Bringing Water Quality Results Back to Your Community

Summary of results from 2012-2014 from the NWT-wide Community-based Water Quality Monitoring Program

Government of
Northwest Territories

2012-2014 Results Summary

Northern Voices, Northern Waters: NWT Water Stewardship Strategy **(Water Strategy (2010) was created by Northwest Territories (NWT) water partners, including communities, regulatory boards, non-governmental organizations, industry and Aboriginal, territorial and federal governments. During the development of the Strategy, communities and Aboriginal governments said they wanted to be more involved in and know more about water stewardship.**

Community-based monitoring is an important way for NWT residents to be involved in water stewardship activities and is a key goal of the Water Strategy.

The Mackenzie DataStream was developed by Walter and Duncan Gordon Foundation in close collaboration with ENR. Using DataStream, you can access, visualize and download full water quality datasets collected by 21 communities through the NWT-wide Community-based Water Quality Monitoring (CBM) Program.

Questions raised by community members that have guided the design of the CBM program include:

- Is the water healthy – at specific locations; related to local, regional or outside the NWT concerns?
- Can we drink the water?
- Is the quality of the water changing?
- Is water quality affecting the health of fish and wildlife?
- Are stressors affecting water quality? Stressors might include climate change, development, municipal dumps and sewage lagoons in the NWT.
- Are there cumulative effects of many different stressors on the water quality?

Roles and Responsibilities

Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT), along with other water partners, have coordinating and supporting roles within the CBM program. These roles include:

- Providing ongoing training and support to the community monitors to collect water samples using standard methods.
- Analyzing the water quality data and providing results back to communities.

The NWT-wide Community-based Water Quality Monitoring Program uses different types of water quality monitoring equipment to collect water quality samples. These samples are analyzed to address water-related community concerns and questions at over 40 sites throughout the NWT (Figure 1). Community members collect these samples, supported by ENR technical staff.

Water Sampling

Data collected through this program can be compared to data collected at a particular site over time, or among sites – for example, the whole NWT, or specific regions or rivers – during a particular month. Data from the CBM program can also be compared to national water quality guidelines and long-term water quality data collected at locations similar to CBM program sampling locations by other organizations, such as Environment and Climate Change Canada, where available.

CBM program data can also be analyzed with information previously collected on contaminants, in fish and furbearers, for example. This information allows us to assess potential water quality related effects on aquatic ecosystem health.

To address community water quality concerns and questions, water is sampled at each community site by community members, supported by ENR technical staff, three to four times during the open water period – that is, between June and October. The CBM program uses four types of sampling equipment to sample water:

YSI Sondes measure pH, water temperature, turbidity, chlorophyll a, conductivity, dissolved oxygen and oxidation/reduction potential.

Polyethylene Membrane Devices (PMDs) measure dissolved hydrocarbons.

Diffusive Gradients in Thin-Films (DGTs) measure dissolved metals.

Surface water grab samples measure around 70 substances, including water pH and conductivity to nutrients, ions, and dissolved and particulate metals.

Water quality information collected through the program helps address community concerns and assess the health of the aquatic ecosystem at certain locations. This information also helps us to better understand the health of the aquatic ecosystem in a region, a river – for example, the Slave River and Mackenzie River – and the whole Mackenzie River Basin when combined with information from other water quality monitoring sites within and outside the NWT.

The CBM program focuses on building community capacity to ensure monitoring will continue for the long term. The CBM program is important because we are addressing communities' concerns about water quality and learning about water quality in more places across the NWT. Before the CBM program, long-term water quality monitoring existed near only nine of the over 40 sites.

Figure 1: *Sites sampled in 2014 in the NWT-wide Community-based Water Quality Monitoring program.*

What We've Learned so Far

So far, we've learned that:

- At each site, as expected, seasonal differences in water quality exist. For example, in 2012 on the Slave River, there were three peaks in turbidity: in June from spring melt and in July and August when rain or high flows moved dirt into the river causing it to become more turbid.

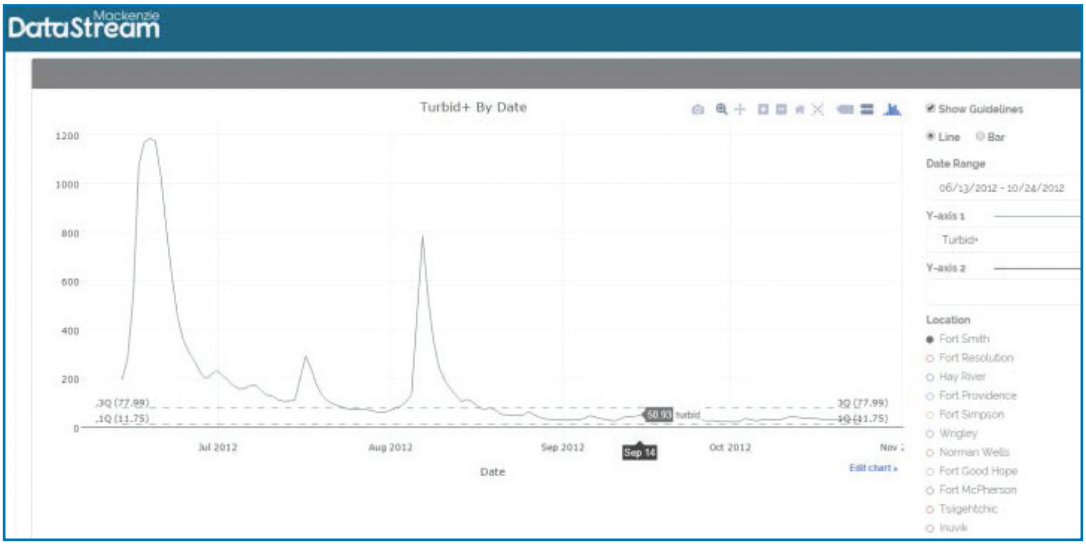

Figure 2: Turbidity in the Slave River, showing the seasonal peaks.

- Every year at each site, these seasonal differences are present, but happen at different times, depending on when spring melt and rain events occur.
- On a particular river, upstream to downstream trends can be identified and are often related to rain events. Turbidity (dirt) and particulate metals (those attached to dirt), which flow into the water from the land during rain, result in peaks (higher concentrations) during rain events. These can be tracked downstream and they decrease as they move downstream.

  For example, in August 2012, a heavy rain caused a peak in turbidity, which was tracked down the Mackenzie River from Wrigley to Norman Wells to Fort Good Hope and then to Tsiigehtchic. It took about 10 days for the water to travel from Wrigley to Tsiigehtchic.

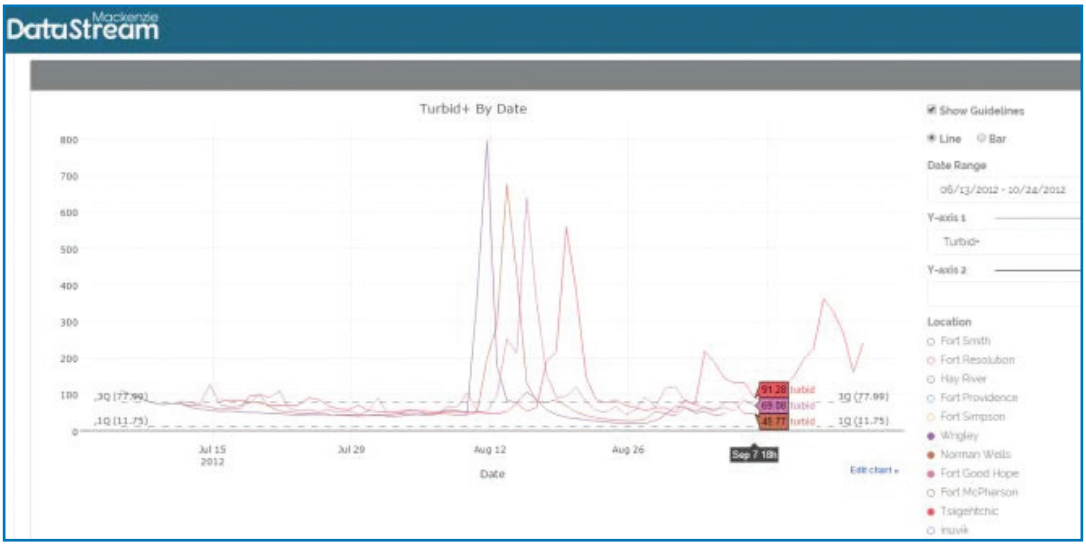

Figure 3: Turbidity in the Mackenzie River and peaks from heavy rainfall.

- Many of the sites experienced heavy rainfall in 2013. Heavy rainfalls cause the water to flow across the land quickly, picking up dirt and bringing it to the lakes and rivers. This increases the amount of dirt in the water sample.
- By comparing data collected from sites across the NWT, some trends can be identified. For example, during the same month, water temperatures are often cooler in the north than the south. The Slave and Hay Rivers in southern NWT often have the warmest water temperatures. Mackenzie River water is colder at the more northern sites, Tsiigehtchic and Inuvik, compared to southern sites, Fort Simpson and Wrigley. Rivers originating in mountains of the NWT are also cooler than those flowing from the south. The Peel River, which flows from the mountains in the Yukon, had the lowest water temperatures.

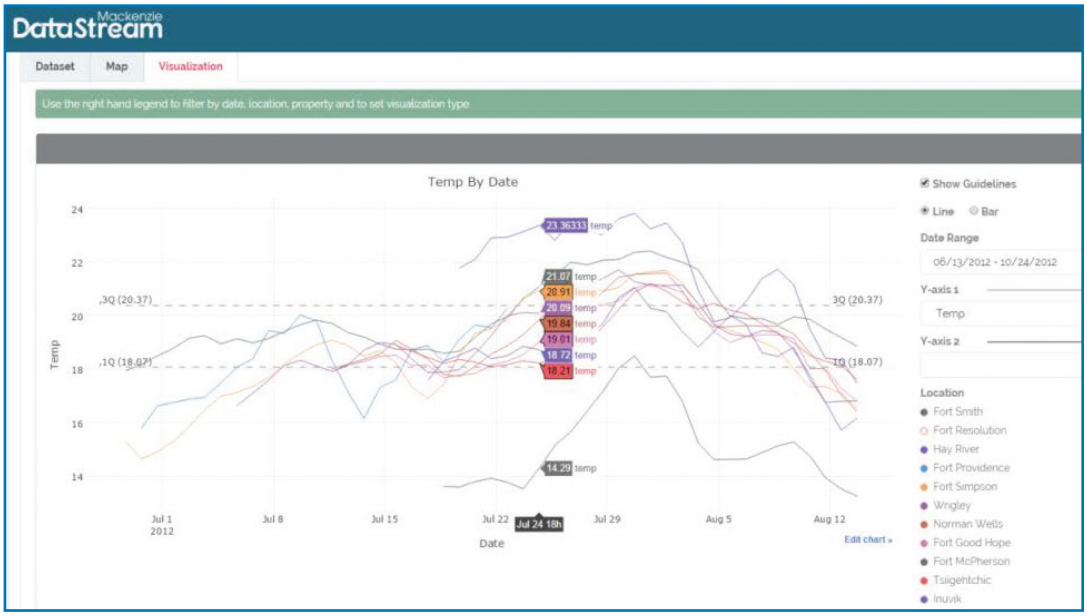

Figure 4: *Water temperature differences in the NWT.*

- At sites where long-term data are available from other sources, such as Environment and Climate Change Canada, we can compare our CBM results to long-term data collected close by to see if they are within the range of what has been recorded previously. We can also assess the long-term data to see if changes have occurred over time. At CBM sites, where there are no long-term data collected nearby, we are learning about water quality at these locations.

- Guidelines have been developed to tell us how much of a particular chemical or substance can be in the water before it might cause harm to fish and other living things. The Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life were made for all water bodies in Canada. These guidelines that we use for reference are not specific for northern waters. While these guidelines provide something we can compare to the data, they don't always account for the natural conditions (like more dirt, mud and silt in the water) of some of the northern rivers. Since metals attach to dirt, northern rivers sometimes have naturally high concentrations of some metals. At the nine sites where there was long-term data collected, if a substance increased over time, the CBM program data was compared to the long-term data set and the CCME for the Protection of Aquatic Life (PAL) guideline, where available. The vast majority of the CBM program data for these substances were within the long-term data range and none were over the guidelines.
- For some substances, such as mercury, silver and arsenic, guidelines were exceeded; however, guidelines had also been exceeded in the past. For these substances, increasing trends were not found.
- Analysis of long-term data from other sources indicates that no trends existed for many substances – for example, arsenic, mercury, and silver. Some substances had increasing trends – molybdenum, total dissolved solids, and turbidity; while others decreased – for example, nickel, cadmium, and lead. Continued monitoring at the same locations and same time of year will strengthen our knowledge of potential trends.
- CBM program samples for fluoride, chloride and nitrite concentrations were always within the range of what had been measured at a site over the long term. Some other substances were higher than the long-term range, but rarely more than once, likely due to heavy rainfall.
- Most of the hydrocarbon (oil and gas chemicals) concentrations were below the background levels for northern rivers (15 ng/L[1]). All of the dissolved hydrocarbon results were well below concentrations that can affect aquatic life (400 ng/L[2]).

[1] Yunker, M.B., S.M. Backus, E. Graf Pannatier, D.S. Jeffries and R.W. Macdonald (2002). Sources and Significance of Alkane and PAH Hydrocarbons in Canadian Arctic Rivers. Estuarine, Coastal and Shelf Science (2002) 55, 1–31.

[2] Carls, M. G., Rice, S. D. and Hose, J. E. (1999), Sensitivity of fish embryos to weathered crude oil: Part I. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval pacific herring (Clupea pallasi). Environmental Toxicology and Chemistry, 18: 481–493. doi: 10.1002/etc.5620180317 http://onlinelibrary.wiley.com/doi/10.1002/etc.5620180317/abstract

Looking Forward

We look forward to sharing detailed results on the program in a more comprehensive report, which will be available soon. In the meantime, the Mackenzie DataStream provides access to all of the water quality data collected through the CBM program.

In summer 2015 and spring 2016, biofilm (algae) and fish were collected at some sites to assess the feasibility of including biological indicators in the CBM program. This data will help us further understand the bioavailability of metals in our aquatic environment.