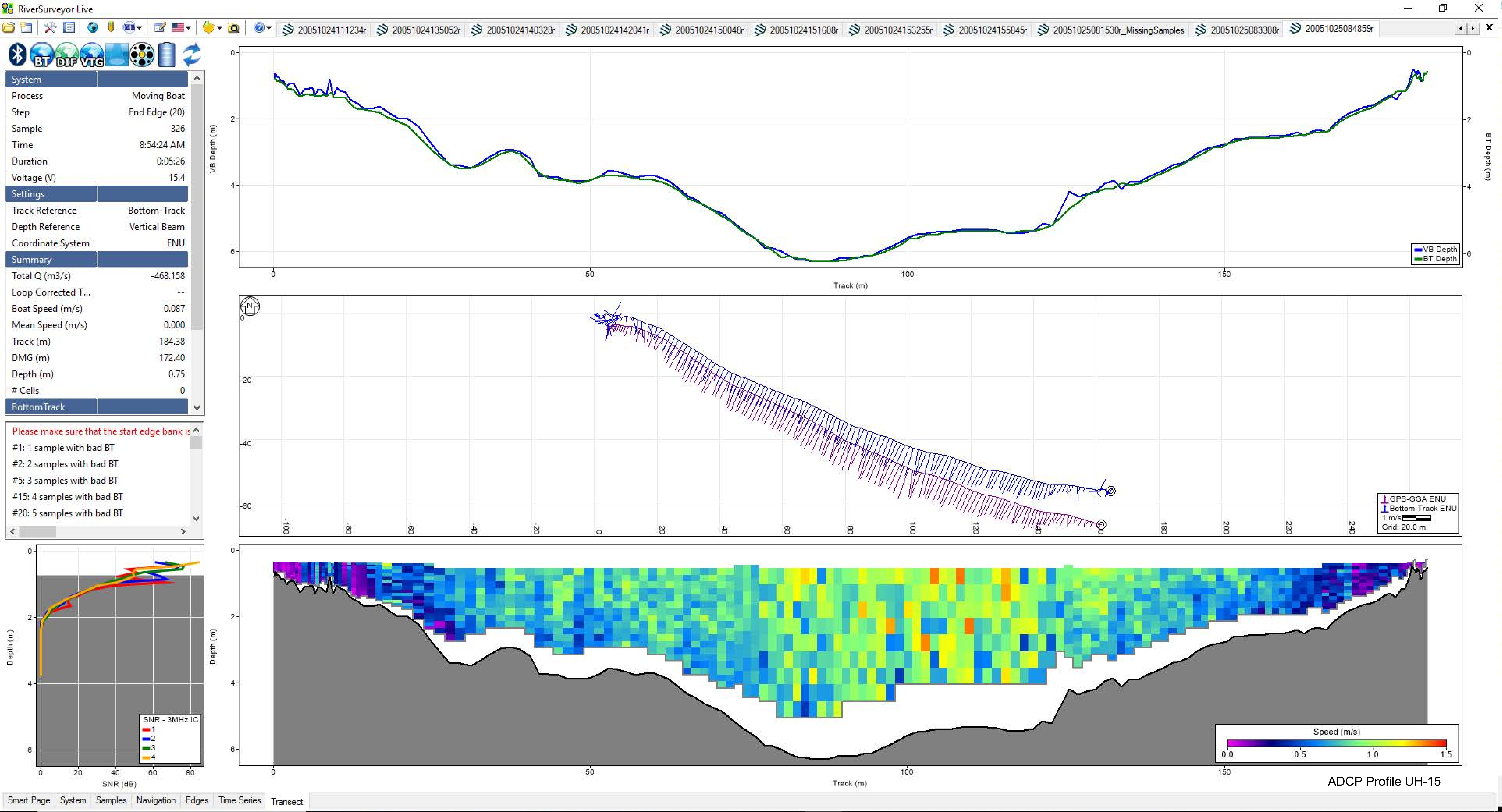
ADCP Profile UH-13

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-14 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5452182.884, 200744.5656 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.48 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | X | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:18 AM |



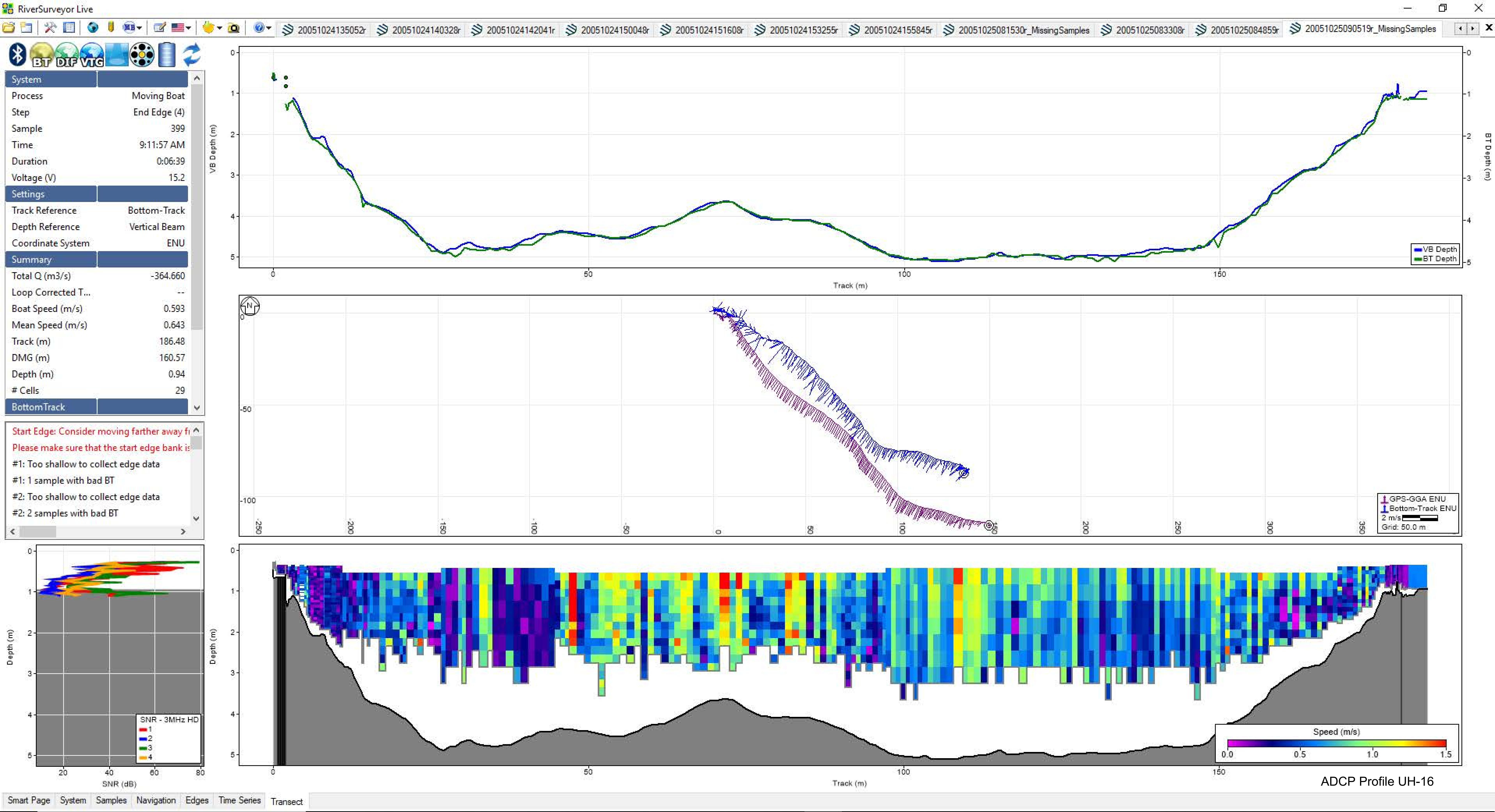
ADCP Profile UH-14

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-15 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5452553.001, 200959.6866 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.54 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:33 AM |



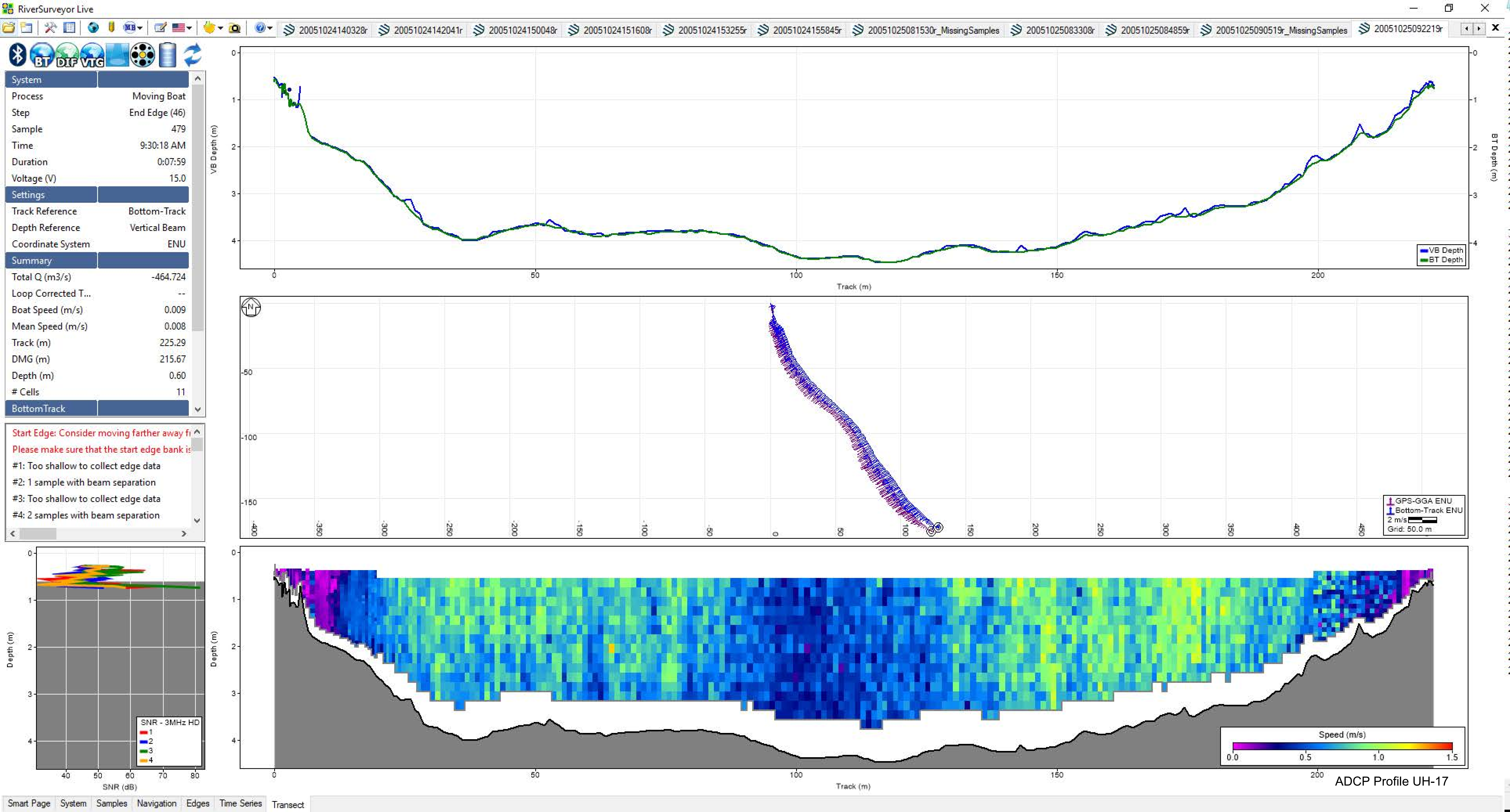
ADCP Profile UH-15

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-16 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5453409.196, 201396.9224 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.54 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:52 AM |



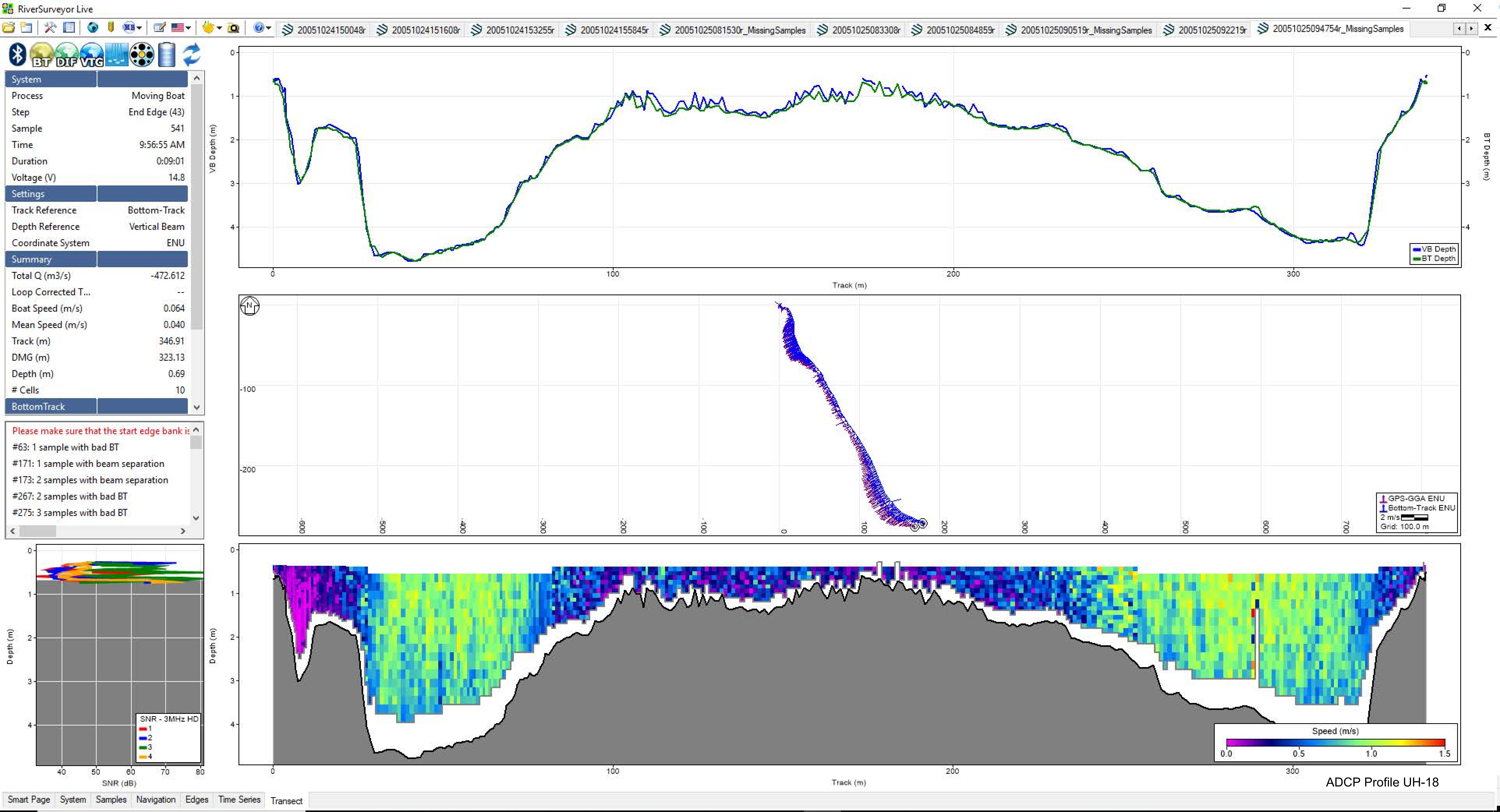
ADCP Profile UH-16

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-17 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5453832.14, 201811.0961 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.523 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| X | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:09 AM |



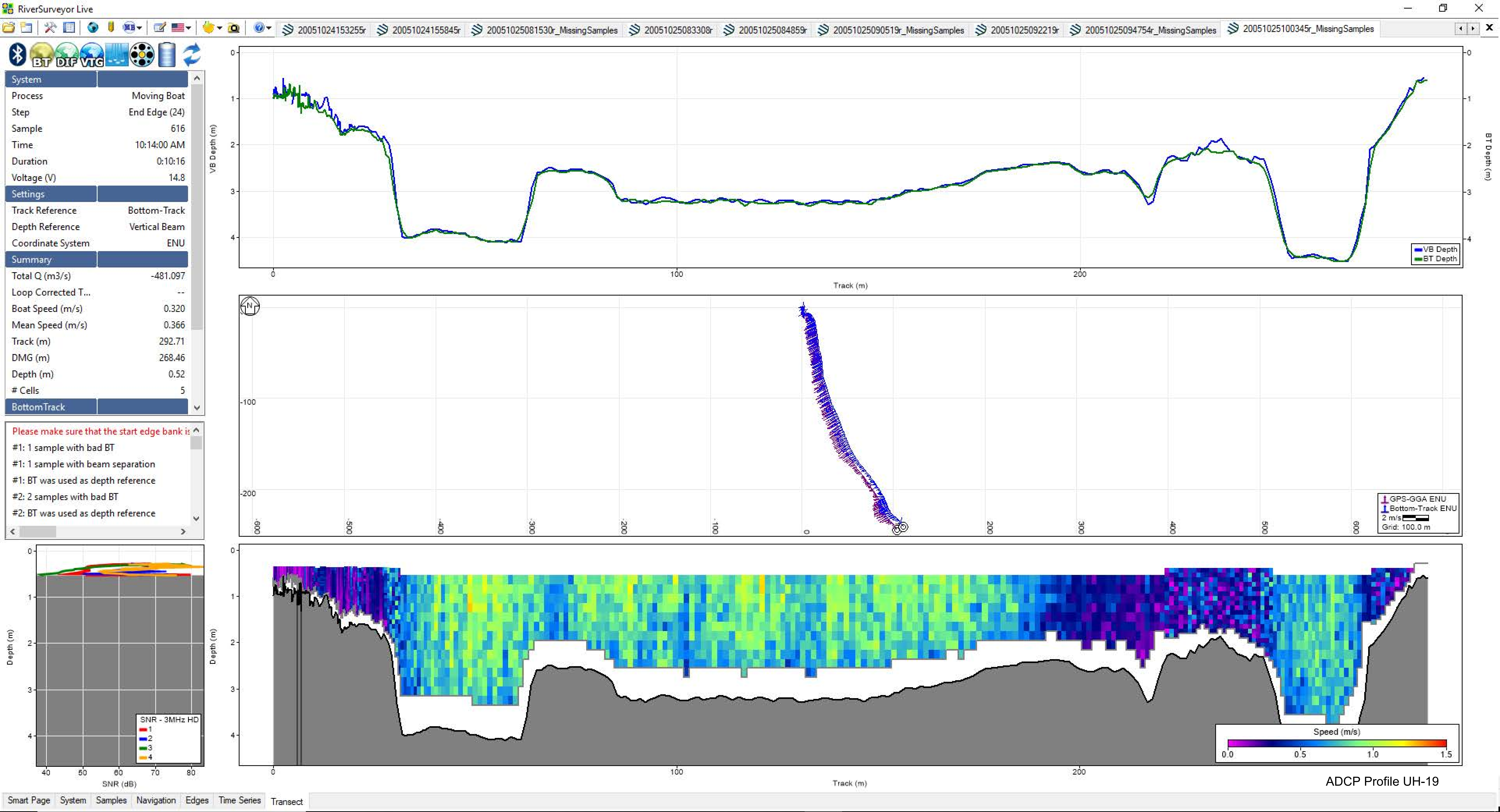
ADCP Profile UH-17

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-18 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5454163.46, 202332.7373 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.596 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | X | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | X | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:35 AM |



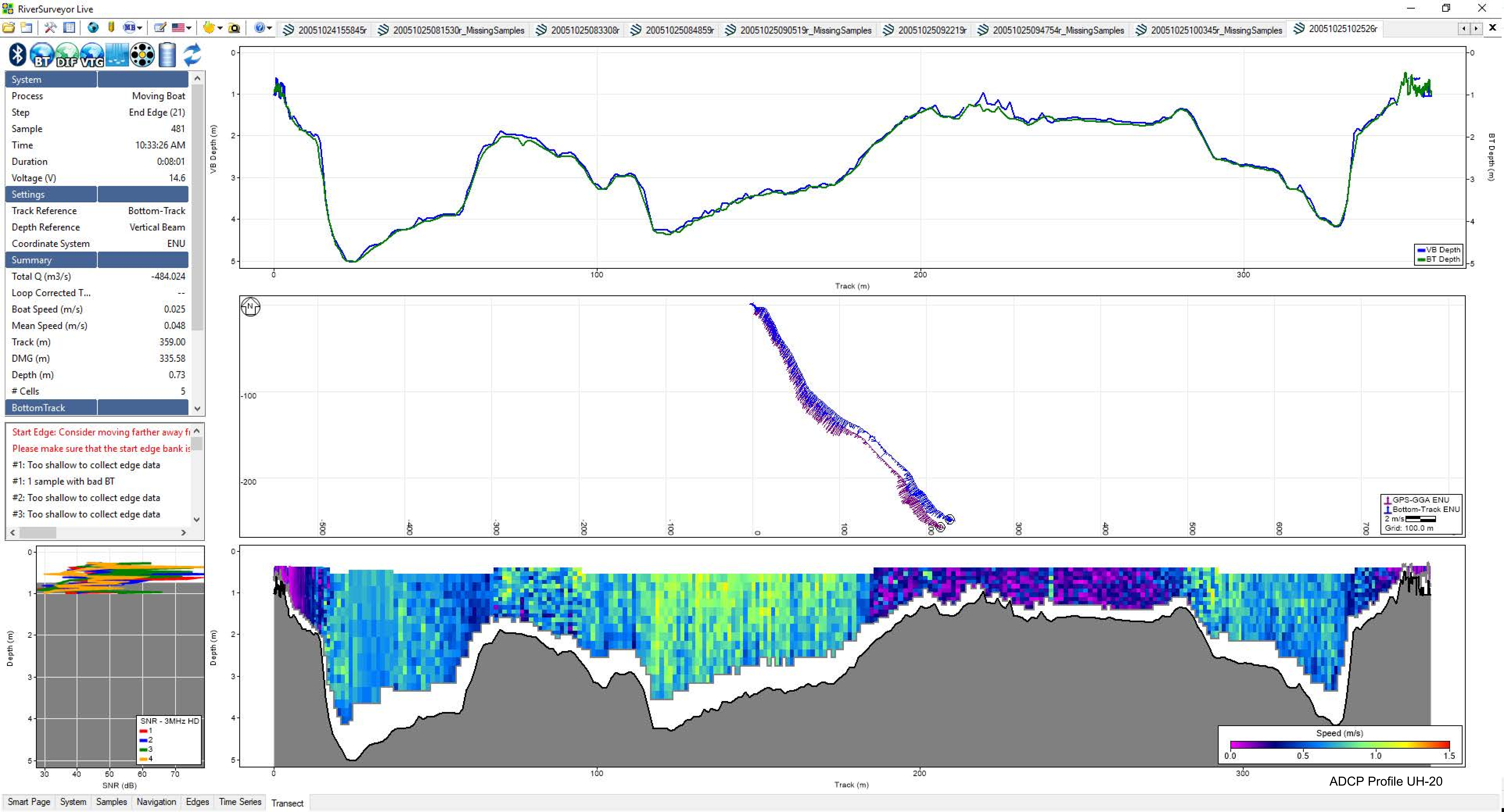
ADCP Profile UH-18

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-19 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5454068.899, 202969.3976 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.628 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:54 AM |



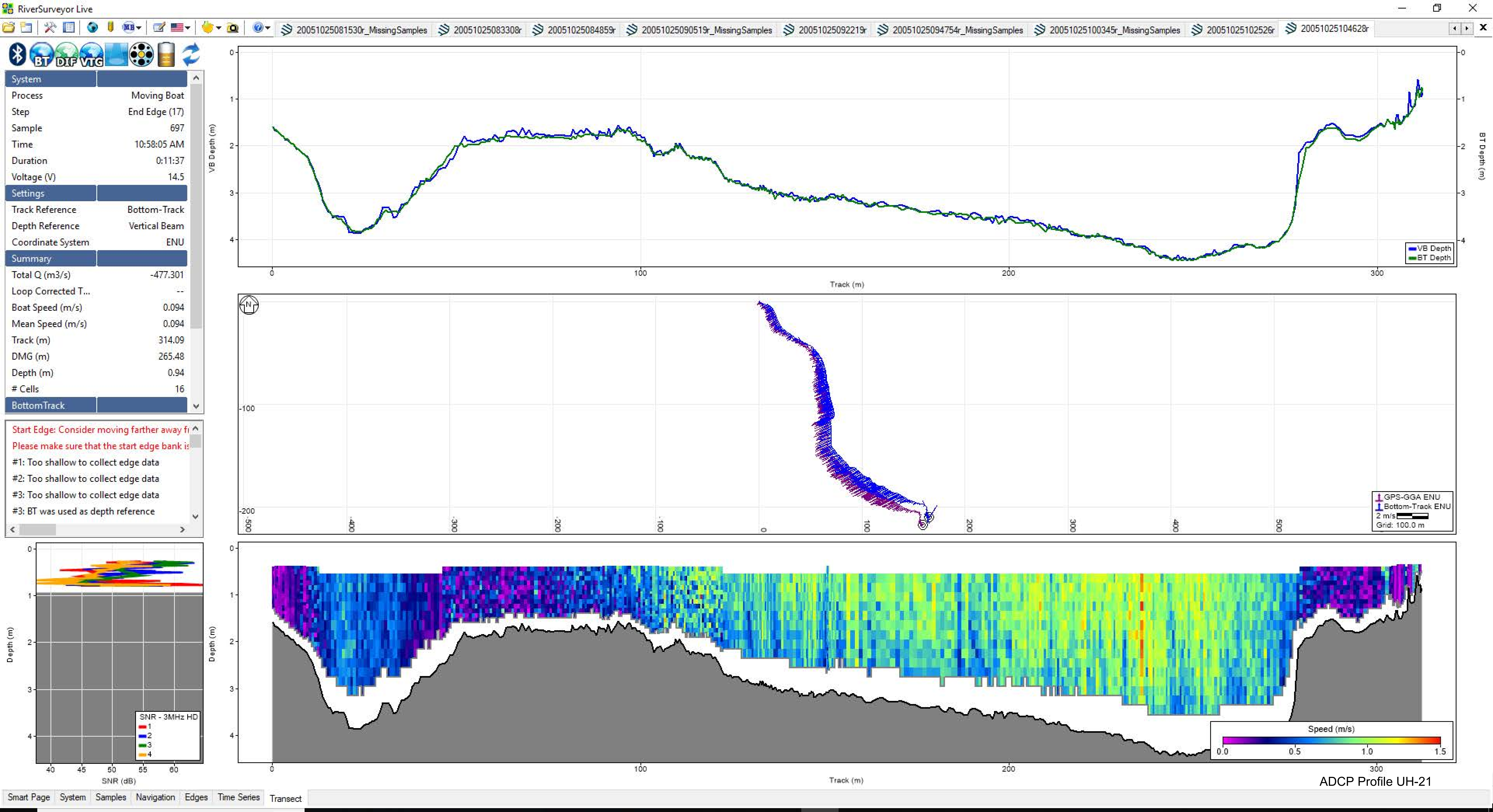

ADCP Profile UH-19

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-20 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5454355.55, 203388.2828 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.675 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 11:14 AM |



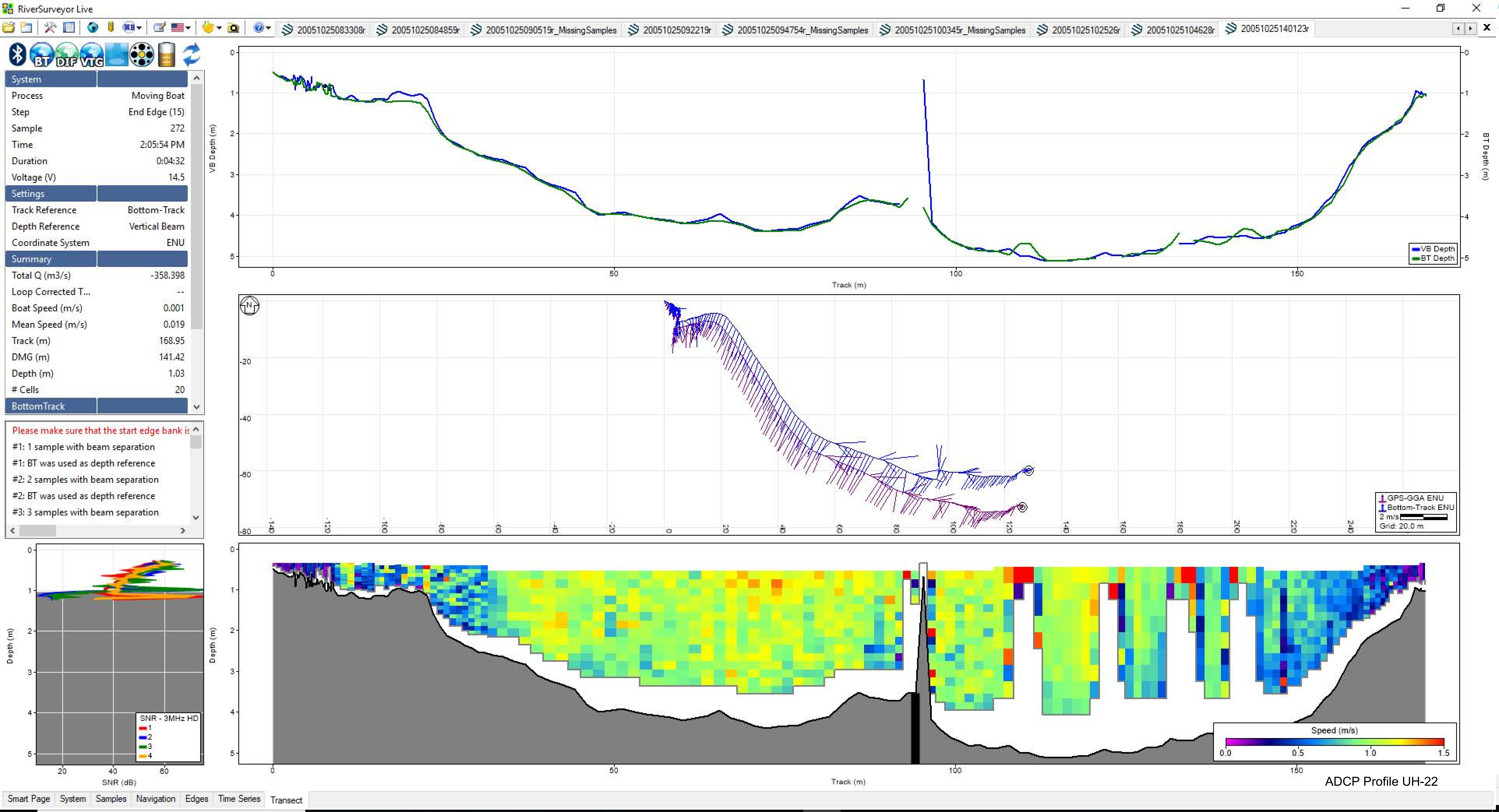
ADCP Profile UH-20

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-21 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5455046.343, 203743.9156 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.707 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 11:37 AM |



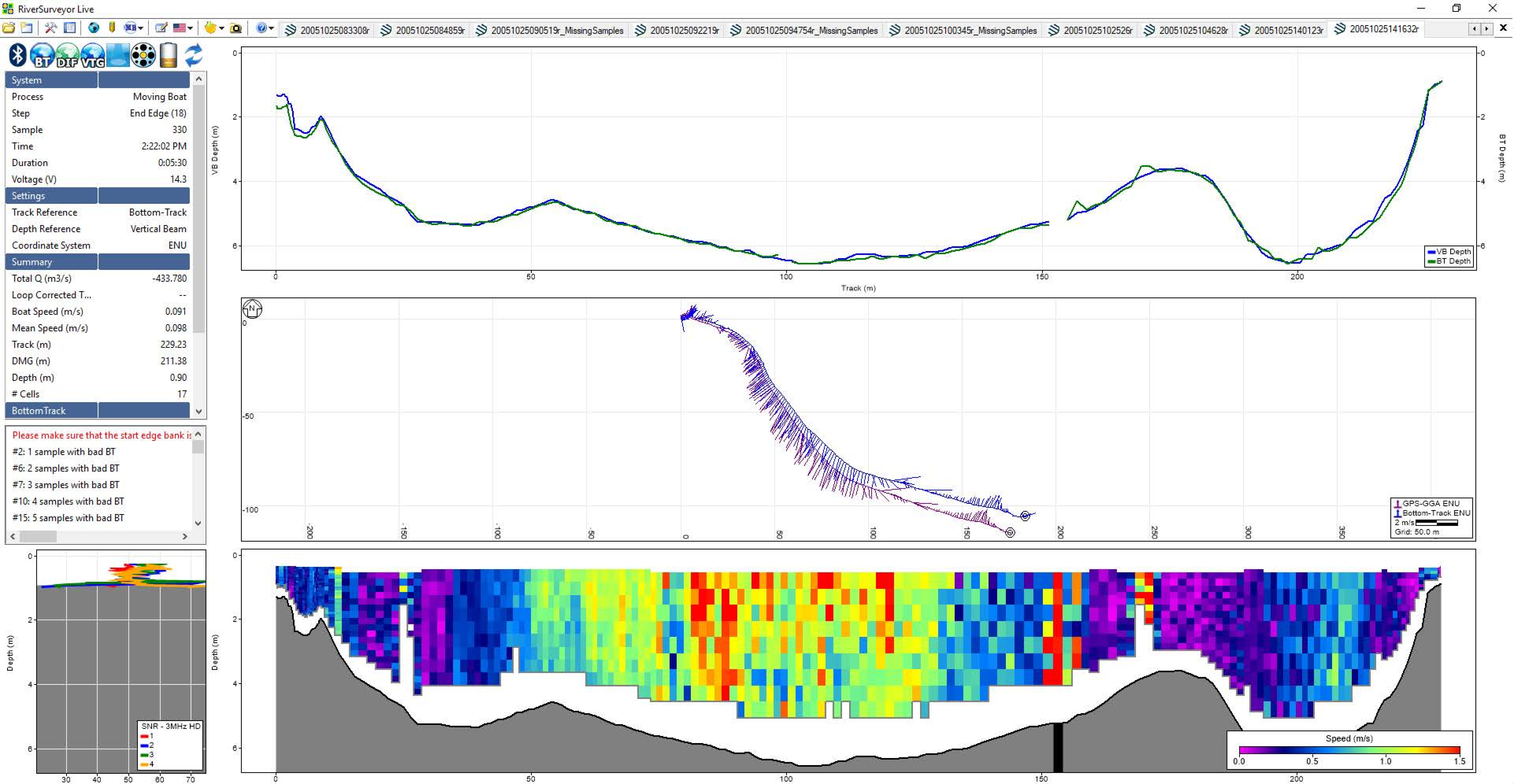

ADCP Profile UH-21

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-22 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5455707.337, 204823.4602 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 7.013 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | X | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 2:45 PM |



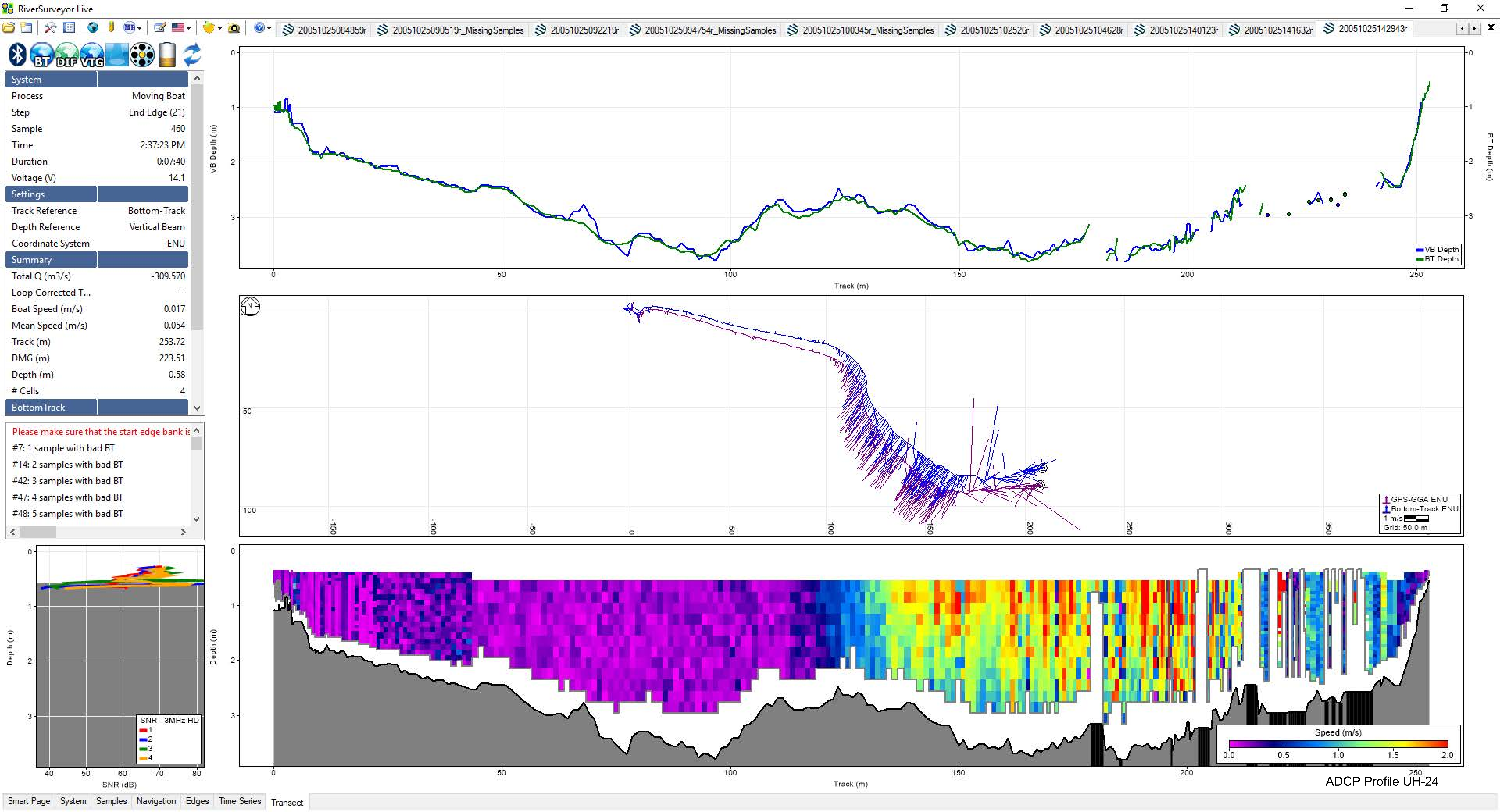

ADCP Profile UH-22

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-23 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5456074.544, 205069.7371 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 7.045 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 3:01 PM |




ADCP Profile UH-23

| | | | |
|---|---|---|---|
| **X-Section ID:** | UH-24 | | |
| **Name of Stream:** | Upper Humber River | | |
| **GPS coordinates:** | 5456267.535, 205143.8273 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 7.012 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: UH-24 was the furthest upstream that bathymetric data was collected on the Upper Humber River. The original intention to complete UH-25 was not possible due to the presence of rapids.** | | | |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 3:16 PM |




ADCP Profile UH-24

| | | | |
|---|---|---|---|
| **X-Section ID:** | Unknown-1 (River has no established name) | | |
| **Name of Stream:** | No name - west of Humber River Golf Club | | |
| **GPS coordinates:** | 5453015.74, 201077.7882 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.52 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| X | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| X | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |

**Downstream towards Upper Humber ------------ Upstream**

| | | | |
|---|---|---|---|
| **Date of Survey:** | **Jun. 06 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:29 AM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | J-1 | | |
| **Name of Stream:** | Junction Brook | | |
| **GPS coordinates:** | 5454857.599, 204718.6596 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.96 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 3:34 PM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | J-2 | | |
| **Name of Stream:** | Junction Brook | | |
| **GPS coordinates:** | 5454491.875, 204626.8117 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.943 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | X | Medium brush/trees |
| X | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | X | Medium to dense brush |
| X | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 3:49 PM |

The survey must extend a minimum of five (5) meters beyond the top of bank on either side of the river
If the survey is associated with a stream crossing structure, a minimum of four sections must be surveyed, two upstream and two down
The cross section alignment must be perpendicular to the channel alignment

| | | | |
|---|---|---|---|
| **X-Section ID:** | J-3 | | |
| **Name of Stream:** | Junction Brook | | |
| **GPS coordinates:** | 5454702.519, 204890.75 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 7.018 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| | Medium brush/trees | | Medium brush/trees |
| X | Heavy brush/trees | X | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:03 PM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | J-4 | | |
| **Name of Stream:** | Junction Brook | | |
| **GPS coordinates:** | 5454915.736, 205290.7769 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.956 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | | Medium to dense brush |
| | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:17 PM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | J-5 | | |
| **Name of Stream:** | Junction Brook | | |
| **GPS coordinates:** | 5454899.672, 205575.0634 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.955 | |
| **Channel Alignment Condition** | | | |
| X | Fairly regular, relatively straight and uniform | | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| X | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 05 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 4:30 PM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | R-1 | | |
| **Name of Stream:** | Remnant | | |
| **GPS coordinates:** | 5452620.328, 201611.9011 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.56 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 06 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:31 AM |

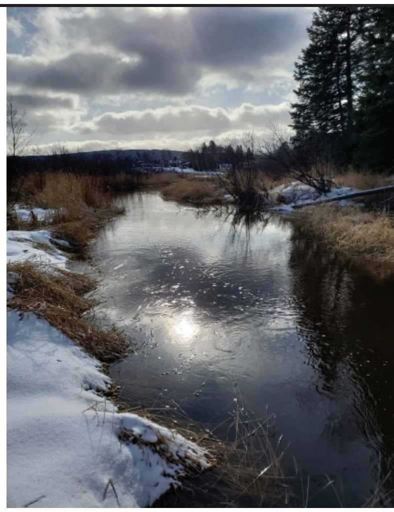
| | | | |
|---|---|---|---|
| **X-Section ID:** | R-2 | | |
| **Name of Stream:** | Remnant | | |
| **GPS coordinates:** | 5452389.803, 201690.0437 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.558 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | X | Some vegetation |
| | Cobbles with frequent large boulders | | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| | Medium to dense brush | | Medium to dense brush |
| X | Medium to dense trees | X | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Date of Survey:** | **Jun. 06 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 9:49 AM |

| | | | |
|---|---|---|---|
| **X-Section ID:** | R-3 | | |
| **Name of Stream:** | Remnant | | |
| **GPS coordinates:** | 5452133.791, 201758.4185 | | |
| **Bridge/culvert ID:** | | | |
| **Water level elevation at time of survey (m):** | | 6.553 | |
| **Channel Alignment Condition** | | | |
| | Fairly regular, relatively straight and uniform | X | Irregular, winding or sluggish |
| **Substrate (can check more than one)** | | | |
| X | Earth material (sand, silt, etc.) | | Little vegetation |
| | Gravel, cobble and occasional boulders | | Some vegetation |
| | Cobbles with frequent large boulders | X | Dense vegetation |
| | Bedrock | | |
| | Other (please describe) | | |
| **Left Bank** | | **Right Bank** | |
| | Light brush/trees | | Light brush/trees |
| X | Medium brush/trees | X | Medium brush/trees |
| | Heavy brush/trees | | Heavy brush/trees |
| **Left Flood Plain** | | **Right Flood Plain** | |
| | No to sparse vegetation | | No to sparse vegetation |
| | Medium to dense grass | | Medium to dense grass |
| X | Medium to dense brush | X | Medium to dense brush |
| | Medium to dense trees | | Medium to dense trees |
| **Pictures (check)** | | X | Picture looking toward left bank |
| | | X | Picture looking toward right bank |
| | | X | Picture looking downstream |
| | | X | Picture looking upstream |
| **Notes: boat incapable of proceeding any further upstream. No survey of R-4 due to inaccessibility. Assumed to be very shallow with significant vegetation growth in the channel.** | | | |
| **Date of Survey:** | **Jun. 06 2019** | **Surveyed by :** | TR & JM |
| **Time Started:** | | **Time Completed:** | 10:07 AM |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-1 | Date: | 14-Nov-19 |
| Location | Northing: | 5448685 | Easting: | 467398 | |

Downstream:



Right Bank:

Upstream:

Left Bank:

Comments:

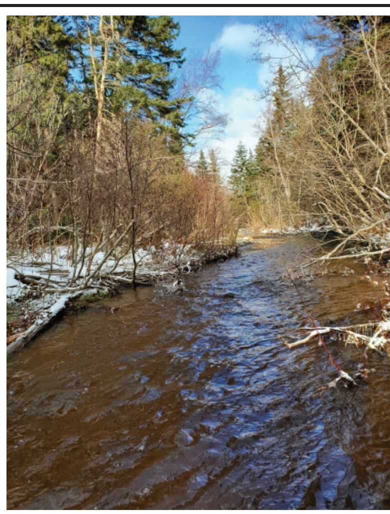
## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-2 | Date: | 14-Nov-19 |
| Location | Northing: | 5448761 | Easting: | 467265 | |

Downstream:

Right Bank:

Upstream:



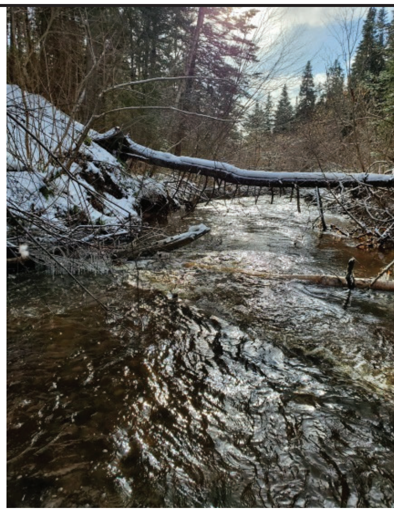
Left Bank:

Comments:

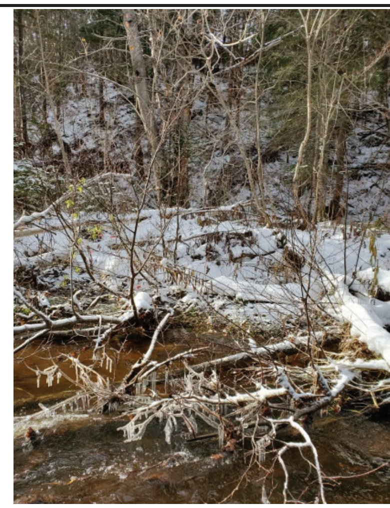
## River Cross Sections

| | | | | |
|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** |
| Stream/river name: | Nichols Brook | Location ID: | N-3 | Date: 14-Nov-19 |
| Location | Northing: | 5448923.2 | Easting: | 467228 |

Downstream:



Right Bank:



Upstream:

Left Bank:

Comments:

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-4 | Date: | 14-Nov-19 |
| Location | Northing: | 5449001 | Easting: | 467224 | |

| Downstream: | Right Bank: |
|---|---|
|  |  |

| Upstream: | Left Bank: |
|---|---|
|  |  |

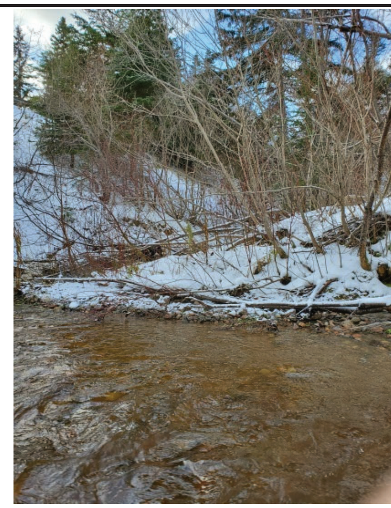
| | |
|---|---|
| Comments: | |

## River Cross Sections

| | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-5 | Date: | 14-Nov-19 |
| Location | Northing: | 5449043 | Easting: | 467210 | |

Downstream:

Right Bank:



Upstream:

Left Bank:

Comments:

| River Cross Sections | | | | | |
|---|---|---|---|---|---|
| Project: | **RTK River Cross Sections** | | Location: | **Nicholsville** | |
| Stream/river name: | Nichols Brook | Location ID: | N-6 | Date: | 14-Nov-19 |
| Location | Northing: | 5449058 | Easting: | 467194 | |

Downstream:

Right Bank:

Upstream:

Left Bank:

Comments: Moved this transect to an area we could safely cross

# Appendix E

# Natural Resources Canada correspondence regarding conversion of chart datum to CGVD-2013

*This page left intentionally blank*

## Nimmrichter, Peter

**From:** Wood
**Sent:** February-18-20 2:07 PM
**To:** Wood
**Cc:**
**Subject:** TIDAL DATA - UPDATE from Natural Resource Canada
**Attachments:** Corner Brook Tidal Data - 02_18_2020.xlsx

There is a forwarded e-mail below from below – one of many contacts looking into the issue.
As you can see the process to get into CGVD2013 ended up being even more involved than what others had even anticipated.
**Either way – please disregard my previous tidal file, as I now know that tidal information for Corner Brook needs to be adjusted by -1.609 m to get tide info into CGVD2013.**
**The attached tidal file is the CGVD2013 tidal elevations.**
**I will prepare a write-up for the report based on Marc's correspondence.**


Wood
Climate Consulting Group Lead
Senior Water Resources Engineer
Direct: 1-709-722-7023

www.woodplc.com

wood.


---

**From:** Wood
**Sent:** Tuesday, February 18, 2020 3:24 PM
**To:** (NRCan/RNCan)
**Cc:** (NRCan/RNCan) Geodetic Information / Information Géodésique (NRCAN/RNCAN) <nrcan.geodeticinformation-informationgeodesique.rncan@canada.ca>
**Subject:** RE: Referencing Tidal Data in CGVD2013 for Corner Brook, NL

Fantastic


Wood
Climate Consulting Group Lead
Senior Water Resources Engineer
Direct: 1-709-722-7023

www.woodplc.com

wood.

**From:** (NRCan/RNCan)
**Sent:** Tuesday, February 18, 2020 3:01 PM
**To:** Wood
**Cc:** (NRCan/RNCan) Geodetic Information / Information Géodésique (NRCAN/RNCAN) <nrcan.geodeticinformation-informationgeodesique.rncan@canada.ca>
**Subject:** RE: Referencing Tidal Data in CGVD2013 for Corner Brook, NL

You are correct. The low tide will be 0.849 m below CGVD2013.

Regards,

NRCan

Team Leader, Surveyor General Branch
Natural Resources Canada / Government of Canada

Chef d'équipe, Direction de l'arpenteur général
Ressources naturelles Canada / Gouvernement du Canada

---

**From:** Wood
**Sent:** February 18, 2020 1:14 PM
**To:** (NRCan/RNCan)
**Cc:** (NRCan/RNCan) Geodetic Information / Information Géodésique (NRCAN/RNCAN) <nrcan.geodeticinformation-informationgeodesique.rncan@canada.ca>
**Subject:** RE: Referencing Tidal Data in CGVD2013 for Corner Brook, NL

Hi
Thank you for providing that guidance as it was very insightful!
So if I'm following that approach, am I right in thinking the following:

- Separation between the Corner Brook chart datum and CGVD2013 = -1.609 m
- So if the tide table indicates low tide on Tuesday February 2020 at 12:18 am is 0.76 m (referenced to chart datum), then that low tide will be at an elevation = 0.76 – 1.609 = -0.849 m in CGVD2013

Wood
Climate Consulting Group Lead
Senior Water Resources Engineer
Direct: 1-709-722-7023

**www.woodplc.com**

---

**From:** (NRCan/RNCan)
**Sent:** Tuesday, February 18, 2020 10:01 AM

**To:** Wood
**Cc:** (NRCan/RNCan) ; Geodetic Information / Information Géodésique (NRCAN/RNCAN) <nrcan.geodeticinformation-informationgeodesique.rncan@canada.ca>
**Subject:** RE: Referencing Tidal Data in CGVD2013 for Corner Brook, NL

Hi

In order to determine the separation between a chart datum and CGVD2013 (DH), you need to have an ellipsoidal height (h) on a benchmark having a known height above the chart datum (Hcd): **DH = (h – N) – Hcd**, where N is the geoid height from CGG2013A.

You can calculate the height of the mean sea level (SST) above CGVD2013 by using this equation: SST = (h – N) – Hcd + Zo, where Zo is the height of the mean sea level above the chart datum.

Height of benchmarks and water above a chart datum is available from the Canadian Hydrographic Service (CHS).

As for Corner Brook, CHS has a temporary gauge (#2680) that ran briefly in 1948 and 1990. The list of benchmarks having a height above the chart datum can be found from this site: http://www.isdm-gdsi.gc.ca/isdm-gdsi/twl-mne/benchmarks-reperes/station-eng.asp?T1=2680&region=ATL&ref=maps-cartes

The ellipsoidal height can be found under the Canadian Geodetic Survey web site: https://webapp.geod.nrcan.gc.ca/geod/data-donnees/passive-passif.php?locale=en. (Select High Precision 3D to see BMs with GPS observations).

There is only BM (96G7002) with a published ellipsoidal height in Corner Brook: https://webapp.geod.nrcan.gc.ca/geod/data-donnees/station/report-rapport.php?id=96G7002. This BM is not a reference BM for the gauge, but it is tied to one by levelling (BM #76F048). https://webapp.geod.nrcan.gc.ca/geod/data-donnees/station/report-rapport.php?id=76F048

Thus, it is possible to determine the separation.

DH (2010.0) = (h – N) - H(96G7002) + H(76F048) – Hcd

= (66.460 - -1.777) - 68.240 + 2.743 – 4.349

= -1.609 m (thus CGVD2013 datum is higher than the chart datum)

H(96G7002) and H(76F048) are the published heights in CGVD2013. The -4.349 is the published height above the chart datum.

Note: Always good to double check my calculation. It might also be good to observe more marks by GPS if necessary.

As for the tide, a 1-m tide always maintains the same magnitude with respect to chart datum and CGVD2013.

If you have more questions, please do not hesitate to contact the Geodetic Information Service or me.

Regards,

NRCan

Team Leader, Surveyor General Branch
Natural Resources Canada / Government of Canada

Chef d'équipe, Direction de l'arpenteur général
Ressources naturelles Canada / Gouvernement du Canada

---

**From:** Wood
**Sent:** February 17, 2020 6:40 PM
**To:** (NRCan/RNCan)
**Cc:** (NRCan/RNCan)

**Subject:** Referencing Tidal Data in CGVD2013 for Corner Brook, NL

Hi
I came across a presentation you gave previously on CGVD2013 for tidal reference:
http://www.goceplushsu.eu/ext/doc/fin-meet/12-Canada_Veronneau.pdf

And I'm hoping you can help answer a question I have regarding tidal data posted for Corner Brook Newfoundland. The tidal data I've found online is all referenced to the chart datum for Corner Brook (which I believe should be LLWLT) – but I can't find any information on how tidal data in Newfoundland can be presented in CGVD2013 format. E.g. what is a +1.0 m tide (referenced to chart datum) when converted to CGVD2013 vertical elevation.

***Your presentation had some useful information for Halifax (e.g. mean water level was -0.39 m for Halifax in CGVD2013). And I'm wondering if any other reference information is available for Eastern Canada tidal stations?***

All the best and thank you for your time,

Wood
Climate Consulting Group Lead
Senior Water Resources Engineer
Direct: 1-709-722-7023

www.woodplc.com

wood.

---