Our Water, Our Life: Building Partnerships to Assess the Health of the Slave River and Slave River Delta

Summary Report for the Community Workshop Convened in Fort Smith, NWT on March 1 and 2, 2011

Aboriginal Affairs and Northern Development Canada
Affaires autochtones et Développement du Nord Canada
Northwest Territories

Our Water, Our Life: Building Partnerships to Assess the Health of the Slave River and Slave River Delta

Summary Report for the Community Workshop Convened in Fort Smith, NWT on March 1 and 2, 2011

Prepared -- January 2012 -- by:

Aboriginal Affairs and Northern Development Canada

and

Department of Environment and Natural Resources, Government of the Northwest Territories

Yellowknife, Northwest Territories

CONTENTS

Executive Summary

On March 1 and 2, 2011, Aboriginal Affairs and Northern Development Canada and the Government of the Northwest Territories held a two-day workshop in Fort Smith, NWT. The workshop brought together participants from Fort Resolution, Fort Smith, Salt River, Smith's Landing and elsewhere in the NWT to discuss a number of topics related to aquatic ecosystem health in the Slave River and Slave River Delta. An information session was also convened on the evening of the second day of the workshop to solicit further input on these topics from members of the public. The technical workshop and public information session challenged participants to:

- Identify issues and concerns about water management in the Slave River Basin;
- Describe the key elements of an effective ecosystem health monitoring program for the study area; and,
- Discuss ways to engage communities in monitoring the health of the aquatic ecosystem.

In response to this challenge, workshop participants described their concerns relative to the effects of upstream developments on the health of the Slave River and Slave River Delta. A diverse array of human activities were discussed; however, concerns were focused primarily on:

- The potential effects of oil sands developments on water quality conditions; and,
- The effects of dam operations on river hydrology (both water levels and flows).

Workshop participants also indicated that the cumulative effects of all upstream developments and climate change are of great concern and need to be effectively evaluated and addressed.

Workshop participants indicated that an ecosystem-based approach would likely provide the most effective basis for documenting the effects of upstream developments on the aquatic ecosystem. Accordingly, workshop participants identified a variety of potential indicators of ecosystem health, including:

- Physical indicators (such as water levels, water temperature, flows, ice, and weather);

- Chemical indicators (such as contaminant concentrations in air, water, sediment, and the tissues of fish, birds, and mammals); and,
- Biological indicators (such as benthic invertebrates and other insects, fish, frogs, and aquatic-dependent birds and mammals).

For each of the candidate indicators, workshop participants identified one or more characteristics of the indicator that should be measured to provide information on the health of the aquatic ecosystem (these characteristics are termed metrics). It was recognized that additional discussions would be needed to support selection of the suite of ecosystem health indicators that will be included in an ecosystem health monitoring program for the Slave River and Slave River Delta.

Workshop participants agreed that:

The information collected to evaluate ecosystem health must be relevant to northerners.

It was further agreed that:

Northern residents must play a central role in the design and implementation of ecosystem health monitoring programs.

Workshop participants indicated that:

Building effective partnerships between communities, government agencies, and academics represents a key step in the transition toward community-based monitoring in the Slave River and Slave River Delta.

Workshop participants emphasized the need to:

Build effective communication strategies to ensure that successful partnerships are developed and maintained, and to ensure that monitoring programs yield reliable and relevant results.

Our Water, Our Life: Building Partnerships to Assess the Health of the Slave River and Slave River Delta

Summary Report for the Community Workshop Convened in Fort Smith, NWT on March 1 and 2, 2011

1.0 Introduction and Background

On March 1 and 2, 2011, Aboriginal Affairs and Northern Development Canada (AANDC; Water Resources Division; WRD) and the Government of the Northwest Territories (Department of Environment and Natural Resources; ENR) held a two-day workshop in Fort Smith, NWT. The workshop brought together representatives from communities throughout the territorial portion of the Slave River and Slave River Delta (i.e., from Fort Resolution, Fort Smith, Salt River, and Smith's Landing) to discuss a variety of topics related to the health of the aquatic ecosystem, including the people who rely on the plants and animals that are found in this area. Workshop participants included representatives from Aboriginal organizations, Elders, and water treatment operators from each community. Representatives from AANDC, ENR, Environment Canada, Parks Canada, and the Aurora Research Institute also attended the workshop. A list of workshop participants and participants of the Public Information Session are provided in Appendix 1.

Workshop Participants. Source: GNWT

The workshop was convened to provide participants with an opportunity to:

- Identify key issues and concerns regarding upstream development;
- Discuss ongoing aquatic monitoring programs;
- Identify and evaluate potential indicators of aquatic ecosystem health; and,
- Discuss options for community-based monitoring in the Slave River and Delta.

To facilitate discussions during the workshop, a series of presentations were made on developments in the upstream portion of the Slave River Basin, on water quality and quantity conditions in the Slave River and Delta, and on potential ecosystem health indicators. Workshop participants were divided into four work groups and asked to participate in a total of three break-out sessions. The first break-out session was designed to enable workshop participants to describe key issues and concerns related to human activities in the Slave River Basin. In the second break-out session, workshop participants were asked to identify potential indicators of aquatic ecosystem health in the Slave River and Delta. Workshop participants were encouraged to consider a broad range of potential indicators, including water quality, water quantity, as well as the plants, fish, birds, and mammals that live in the area. In the third break-out session, workshop participants were asked to describe how communities can best contribute to aquatic ecosystem monitoring. Following each break-out session, a representative of each work group presented the results of their discussions to all of the workshop participants. A copy of the workshop agenda is included in Appendix 2 of this report.

The Lower Slave River Subbasin. Source AANDC.

During the evening of the second day of the workshop (March 2, 2011), a public information session was held to solicit further input on aquatic ecosystem monitoring and to share the results of the technical workshop with the community.

At the beginning of the evening session, a summary of the results of the first two days of discussion was delivered by workshop organizers. Subsequently, members of the public were encouraged to offer their thoughts about each of the three topics addressed during the workshop. All of the comments offered by participants in the public information session were captured on flip charts and later compiled.

The results of the two-day community workshop and evening public information session are summarized in this report. The report includes the following sections:

- Introduction and Background (Section 1.0);
- Summary of Break-Out Session 1 - Human Activities in the Slave River Basin (Section 2.0);
- Summary of Break-Out Session 2 - Monitoring Priorities for the Slave River Basin (Section 3.0);
- Summary of Break-Out Session 3 - Community Participation in Aquatic Monitoring in the Slave River Basin (Section 4.0);
- Summary of Public Information Session - Monitoring the Health of the Slave River and Slave River Delta (Section 5.0); and,
- Summary and Next Steps (Section 6.0).

In addition, this report includes a series of appendices that provide further information on the Slave River Basin (Appendix 3), on the monitoring activities that are currently being conducted (Appendix 4), on the NWT Water Stewardship Strategy and the Slave River and Delta Partnership (Appendix 5), on candidate ecosystem health indicators (Appendix 6), and on the results of the technical workshop (Appendices 7-10). Furthermore, a summary of the workshop evaluation forms (Appendix 11) and selected media coverage (Appendix 12) is provided.

2.0 Summary of Break-Out Session 1 - Human Activities in the Slave River Basin

Break-Out Group during Session 1 of the Workshop. Source: GNWT

The Slave River is the largest Alberta-Northwest Territories (NWT) transboundary river and is an important part of the Mackenzie River Basin. The Slave River is 440 kilometres (km) long and flows from northeastern Alberta into the NWT. It draws its flow from the Peace River, Athabasca River, and Lake Athabasca catchments located in the provinces of Alberta, British Columbia, and Saskatchewan. All of the water flowing through the upstream catchment area ultimately flows into the Slave River and, therefore, into the NWT. As a result, developments in upstream areas have the potential to influence the quality and quantity of water flowing into the NWT. These changes could adversely affect the plants, animals, and humans that rely on this precious resource.

One of the key objectives of the workshop was to identify the concerns that NWT residents have regarding upstream developments within the Slave River Basin. To facilitate discussions on this topic, a presentation on the Slave River and upstream development was delivered. Then, workshop participants were divided into four work groups (Cattails, Mink, Jackfish, and Pelican work groups) and each of the work groups were asked to answer the following two questions:

- What are the human activities that are causing potential impacts on the Slave River and Slave River Delta?
- Why do these activities matter to you?

The detailed responses to these questions offered by workshop participants are presented in Appendix 7. Based on the input that was provided, it is apparent that workshop participants agreed that many activities can impact water quality, water quantity, aquatic ecosystem health, and, ultimately, human health in the Slave River Basin. Workshop participants indicated that the following developmental activities are of greatest concern relative to aquatic ecosystem health (the activities are not listed in order of importance):

- ***Forestry/Pulp and Paper:*** Workshop participants indicated that logging changes the landscape and increases erosion. Concerns were expressed that, without trees, there is no purification of the water and the runoff takes place too quickly. Logging, and the resulting increase in erosion and sedimentation, can reduce fish abundance and degrade wildlife habitat. Impacts can be observed throughout the food chain, which inevitably changes the aquatic ecosystem and the relationships between animals and people. The pulp and paper industry also affects water quality by increasing levels of nutrients and other contaminants in the river system. Concerns were raised regarding the use of bleach in the production of pulp and paper and the use of other chemicals in wood treatment.

Pulp Mill, Hinton Alberta. Source: unknown

- ***Oil Sands Development:*** Workshop participants indicated that oil sands developments represent significant concerns relative to water quality conditions in the Athabasca River, Athabasca Lake, and the Slave River. These industrial operations are disturbing large areas of the natural environment, both on the surface of the land and underground. As a result, the effects of this industry are likely to be observed large distances downstream.

Alberta Oil Sands. Source: Edward Burtynsk.

  Workshop participants were uncertain about how the underground activities, such as the use of steam to extract bitumen, are impacting the water and the earth. However, they understood that processing of bitumen requires large amounts of chemicals and fresh water, with the wastewater ending up in large tailings ponds. Workshop participants expressed concerns that the tailings ponds are located too close to the Athabasca River and there is a lack of progressive management and reclamation of these

tailings ponds. Accordingly, they felt that it is likely that wastewaters are seeping into the Athabasca River and that the associated contaminants are being transported to downstream areas, including the Slave River. Many workshop participants were concerned that monitoring conducted in Alberta is insufficient to evaluate the nature or extent of contamination or to assess the associated effects on the aquatic ecosystem. Workshop participants were also concerned that the flows needed to maintain ecosystem health are not being met in the Athabasca River.

- ***Conventional Oil and Gas:*** Workshop participants indicated that oil and gas developments have the potential to release contaminants into the environment and that current reporting mechanisms for spills are not adequate. They also felt that ground water is being impacted by drilling for natural gas and the chemicals that are used during drilling processes.

Oil Pumpjack. Source: unknown

- ***Human Occupancy:*** Workshop participants indicated that water use, sewage water discharge, disposal of garbage and seepage of landfill wastes into the water, as well as oil and gas leakage from boats are the main concerns related to the growing human population in areas located upstream of the Slave River and within the river basin.

- ***Hydro Development:*** Workshop participants indicated that operation of the W.A.C. Bennett Dam has profound effects on the water levels in the Slave River and in the Slave River Delta. It was noted the Bennett Dam releases water at the wrong time of the year (compared to natural flow patterns). These changes in flow have caused declines in local

W.A.C. Bennet Dam Peace River. Source: Panamerican Peaks Project

beaver and muskrat populations, since the majority of water is released from the dam after the animals have built their winter homes. High water levels in the winter cause a double layer of ice to form, and because these layers of ice are separated by water, the animals cannot escape (i.e., the animals drown).

Workshop participants also indicated that changing water levels are affecting access to traditional hunting and trapping areas, forcing people to eat less traditional food. Changes in the quality of ice were also noted (i.e. ice thickness). Some workshop participants stated that the ice doesn't freeze like it used to and noted that they commonly see "open spots" during the winter that were never observed in the past. It was observed that the Slave River and Delta is changing due to the decreased frequency of spring flooding. As a result, vegetation, like willows and other small trees are growing faster and covering larger areas of the Delta.

Workshop participants indicated that seasonal changes in water flow associated with dam operations are also affecting fish spawning grounds. Participants noted that spawning areas naturally dry out, but are then flooded at the wrong time of the year. As a result, the reproduction of certain fish species, such as jackfish, is being impaired by operation of these upstream dams.

- ***Climate Change:*** Workshop participants indicated that the effects of climate change are already being observed locally. Some workshop participants noted that there have been a number of warmer winters with less snow, while others noted that there have also been colder winters with lots of snow. Neither of these extremes in weather was common before. Some of the other changes in local climate that have been observed include:
  - More severe storms;
  - Freezing rain;
  - Less flooding;
  - Ice melting earlier in the season; and,
  - Changes in frequency of forest fires.

  The changing climate makes it difficult for people to forecast the weather and plan activities on the land.

- ***Transboundary Agreement:*** Workshop participants indicated that the lack of a transboundary water agreement with Alberta is an important issue that

needs to be addressed. Workshop participants stated that the NWT has no control over upstream development activities or the associated impacts to downstream areas. It was suggested that the federal government needs to become more involved in transboundary negotiations.

- ***Historic Contaminants:*** Workshop participants identified a number of historical sources of contaminants that have likely affected ecosystem health in the Slave River and Slave River Delta, including:
  - Old military sites/deposits: Local people do not know all the contaminants present at these sites;
  - Historic uranium mining along the shore of Lake Athabasca; and,
  - Leakage/deposition from previous transportation of ore, uranium and other supplies.

Uranium Mine, Saskatchewan. Source: Saskatchewan Research Council.

The need to look at different contaminants in the sediment, particularly in the Delta, was also noted. Workshop participants emphasized that the Elders have important information to provide regarding historical activities and potential impacts on the ecosystem.

- ***Forest Fires:*** Workshop participants observed that more fires have been caused by humans in recent years. As well, participants stated that the increased incidence of fires is related to climate change and associated storms. These factors are causing fires where there have never been fires before. It was noted that air quality is affected by these fires, as is water quality and the winter range of caribou.

- ***Farming:*** Workshop participants noted that farming activities contribute to increased levels of nutrients, pesticides, and antibiotics in the water. Air quality can also be impaired due to releases of carbon dioxide and methane from animal operations. Concerns were raised about irrigation practices and regulations on the agricultural sector's water withdrawals.

- ***Cumulative Effects:*** The overwhelming message from each of the break-out groups was that each activity cannot be looked at in isolation and the effects of upstream developmental activities must be considered together. That is, the cumulative effects of proposed, current and past activities must be evaluated together to develop a clear understanding of the impacts of upstream developments on the health of the Slave River and Slave River Delta.

3.0 Summary of Break-Out Session 2 - Monitoring Priorities for the Slave River Basin

In the first break-out session, workshop participants identified the upstream activities that have the potential to affect water quality and water quantity in the Slave River. Workshop participants agreed that such changes in the quality and quantity of water in the Slave River have the potential to harm the plants and animals that live in the Slave River and Slave River Delta. As the residents of this area depend on these natural resources, it is important to monitor the effects of upstream activities on the health of the Slave River ecosystem.

To facilitate discussions on aquatic ecosystem monitoring, presentations on the current aquatic monitoring activities that are taking place on the Slave River were made at the end of the first day. On the second day of the workshop, a presentation on potential indicators of aquatic ecosystem health was delivered. Following this presentation, the break-out groups were asked to address the following questions:

The Second Break-Out Session at the Workshop. Source: GNWT

- What would you measure to monitor the health of the Slave River and Slave River Delta (i.e., what are the key ecosystem health indicators);
- Why should these indicators be monitored; and,
- Where and when should these indicators be monitored?

In response to these questions, workshop participants indicated that the plants, animals, and people that depend on the river and delta are all potential indicators of aquatic ecosystem health. In the context of this discussion, ecosystem health

indicators were defined as the physical (e.g., water level), chemical (e.g., petroleum hydrocarbons), or biological (e.g., beaver) elements of the aquatic ecosystem that could be used to provide information on the health of the Slave River ecosystem as a whole (i.e., to assess aquatic ecosystem health). Workshop participants also identified one or more characteristics of each indicator that should be measured to provide information on the status of that ecosystem health indicator. Such characteristics were termed "metrics" in this discussion of ecosystem health indicators. For example, population size was identified as one of the metrics that could be used for evaluating the status of beavers (which is an indicator) in the Slave River Basin. The following list of indicators was developed by workshop participants (see Appendix 8 for the detailed responses that were provided):

- ***Fish:*** Fish were identified as important indicators of the health of the ecosystem. Workshop participants indicated that a number of fish species would be good indicators of aquatic ecosystem health, including:
  - Jackfish;
  - Whitefish;
  - Walleye;
  - Lake trout;
  - Inconnu;
  - Suckers; and,
  - Burbot.

Inconnu. Photo Credit: Paul Vecsei

  Some of the characteristics of fish (i.e., metrics) that could be measured to provide information on aquatic ecosystem health include:
  - Texture of the flesh (i.e., is meat firm or mushy?);
  - Number of parasites in the intestines (guts) or flesh;
  - Number of spinal malformations;
  - Number of lesions or tumours;
  - Abundance of each fish species (population size);
  - Number of eggs (fecundity);
  - Colour and texture of eggs;
  - Number of fish with abnormalities;
  - Levels of contaminants in fish tissues; and,
  - Stomach contents of fish.

- ***Muskrat:*** Workshop participants agreed that muskrats represent important ecosystem health indicators because the animals can be adversely affected by changes in water levels and flow (i.e., by hydroelectric dam operations). Population size and distribution were two of the key metrics that were identified for muskrats. In addition, the levels of contaminants in muskrat tissues were considered to be important metrics due to the potential for effects on human health (i.e., muskrats are used as a food source by area residents). The concentrations of contaminants in the push-ups could also be studied.

Muskart and Beaver. Photo Credit: Randy Kimura

- ***Beaver:*** Like muskrats, beavers that live along the Slave River were considered to be sensitive to changes in water levels and flow. Increased flows during the winter can drown beavers that build dens along the river. The size of beaver populations was identified as one of the important metrics for this species. It was also noted that the health of beavers can be determined by examining the meat, tail, feet, kidney, liver and glands. The health of river-resident beavers can be compared to that of pond-dwelling beavers to assess the effects of upstream developments on this species. Beavers taste different depending on what food is available and, hence, could be used to monitor changes in vegetation.

- ***Vegetation:*** Medicinal plants, such as rat root, and different types of berries are used extensively by community members. Species such as willow were identified as good indicators of habitat change. Other plant species that could be used as ecosystem health indicators included yellow pond lily (important for beavers), cattails (important for muskrats), goose grass, moose grass, and algae. Further discussions are needed to identify which plant species are likely to be most sensitive to changes in water quality or quantity associated with upstream development.

- ***Human Health:*** Due to their dependence on aquatic resources, workshop participants suggested that human health should also be included in the suite of indicators used to assess aquatic ecosystem health. The key indicators of human health that were identified included:
  - Cancer rates in the local communities;
  - Causes of death of community members;
  - Types and rates of various diseases in community members;
  - Human exposure to contaminants (i.e., levels in hair or blood);
  - Frequency of contamination of water sources by bacteria (i.e., *E. coli*) and beaver fever (*Giardia*);
  - Consumption rates of traditional foods;
  - Number of people out on the land; and;
  - Percentage of people drinking bottled water.

- ***Ice Quality:*** Ice quality was identified as an important indicator of aquatic ecosystem health in the Slave River Basin. More specifically, monitoring of the quality of river ice is needed to determine if ice conditions are adequate for travel on the Slave River. In particular, monitoring the double ice layers resulting from changes in the amount of water that is released from the W.A.C Bennett Dam was emphasized by workshop participants. Participants wondered whether chemicals in the water or precipitation could affect the formation and quality of the ice. It was acknowledged that traditional knowledge and local knowledge were essential elements of ice quality monitoring programs.

The Slave River. Photo Credit: A. Czarnecki

- ***Precipitation:*** Workshop participants indicated that the monitoring of the quantity, quality, and timing of snow and rain could provide important information on the health of the aquatic ecosystem. In addition, the texture of the snow was identified as a key metric for precipitation monitoring.

- ***Water Quality:*** Workshop participants agreed that water quality represents a key indicator of aquatic ecosystem health in the Slave River Basin. Some of the metrics that were identified included:
  - Concentrations of industrial contaminants and atmospheric pollutants in water and/or sediment;
  - Levels of nutrients, such as nitrate and phosphorus in water;
  - Types and abundance of algae;
  - Levels of bacteria and other microorganisms (e.g., *Giardia*); and,
  - Temperature and turbidity of water.

  During the discussions on water quality monitoring, workshop participants indicated that monitoring at additional stations along the river would provide more information on water quality conditions. The following locations for additional monitoring stations were suggested:
  - Half-way between Fort Smith and Fort Resolution;
  - Close to the mouth of the main channel (Delta);
  - Sloughs draining into the river; and,
  - Open areas that don't freeze (flow locations and back-water areas).

Sampling on the Slave River: Source AANDC.

It was suggested that monthly water quality sampling, instead of seasonally, would provide valuable information on water quality conditions in the Slave River. Workshop participants also stated that both raw-water and treated-water testing would be useful. Questions were raised about the safety of drinking the water of the Slave River after boiling.

- ***Water Quantity:*** Workshop participants agreed that changes in water levels and flows associated with operation of the W.A.C. Bennett Dam could be adversely affecting aquatic ecosystem health. Therefore, it was recommended that both water flow and water levels be measured in the Slave River and in an appropriate reference river (i.e., for comparison). Participants wanted more information regarding water releases from the dam. Because precipitation affects streamflow, it was agreed that

precipitation monitoring is also needed to understand the streamflow data. Suggested monitoring stations included the Peace River (at Quatre Fourches), Slave River (at Fitzgerald), and the tributaries feeding into the Slave River. It was also agreed that collection of more information on the movement of the sandbars and on the location of channels in the river would be valuable.

- ***Benthic Invertebrates and Insects:*** Workshop participants indicated that changes in benthic invertebrate populations (how many and where they are) have the potential to adversely affect fish in the Slave River. Therefore, benthic invertebrates were identified as important ecosystem health indicators. It was also noted that developing a better understanding of the linkages between sediment quality conditions (i.e., contaminant concentrations) and benthic invertebrate populations was an important information need. Workshop participants indicated that it is important to study changes in insects and their habitats, as insect abundance and behaviour can be indicators of weather conditions. For example, if bees build nests lower to the ground, then there will be little snow the coming winter; if bees build their nests high, there will be a lot of snow the coming winter.

Nest in a Cedar Tree. Source: unknown

- ***Waterfowl:*** Both geese and ducks are important country foods for the local communities. Accordingly, workshop participants felt that it is important to monitor these birds in the Slave River Basin. Swans, cranes, gulls, and pelicans were also listed as important ecosystem health indicators. The health of the waterfowl can be evaluated using the following metrics:

Pelican on the Slave River. Source: unknown.

- Abundance of waterfowl;
- Migration patterns;
- Changes in species distribution;
- Changes in habitat quality or quantity;
- Abundance of internal parasites; and,
- Concentrations of contaminants in liver, heart, eggs, gizzards, and the meat.

- ***Air Quality and Weather:*** Long-range transport of contaminants, air temperature, and wind speed (winds are now stronger in the spring than they were in the past and the wind directions have changed) were the key indicators identified by workshop participants.

- ***Frogs:*** Frogs were identified as important ecosystem health indicators because they provide an early warning about changes in the ecosystem. Workshop participants indicated that the abundance of frogs and the number of frogs with deformities are high priority metrics. It was noted that there is local knowledge available on the types of deformities that occur in frogs and that pictures can be used to provide more information to experts on the deformities that have been observed.

Northern Leopard Frog. Source: Canadian Wildlife Federation.

Workshop participants agreed that monitoring a number of indicators of the health of the aquatic ecosystem is needed to evaluate the effects of upstream developments. By taking this ecosystem-based approach, participants felt they would have confidence in the information produced by a monitoring program. Overall, participants felt balanced and relevant information from credible and trustworthy sources needs to be available to identify trends in environmental quality conditions, to assess the potential impacts of human activities, and to support well-informed decisions on the management of aquatic resources.

4.0 Summary of Break-Out Session 3 - Community Participation in Aquatic Monitoring in the Slave River Basin

All of the workshop participants agreed that maintaining and, as necessary, restoring the health of the Slave River and Delta is a common goal that requires strategic coordinated action to achieve. They stated that communities, Aboriginal organizations, municipal, territorial and federal governments, non-governmental organizations, and academic institutions must work together to collect and share information on aquatic ecosystem health. Furthermore, workshop participants indicated that reliable information on the health of the aquatic ecosystem is urgently needed to support transboundary negotiations on water quality and water quantity in the Slave River Basin.

A Break-Out Group Reports Back to the Workshop Participants. Source: GNWT

A common theme that emerged from each of the break-out groups was the need to engage communities in ecosystem health monitoring in the Slave River Basin. Such community-based monitoring was identified as an essential element of an effective and efficient ecosystem health monitoring program. However, virtually all workshop participants agreed that transitioning towards community-based monitoring will not be easy. It will require the development of effective partnerships, communication, coordination, targeted training, and consistent funding. It was also understood, that for such collaborative monitoring partnerships to be effective, communities would need to play leadership roles and help to sustain the momentum that was achieved during the workshop. Some of the suggestions that were offered by workshop participants included (see Appendix 9 for detailed responses provided by workshop participants):

<u>*Empower People in the Community to Participate in Monitoring Activities*</u>

- Identify the people in each community with an interest in participating in community-based monitoring programs;
- Locate champions within the communities and bands to coordinate activities;

- Identify potential sources of funding for community-based monitoring;
- Provide training on proposal writing for key members of the community; and,
- Assist communities in preparing and submitting funding requests.

Identify the Key Elements of Community-Based Monitoring Programs

- Use the results of this workshop to identify options for community-based monitoring;
- Engage Traditional Knowledge and local knowledge holders in discussions on community-based monitoring;
- Establish working groups within each community to identify regional monitoring priorities;
- Allow community members to take ownership of the monitoring programs; and,
- Inform, educate, and involve youth in community-based monitoring programs.

Coordinate Research and Monitoring Activities to Increase Effectiveness of Monitoring Programs

- Link to other existing programs to access training and equipment;
- Use standard protocols in the monitoring programs to ensure that information is comparable;
- Provide training to all participants in community-based monitoring; and,
- Work with upstream communities to cover a larger area, from the headwaters to the Slave River Delta.

Effectively Communicate the Results of Community-Based Monitoring Programs

- Host data from different monitoring and research activities in one place;
- Provide avenues of communication between researchers and community members;
- Meet periodically in communities to discuss monitoring program results;
- Convene an annual conference on the health of the Slave River and Slave River Delta;
- Hold an event on Water Day that focuses attention on the Slave River Basin; and,
- Identify ways of communicating the results of monitoring programs to Canadians within and outside the NWT.

Workshop participants left the workshop eager to think more about potential indicators, community-based monitoring activities, and other ways to involve their communities in monitoring the Slave River and Delta. They also expressed an urgency to get the process started in the near term.

5.0 Public Information Session on the Health of the Slave River and Slave River Delta

Dinner during the Public Meeting. Source: GNWT

Following the two-day community workshop in Fort Smith, a public information session was held in on the evening of March 2, 2011. This session was convened to share the results of the two-day technical workshop and to provide the public with an opportunity to express their concerns about upstream development, to describe the impacts of those activities on water resources, and to provide input on the monitoring of aquatic ecosystem health.

The public information session was attended by more than 100 people including workshop participants and members of the community. The main concern expressed during the public meeting was that the Slave River is highly vulnerable to upstream industrial development. Community members expressed frustration that the environment they love and depend on is at risk. Residents are concerned about the presence of contaminants in the traditional foods they eat. They are also concerned about the health of their friends, family, and communities at large. Many of the participants expressed their frustration that the Government of Canada is not adequately regulating developmental activities in the Athabasca region and the failure to manage oil sands developments has resulted in serious downstream impacts. Participants also emphasized that hydroelectric power developments in the Peace region are impacting aquatic resources in the Slave River Basin. People

are eager for change and would like to see real progress in the near future. A more detailed summary of the input provided by the public is included in Appendix 10.

6.0 Summary and Next Steps

This workshop brought together Elders, water treatment plant operators, and representatives from Aboriginal organizations, Aboriginal Affairs and Northern Development Canada, Department of Environment and Natural Resources, Environment Canada, Parks Canada, and the Aurora Research Institute to discuss how to monitor the health of the aquatic ecosystem in the Slave River and Slave River Delta. The technical workshop and public information meeting challenged participants to identify issues and concerns about water management in the Slave River Basin, to describe the key elements of an effective ecosystem health monitoring program, and to discuss ways to engage communities in monitoring programs.

Slave River at Fitzgerald. Source: Water Survey Canada

In response to this challenge, workshop participants described their concerns relative to the effects of upstream developments on the health of the Slave River and Slave River Delta. While a diverse array of human activities were discussed, concerns were focused primarily on the potential effects of oil sands developments on water quality and the effects of dam operations on river hydrology (both on water levels and flows). Workshop participants also indicated that the cumulative effects of all upstream developments and climate change are of great concern and need to be effectively evaluated and addressed.

Workshop participants indicated that an ecosystem-based approach would likely provide the most effective basis for documenting the effects of upstream developments on the aquatic ecosystem. Some of the key questions that monitoring program results must answer include:

- Is the water safe to drink?
- Are the fish safe to eat?

- Are the plants and animals healthy?

With these questions in mind, workshop participants identified a variety of potential indicators of aquatic ecosystem health. These candidate ecosystem health indicators included a diversity of physical (i.e., water levels, water temperature, flows, ice, and weather), chemical (i.e., contaminant concentrations in air, water, sediment, and the tissues of fish, birds, and mammals) and biological (i.e., benthic invertebrates and other insects, fish, frogs, and aquatic-dependent birds and mammals) components of the aquatic ecosystem. For each candidate indicator, workshop participants identified one or more characteristics of that indicator that should be measured (i.e., metrics) to provide relevant information on the health of the aquatic ecosystem. It was recognized that additional discussions would be needed to support selection of the suite of ecosystem health indicators that will be included in an ecosystem health monitoring program(s) for the Slave River and Slave River Delta.

All of the workshop participants agreed that the information collected to evaluate ecosystem health must be relevant to northerners. It was further agreed that northern residents must play central roles on the design and implementation of ecosystem health monitoring programs. To initiate a transition toward community-based monitoring, workshop participants identified several steps that should be taken in the near term, including:

Ice Fishing in a Northern Lake. Photo Credit: Paul Vecsei

- ***Build Effective Partnerships*** **-** Communities want to:
  - Work with government, agencies, and academics to build an effective ecosystem health monitoring program;
  - Lead discussions on potential ecosystem health indicators; and,
  - Participate in the selection of indicators that are directly relevant for assessing their issues and concerns associated with upstream developments.

It was recognized that the building of such collaborative partnerships would require a number of steps, including:

- Preparing proposals to obtain the resources needed to participate in the process;
- Coordinating with other participants in the monitoring program development process;
- Collecting data and information;
- Compiling and evaluating the monitoring data; and,
- Reporting the results to communities and others.

- ***Build Effective Communication Strategies -*** Communities want effective and timely communications between themselves and governments, academics, and agencies with an interest in monitoring the Slave River and Delta. ***Strong, clear communication is the key to building successful partnerships and a trustworthy monitoring program.***

Appendix 1. Participant Lists

Workshop Participants List by Break-Out Session – Fort Smith, March 1, 2, 2011

Cattails Group *Facilitator –* *Stephanie Yuill*	**Mink Group** *Facilitator –* *Jennifer Dallman-Sanders*	**Jackfish Group** *Facilitator –* *Jodi Woollam*	**Pelican Group** *Facilitator –* *Don MacDonald*
Angus Beaulieu	Sunny Ashcroft	Fred Beaulieu	Jack Bird
Andrea Czarnecki	Stanley Beck	Carol Collins	Karl Cox
Henry Fabian	Connie Benwell	Matthew Fraser	Dot Desjarlaris
Chris Heron	Katarina Carthew	Jennifer Fresque	Lauren Fabian
Erin Kelly	Michel Labine	Cec Heron	Derek Faria
Brad Laviolette	Gabriel Lafferty	Tim Heron	Jeannie Marie Jewell
Richard Mercredi	Kerry Pippy	Pete King	Rhona Kindopp
Pat Simon	Sarah Rosolen	George Lafferty	Victor Marie
	Jeff Shatford	Peter Paulette	Lena McKay
	Wayne Starling	Loretta Ransom	Lloyd Norn
	John Tourangeau	Juanetta Sanderson	Richard Simon
			Tom Unka

Public Information Session Meeting List – Fort Smith, March 2, 2011

Sunny Ashcroft
Adam Bathe
Elizabeth Beaulieu
Jack Bird
John Blyth
Ivan Bourque
Brad Brake
Bozena Breznik
Betty Chinna
Genevieve Cote
Karl Cox
Louise Cumming
Andrea Czarnecki
James Darkes
Marie Darkes
Cindy Desjarlais
Michelle Douglas, Metis
Sholto Douglas
Craig Faulkner
Darrell Fraser, Aurora Research Institute
Matthew Fraser, Metis
Jennifer Fresque
Glen Freund
Ruth Gal
Jim Green
Alex Hall
Debbie Hansen
Lisa Hudson
Tracey Hutton
Jessica Hval
Brenda Johnson
Stephen Kakfwi
Mike Keizer
Erin Kelly
Rob Kent
Dale Kirkland
Ib Kristensen
Aleda Lafferty
Steve Lafferty
Stu Macmillan
Victor Marie
Debbie McArthur
John McKinnon
Richard Mercredi
Grank Paziuk
Leslie Rankin
Norris Ricketts
Doug Robertson
Juanetta Sanderson
Jeff Shatford
Richard Simon
Kevin Smith
Marie Swanson
Sylvie Tordiff
Rob Tordiff
Jack Van Camp
Hannah van der Wielen
Sjoerd van der Wielen
Jacques van Pelt
Tony Vermillion

Appendix 2. Workshop Agenda

Goals and Objectives: This workshop is being held to gather input from communities on monitoring the health of the Slave River and Slave River Delta. The workshop will provide participants with an opportunity to:

- Identify key issues and concerns about the conservation and use of aquatic resources in the Slave River Basin;
- Share information on the monitoring that is currently being done to evaluate environmental conditions in the NWT section of the Slave River Basin;
- Identify and evaluate the physical, chemical, and biological indicators that could be used to assess ecosystem health (these indicators are called ecosystem health indicators); and,
- Provide advice and guidance on the role of community-based monitoring for assessing the health of the Slave River and Slave River Delta.

We anticipate that the results of this workshop will provide guidance for designing and refining monitoring programs to assess the health of the Slave River and Slave River Delta and for addressing the interests and needs of communities in the watershed.

AGENDA

Workshop on Monitoring the Health of the Slave River and Slave River Delta

Day 1 -- Tuesday, March 1, 2011 **9:00 a.m. – 5:00 p.m.**

9:00 – 10:00	Opening Prayer Welcome and Introductions Overview of Workshop Goals and Objectives	*Elder* *Don MacDonald - Facilitator* *Don MacDonald - Facilitator*
10:00 – 10:30	Water Stewardship Strategy - Keys to Success	*Erin Kelly -ENR and Jennifer Dallman-Sanders - INAC*
10:30 – 10:45	*Break (Refreshments will be provided)*	
10:45 – 11:30	The Importance of Water Resources of the Slave River Basin and Overview of Source Water Protection Initiatives	*Andrea Czarnecki - INAC and Loretta Ransom - ENR*
11:30 – 12:00	Water Quantity Monitoring in the Slave River Basin	*Derek Faria - INAC*
12:00 – 1:00	*Lunch (Provided at Roaring Rapids Hall)*	
1:00 - 2:15	Break-out Session on Water Quality and Quantity Issues and Concerns in the Slave River Basin	*Don MacDonald - Facilitator*
2:15 - 2:45	Report on Issues and Concerns Discussion	*Working Group*
2:45 – 3:00	*Break (Refreshments will be provided)*	
3:00 – 3:30	Design and Implementation of the INAC Slave River Environmental Quality Monitoring Program	*Juanetta Sanderson - INAC*
3:30 – 4:00	Overview of the Environment Canada Monitoring Program at Fitzgerald	*Kerry Pippy - EC*
4:00 – 4:30	Overview of the ENR Slave River Mink Contaminants Program	*Karl Cox – ENR*
4:30 – 5:00	Overview of Results of Day 1 Closing Prayer	*Don MacDonald - Facilitator* *Elder*

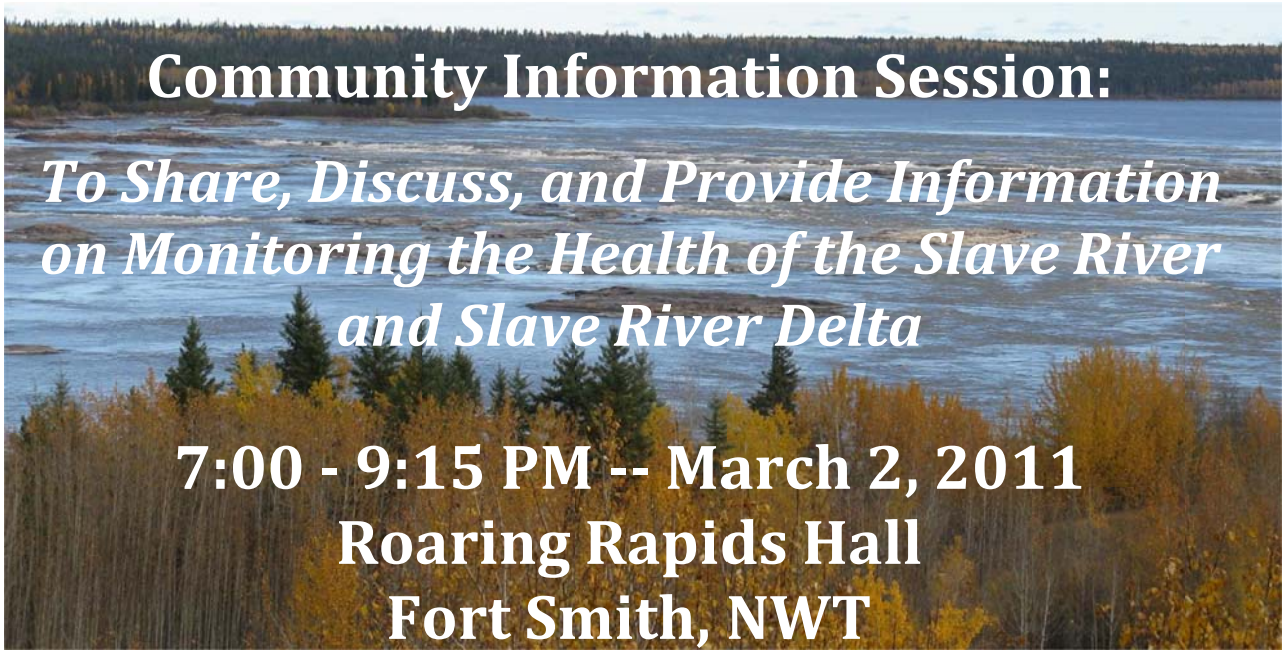
Key to Abbreviations: ENR – Environment and Natural Resources, GNWT; INAC – Indian and Northern Affairs Canada; EC – Environment Canada

AGENDA

Workshop on Monitoring the Health of the Slave River and Slave River Delta

Day 2 -- Wednesday, March 2, 2011 **9:00 a.m. – 4:45 p.m.**

9:00 – 9:15	Opening Prayer Welcome and Objectives of Day 2	*Elder* *Don MacDonald - Facilitator*
9:15 – 9:35	Potential Aquatic Ecosystem Health Indicators for the Slave River and Slave River Delta	*Katarina Carthew - ENR*
9:35 – 10:30	Break-out Session to Identify Aquatic Ecosystem Health Indicators (AEHIs) What should be Measured? Why should we Monitor each AEHI? Where should we Monitor each AEHI? When should we Monitor each AEHI?	*Don MacDonald - Facilitator*
10:30 – 10:45	*Break (Refreshments will be provided)*	
10:45 – 12:00	Break-out Session on AEHIs (continued)	*Don MacDonald - Facilitator*
12:00 – 1:00	*Lunch (Provided at Roaring Rapids Hall)*	
1:00 – 1:30	Report on Aquatic Ecosystem Health Indicators	*Working Group*
1:30 – 1:40	Overview of the Slave River Partnership	*Erin Kelly - ENR*
1:40 - 3:00	Break-out Session to Identify the Role of Communities in Ecosystem Health Monitoring	*Don MacDonald - Facilitator*
3:00 – 3:15	*Break (Refreshments will be provided)*	
3:15– 3:45	Report on Role of Communities in Ecosystem Health Monitoring	*Working Group*
3:45 – 4:15	Open Discussion	*All*
4:15 – 4:45	Summary of Workshop Results Next Steps Closing Prayer	*Don MacDonald – Facilitator* *Erin Kelly – ENR and Juanetta Sanderson – INAC* *Elder*



Goals and Objectives

This Information Session is being held to share, discuss and provide input on monitoring the health of the Slave River and Slave River Delta.

Information Session Agenda

7:00 - 7:15 **Opening Prayer** (*Elder)*
Welcome (*Erin Kelly - ENR and Juanetta Sanderson - INAC*)

7:15 - 8:00 **Dinner (To be Provided)**

8:00 - 8:20 **Overview of Results of Workshop on Monitoring the Health of the Slave River and Slave River Delta** (*Don MacDonald - Facilitator*)

8:20 - 9:00 **Discussion on Ecosystem Health Indicators for the Slave River and Slave River Delta** (*Don MacDonald – Facilitator)*

9:00 – 9:15 **Next Steps** (*Erin Kelly - ENR and Juanetta Sanderson - INAC*)
Closing Prayer (*Elder)*

Focus Questions for the Workshop on Monitoring the Health of the Slave River and Slave River Delta

March 1 and 2, 2011
Fort Smith, NWT

1.0 What are the human activities that could adversely affect the health of the Slave River and Slave River Delta, now and in the future?

2.0 How could the health of the Slave River and Delta be adversely affected by these human activities?

3.0 What characteristics of the ecosystem should be measured to provide information on the ecosystem health indicators?

4.0 Where and when should these monitoring activities take place?

5.0 How can communities best contribute to such monitoring programs?

Appendix 3. Overview of the Slave River and the Slave River Delta

The Slave River is the largest Alberta-NWT transboundary river and an important part of the Mackenzie River Basin. The Slave River is 440 kilometres (km) long and flows from northeastern Alberta into the Northwest Territories (NWT). It draws its flow from the Peace River, Athabasca River and Lake Athabasca catchments located in the provinces of Alberta, British Columbia and Saskatchewan. All of the water flowing through the upstream catchment area ultimately enters the Slave River and the NWT.

Figure A3-1. Satellite images over the Slave River Delta and Great Slave Lake. Source: Google Earth 2010.

The Slave River is formed where the Peace River and the Rivière des Rochers come together. From the Peace-Athabasca Delta, the Slave River flows north past Fort Fitzgerald before crossing into the NWT at Fort Smith. The river falls 35 metres between Fort Fitzgerald and Fort Smith as it flows through a series of four major rapids. These are: Cassette Rapids; Pelican Rapids; Mountain Rapids; and, Rapids of the Drowned. The river then flows about 300 km north to where it forms the Slave River Delta and flows into Great Slave Lake.

The Slave River Delta lies within the southeastern portion of Great Slave Lake, immediately northeast of Fort Resolution (Figure A3-1). It covers an area of 640 square kilometres (km^2). The active portion of the Delta covers an area of approximately 75 km^2. It stretches for 20 km along the south shore of Great Slave Lake and extends 10 km to the head of the Delta in the south. The Slave River Delta, like all delta ecosystems, depends on the continued deposit of fresh sediment and periodic flooding to maintain its biological productivity. It provides essential habitat for numerous species of mammals, fish and waterfowl.

The Slave River and its Delta draw flow from a catchment area of 613 000 km^2, with three sub-basins. They are the Peace River, the Athabasca and the Slave River sub-basins. About 66% of the total Slave River catchment area is located within Alberta, with 24% in British Columbia and10% in Saskatchewan. Less than 1% of the Slave River catchment area is located within the NWT.

Industrial activity in the upstream portion of the Slave River catchment is extensive and has increased during the past decade (Figure A3-2). Predominant activities include oil sands operations, other mining activities (including coal and uranium mining), forestry, pulp and paper mills, hydro development, conventional oil and gas development, and agricultural operations.

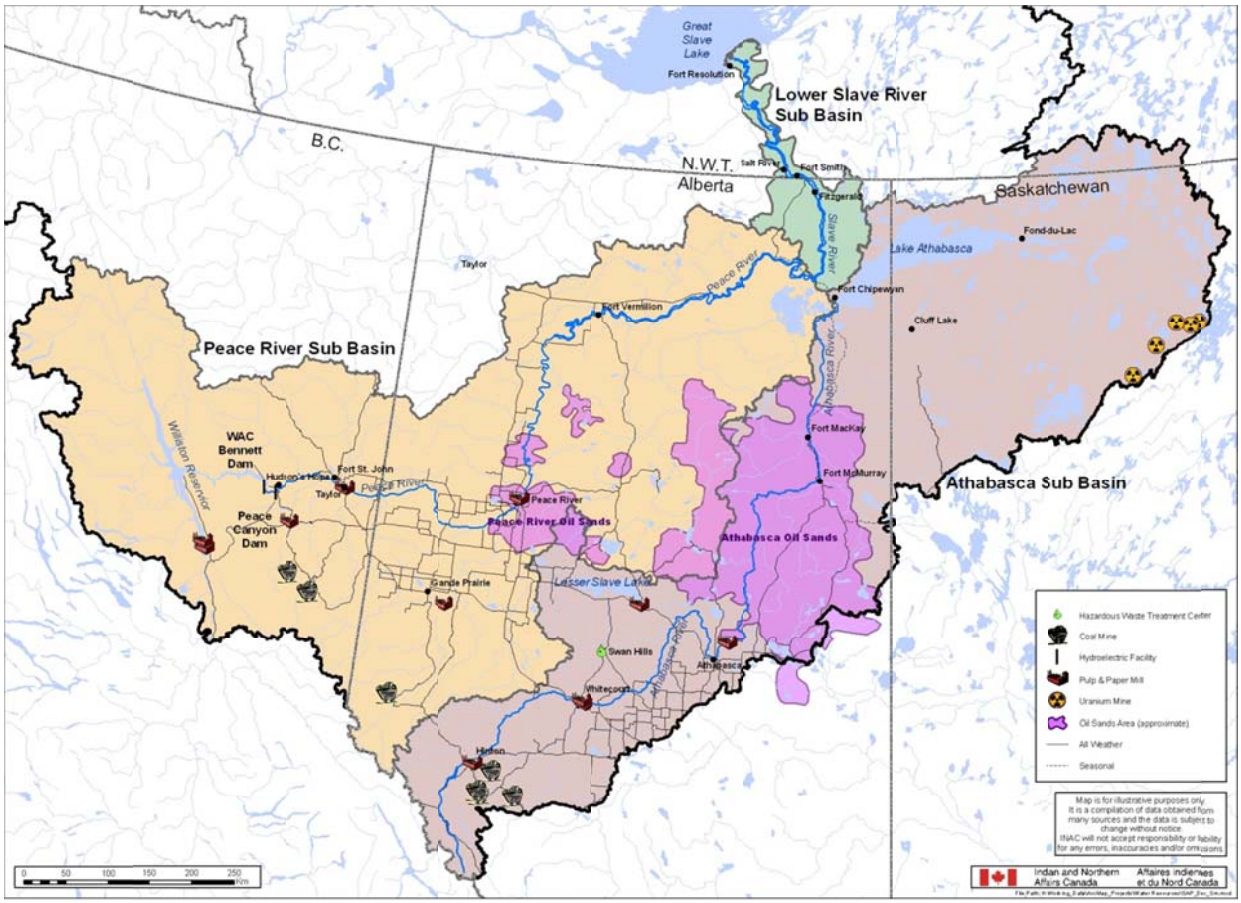


Figure A3-2. Current activities in the Slave River basin excluding oil and gas and oil sands operations. Source AANDC.

Northerners have raised concerns for many years about the cumulative impacts of these upstream activities. To understand cumulative impacts to the Slave River and Delta, the effects of ongoing and future development activities must be considered together. The implications of climate change and natural disturbance must also be considered as these contribute to changing water levels, water flows and water chemistry.

Many people are concerned about contamination of the river from oil sands development and the processing of bitumen producing a variety of wastes that can be released into the environment. The close proximity of tailings ponds to the Athabasca River raises concerns that the tailing ponds may be leaking into the river. The removal of top soil and overburden is another concern. The removal of top soil can result in erosion and cause naturally-occurring organic compounds to enter the river. Air emissions from the oil sands processing are another concern for people living in the Slave River and Delta area.

Concerns have also been raised about changes in the flow of the Slave River and low water levels in Great Slave Lake with respect to hydro developments in British Columbia.

Pulp and paper operations have been a concern of the people living on the Slave River and Delta for more than 20 years. They worry about the organic contaminants in the effluents being discharged into the water.

The people living on or near the Slave River and Delta are worried about the quality and quantity of the water and the health of wildlife and people who depend on the water. This is especially relevant in the North, given the subsistence lifestyle and the close connection to the land that still exists among the people.

Appendix 4. Overview of Aquatic Monitoring Activities in the Slave River and Slave River Delta

A4.1 Introduction

Monitoring represents a key element of effective environmental assessment and management programs. Water quality and water quantity monitoring has been conducted in the Slave River and/or Slave River Delta for over 50 years. An overview of the historical and ongoing monitoring activities is provided in this appendix.

A4.2 Water Quantity Monitoring

The baseline water quantity monitoring program in the Slave River basin forms part of the National Hydrometric Network across Canada. The hydrometric data described in this workshop report are available online at www.wateroffice.ec.gc.ca, including data for Great Slave Lake, the Slave River, and its tributaries. Some of the cycles and trends in the Slave River data since monitoring of its annual discharge began in 1960 are highlighted herin. Links are also made with trends and cycles in the downstream Great Slave Lake and the upstream Peace and Athabasca tributaries.

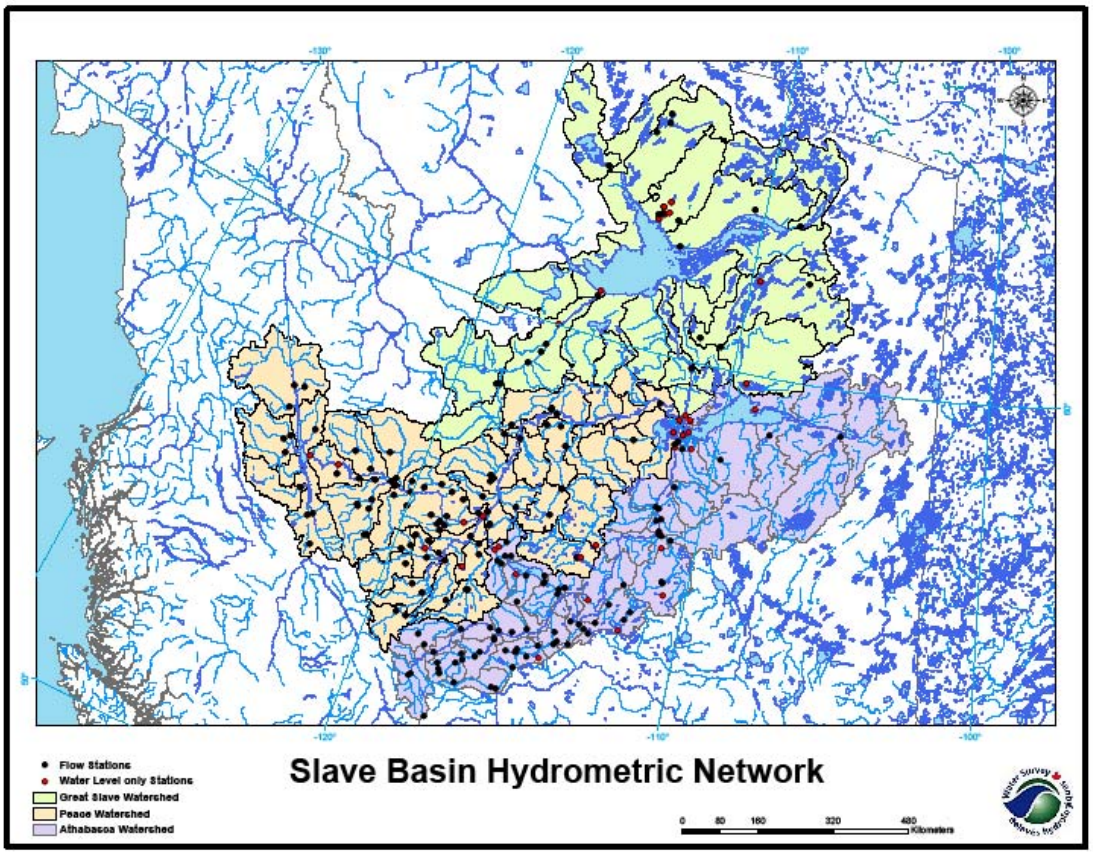


Figure A4-1. About 152 active network stations within the Great Slave Lake watershed are shown in this figure, where level and flow stations are colour-coded.

Source: Water Survey Canada, Yellowknife.

Hydrometric data can be used for many purposes. Flow data are useful in designing infrastructure around streams, such as stream crossings by pipelines, or roadway crossings (bridges or culverts). Flow and associated water-level data are also useful to transportation departments, for forecasting conditions for ferry and barge traffic. Federal, provincial, and territorial jurisdictions use flow data for administering water management agreements. Hydrometric flow data are also used to assess the potential for hydro-power generation. Long-term data series support for analyses of climate trends, modeling of ice jams, and assessing flood frequency.

The current Fort Fitzgerald station was established primarily to collect data for transportation and navigation purposes. Initially, data were collected manually (i.e., 1921-22, 1930-31, and 1953-58). An automatic recorder was installed in 1959 at the dock at Fort Fitzgerald. These data have been used in assessment studies for hydro-power development (Alberta Power Slave River Studies 1983). These data are also used as part of a long-term Slave River monitoring project to monitor contaminants originating from upstream oil sands and pulp mill activities.

The hydrometric data in this appendix are presented in two ways. First, there are the graphs showing daily measurements taken during specific years (e.g., example 2009). Second the minimum, maximum, and average flows or levels experienced over a given timeframe are presented (example: 1939-2009; 70 years). The minimum and maximum values are the extreme highs and lows recorded for each calendar day over many years. The average of all flow rates or water levels recorded over time is called the mean.

Record low flows were observed on the Slave River through July and August of 2010 and, intermittently from September to November of that year. Great Slave Lake also had record low water levels intermittently between August 2010 and January 2011. Over 75% of Great Slave Lake inflow is from the Slave River, so the lake level is affected more by flows in the Slave River and its tributary basins (Peace and Athabasca in Alberta) than it is by local rainfall in NWT. The following graphs illustrate these low water levels as measured on Great Slave Lake (Figure A4-2) and in the Slave River at Fitzgerald (Figure A4-3 and A4-4).

Data from the flow station on the Slave River at Fitzgerald (Alberta) can be seen below. Figure A4-3 shows that extremely high flows were observed both before (1921) and after (1974) construction of the W.A.C. Bennett Dam (completed in 1967). Data for 2009 and 2010 are also graphed here. The 2009 data indicate sharp increases in flow were observed in both early May and mid-July of that year. The 2010 data can be seen dipping intermittently below the lowest recoded levels between 1959 and 2009.

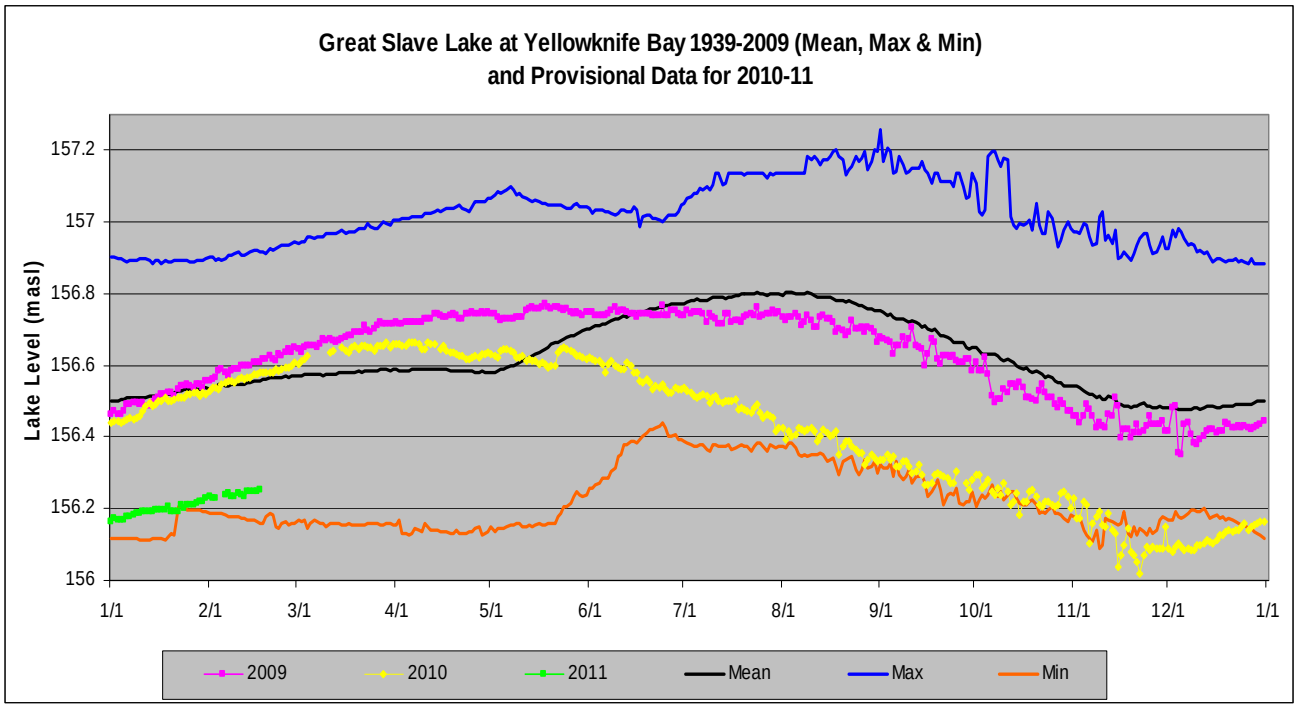


Figure A4-2. The level data above from Yellowknife Bay show the means and extremes of daily lake levels from 1939-2009. Daily observations for 2009, 2010 and the start of 2011 are also shown for comparison. Source: Water Survey of Canada, Yellowknife.

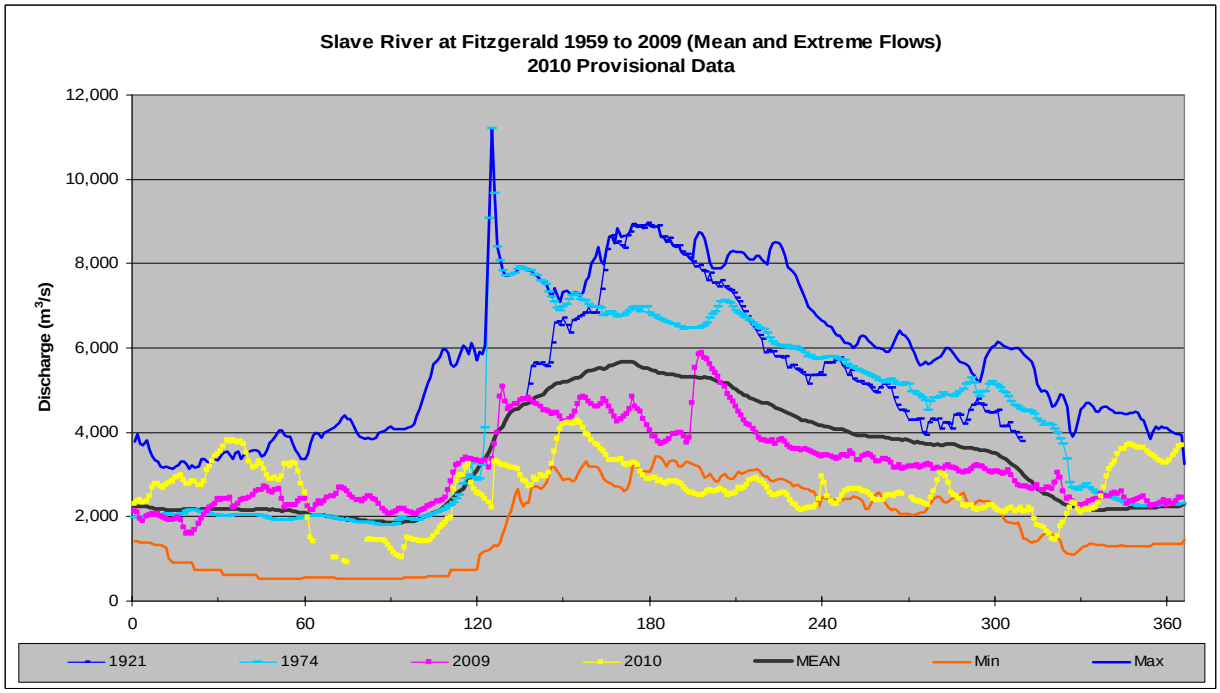


Figure A4-3. Slave River at Fitzgerald 1959- 2009 (mean and Extreme Flows). Source: Water Survey of Canada, Yellowknife.

Figure A4-4 compares the average pre-dam flow conditions to the average post-dam flow conditions in the Slave River at Fitzgerald. These data do not include the four years between 1968 and 1971 when the Williston Lake reservoir was being filled. Of important note is the substantial difference between the pre-dam and post-dam periods, which shows that regulation of water flow for hydropower generation at the Bennett Dam has resulted in an increase in winter flows and a decrease in summer flows on the Slave River.

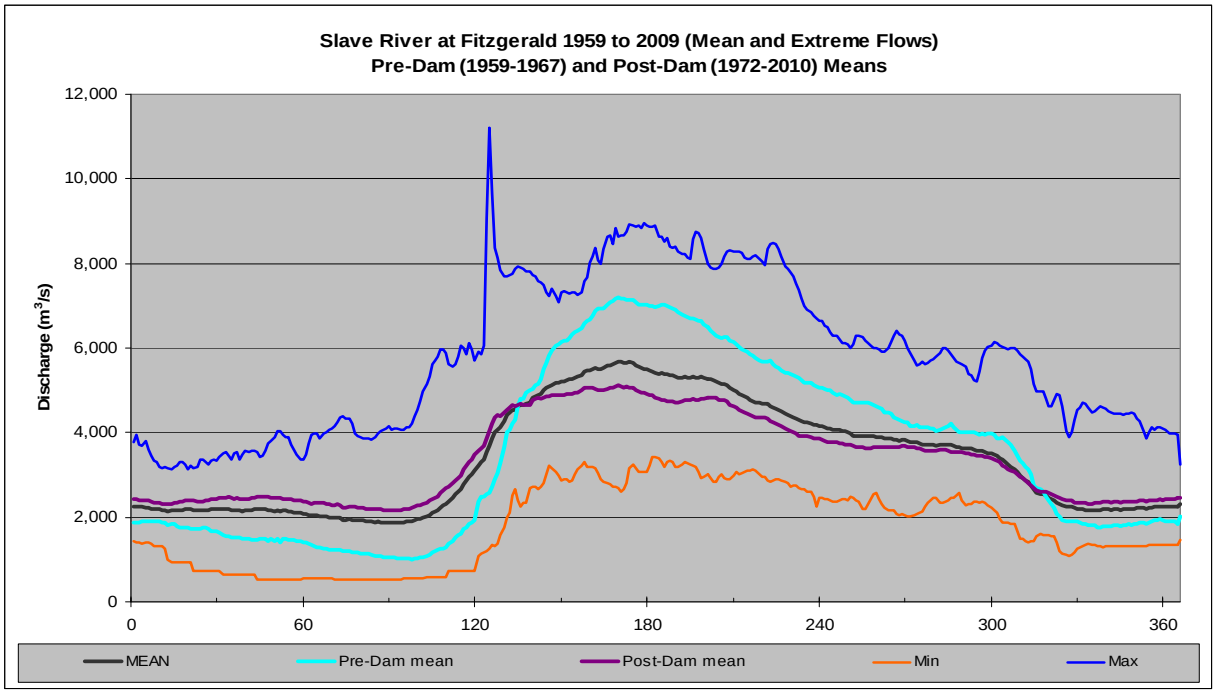


Figure A4-4. Slave River at Fitzgerald. Pre-dam and post-dam.
Source: Water Survey of Canada, Yellowknife.

Upstream from Fitzgerald in the lower Peace River sub-basin, observations of streamflow have been recorded at Peace Point since 1959. Upstream from Fitzgerald in the lower Athabasca River sub-basin, streamflow data have been collected from the gauge below the town of Fort McMurray since 1957. Observations at both gauges show the Athabasca and Peace Rivers rising sharply in mid-July of 2009. This indicates there was a rainstorm that affected both the Peace River and Athabasca River, which then affected the Slave River downstream as noted earlier (Figure A4-3).

Further upstream in the Peace River sub-basin, above the Bennett Dam, daily reservoir levels are available since 1976, along with daily inflows from ten reservoir tributaries gauged following the 1960's to provide data for reservoir management. Real-time data for 2010 were presented at the workshop, showed that record lows were observed during 2010 for many of these gauges. Real-time data in that presentation are provisional and subject to change.

Historical data were also analyzed for evidence of trends over time. Variations in Great Slave Lake daily lake levels (1934-2010) before 1968 are entirely due to seasonal and annual climatic variability. During this pre-dam period before regulation, a general (1934-1967) upward trend in lake levels was observed. The filling of Williston Reservoir took place from 1968 to 1971. The 1972-2010 post-dam period is marked by a general

downward trend in Great Slave Lake levels. This latter period exhibits a pattern of seasonal and annual variations which is different than the pattern observed during the earlier, pre-dam (1934-67) period.

Overall, decreasing trends in water flows are indicated by average annual flows upstream at the Fort McMurray and Peace Point gauges, respectively. This has been observed over the 40 to 50 years of data collected.

Farther upstream in the upper Peace River tributaries, over 50 years of data is available from the Smoky River gauge at Watino and the Peace River gauge at Hudson Hope. A decreasing trend in water flows is again observed in annual data from the Smoky River gauge at Watino. The Smoky River is unregulated and its basin above the gauge lies mostly in the foothills.

An upward trend in flows is observed in data from the Peace River gauge at Hudson Hope, which is just downstream of Bennett Dam. The Peace River is completely regulated at this location. Although the filling of Williston Lake reservoir during 1968-1971 resulted in a sharp decrease in the average annual flow observed for 1968, the overall upward trend observed is a reflection of the location of this tributary basin in a high-elevation mountain environment, which experiences a wetter climate and a different response to climate change than what is seen in the foothills and plains.

Although it is true that the regulation of the Slave River has had an impact on the water levels of both the river and Great Slave Lake, much of the available data presented at the workshop and discussed here suggest that the record lows observed on the Slave River and on Great Slave Lake in 2010 are, to some extent, related to climatic variability and climate trends in the watersheds.

A4.3 Water Quality Monitoring

Water quality monitoring has been conducted at three locations on the Slave River since 1960. Brief summaries of these water quality monitoring programs are provided in the following sections of this appendix.

A4.3.1 Slave River at Fitzgerald Water Quality Monitoring Program (1960-present)

Environment Canada (EC) has operated the Slave River at Fitzgerald Water Quality Monitoring Program since 1960. The water quality sampling location is located near Fort Fitzgerald in Alberta, approximately 20 km upstream from Fort Smith. During open water, surface water samples are collected just below the waters' surface from a boat at mid channel. In winter months, a hole is drilled through the ice several metres offshore to collect the water sample. Water quality sampling at Fitzgerald was initiated to document baseline transboundary water quality conditions. During the long record for this site, samples have been collected from two to 13 times a year. Presently, samples are routinely collected eight times per year. During the open water season, samples are collected in May,

July, September and October. During the winter, under ice samples are collected in December, February, March and April. The surface water samples are analyzed for routine parameters, such as pH, turbidity, conductivity, as well as major ions, nutrients, and metals.

A4.3.2 Slave River at the Mouth Water Quality Monitoring Program (1982-present)

The Slave River at the Mouth Water Quality Monitoring Program is operated by staff from the South Mackenzie Sub-District Office (AANDC) in Fort Smith. Water quality sampling was initiated to document baseline water quality conditions in the Slave River. The water quality sampling location is located between Nagle Channel and Old Steam Boat Channel (just before the Slave River divides into the Delta). The surface water quality samples are collected from mid river from the float of a floatplane. Since 1982, surface water samples have been routinely collected two times per year (i.e., in the spring and fall; typically May and October). The surface water samples are analyzed for routine parameters, such as pH, turbidity, conductivity, as well as major ions, nutrients, and metals.

Figure A4-5. Water quality sampling on the Slave River. Source: Wayne Starling

A4.3.3 Slave River at Fort Smith Water Quality Monitoring Program (1982-present)

The Slave River at Fort Smith Water Quality Monitoring Program is operated by staff from the South Mackenzie Sub-District Office (AANDC) in Fort Smith. The water quality sampling was initiated to document baseline transboundary water quality conditions in the Slave River. Since 1982, surface water samples have routinely been collected two times per year in the spring and fall (typically May and October; Figure A4-5). The surface water samples are analyzed for routine parameters, such as pH, turbidity, conductivity, as well as major ions, nutrients, and metals.

A4.3.4 Slave River at Fort Smith Environmental Quality Monitoring Program (1990-present)

The Slave River at Fort Smith Environment Quality Monitoring Program was initiated by AANDC - Water Resources Division in 1990 due to concerns about upstream development. The sampling location is located mid-river at the base of the Rapids of the Drowned at the

town of Fort Smith. This program builds on the surface water quality sampling at Fort Smith described above.

The Slave River at Fort Smith Environmental Quality Monitoring Program (SREQMP: 1990-1995) was set up to:

- Learn more about water, suspended sediment, and fish quality in the Slave River;
- Address concerns of northerners about possible contaminants in the Slave River;
- Contribute to the water quality information and to track changes over time; and,
- Support the development of the Transboundary Bilateral Agreement between Alberta and the Northwest Territories.

During the first phase of the SREQMP, water, suspended sediment, and fish-tissue samples were collected. Water samples were collected monthly, suspended sediment samples were collected approximately four times/year, and fish-tissue samples were collected once a year. From 2000-2010, only water and suspended sediment samples were collected every five years. The water and suspended sediment data collected from 2000-2007 is referred to as the Follow-Up Study.

Figure A4-6. Slave River below Rapids of the Drowned. Source: A. Czarnecki

Water is analyzed for routine parameters such as pH, conductivity and turbidity, as well as major ions, nutrients, metals, and organic compounds (such as hydrocarbons, chlorinated compounds, and PCBs). Suspended sediment is analyzed for the same variables and also for dioxins and furans. Compounds were selected based upon current knowledge of the composition, fate, and effects of the effluents from the developments upstream of the basin. The organic compounds, such as hydrocarbons and chlorinated compounds, are analyzed to address questions and concerns regarding upstream activities, such as oil sands operations, oil and gas developments, pulp mills, municipal effluent, forestry, and agricultural practices.

The SREQMP Follow-Up Study (2000-2007) results will be available in winter 2011/2012. The results will:

- Identify any organic compounds found in the river (water and/or suspended sediment);
- Determine if any of the metals and the organic compounds exceed the recommended guidelines; and,
- Describe any changes in water quality over time (trends).

Appendix 5. The NWT Water Stewardship Strategy and the Slave River and Delta Partnership

The ENR and AANDC, guided by an Aboriginal Steering Committee, released Northern Voices, Northern Waters: NWT Water Stewardship Strategy (Strategy) in 2010. The Strategy is a collaborative approach to responsible water stewardship. NWT Water Stewardship: A Plan for Action 2011-2015 builds upon the Strategy. It is the result of multiple water-partner meetings, public input, and multi-agency workshops. It represents the interests of the GNWT, federal government departments, Aboriginal governments, environmental non-government organizations, regulatory bodies, industry, NWT residents and interested parties across the North.

The Strategy encourages water partners and water managers to work together in a collaborative manner. It supports the sharing of information (traditional, local and western science) to ensure we make the best water-related decisions. An important component in the Strategy is ensuring communities have the opportunity to be actively involved in monitoring and planning initiatives.

In 2010, a Slave River and Delta Partnership (Partnership) was formed to support communities in developing community-based monitoring programs. The Partnership also promotes and supports research and monitoring activities to address concerns and questions raised by community members. The Partnership currently includes members of the following organizations:

- Fort Resolution Métis Council;
- Deninu K'ue First Nation;
- NWT Métis Nation;
- Fort Smith Métis Council;
- Smith's Landing First Nation;
- Salt River First Nation;
- GNWT Department of Environment and Natural Resources;
- Fisheries and Oceans Canada;
- Environment Canada;
- Parks Canada (Wood Buffalo National Park);
- Aboriginal Affairs and Northern Development Canada;
- Aurora Research Institute;
- Aurora College;
- University of Waterloo;
- Wilfrid Laurier University; and,
- Center for Indigenous Environmental Resources.

Appendix 6. Candidate Aquatic Ecosystem Health Indicators for the Slave River and Delta

The ecosystem approach to watershed management is an important component of the NWT Water Stewardship Strategy. Key elements of an ecosystem-based approach are:

- Including people as a part of ecosystems;
- Ensuring the health and diversity of ecosystems;
- Ensuring that human uses of the ecosystems are sustainable; and,
- Understanding ecosystem structure, function and processes, along with how ecosystems respond to environmental disturbances; and,
- Incorporating this understanding of the ecosystem into decision-making processes.

An ecosystem-based approach provides for a holistic approach to monitoring. This is similar to, and reflected in, Aboriginal people's connections to the land and understanding of the linkages between water, plants, animals, and humans. For aquatic monitoring, an ecosystem-based approach typically incorporates:

- *Physical Indicators*: Provide a picture of the health of water in an aquatic ecosystem by studying the water quantity (such as water flow and water levels), sediment abundance and deposition, and water temperature.
- *Chemical Indicators*: Provide information about the levels of compounds in the water, and sediment, and biota. Examples of chemical indicators are levels of iron (Fe), aluminum (Al), and polycyclic aromatic hydrocarbons (PAHs) in water, sediment or fish tissue. Both physical and chemical indicators provide information about the condition of the river and delta where animals and plants are living.
- *Biological Indicators:* Provide information about the structure and function of the ecosystem and how the aquatic ecosystem is being impacted by various disturbances (such as changing chemical and physical conditions). Examples of biological indicators are bugs, plants, and animals. Studying the structure and function of the aquatic ecosystem and how the plant, animal and insect species live and interact with one another, provides a more complete picture of the overall health of the ecosystem.
- *Traditional Knowledge*: Plays an important role in completing the picture of the health of the aquatic ecosystem by providing information about what the ecosystem looked like in the past; about human's relationship to the land and the water; human health, and about how the ecosystem has changed over time in response to natural and man-made disturbances.

The process of choosing aquatic ecosystem health indicators is important for ensuring that the monitoring program is able to generate the information needed and able to answer the key questions of the specific monitoring programs. Criteria help to define what is important and to guide the process of choosing indicators. The following questions provide a basis for determining if a potential indicator should be included in an aquatic ecosystem-health monitoring program:

- Is the indicator sensitive to changes in the environment?

- Is the indicator important to the local people who use the ecosystem?
- Is the indicator a source of food, used in traditional practices, or a source of income?
- Is the indicator measureable (there are several ways to measure an indicator)?
- Is the indicator a good measure of anticipated change?
- Does the indicator act as a good early warning for a disturbance?
- Does this indicator link easily and clearly to other parts of the ecosystem? By choosing indicators that link closely to other parts of the ecosystem, monitoring programs can generate information needed to evaluate the status an entire ecosystem with relatively few indicators.

Aquatic ecosystem health indicators can be found almost anywhere in the aquatic environment. This includes plants found in and around the water, animals living in and around the water (such as beaver, mink, moose, and muskrats) and bugs living in the sediment (benthic invertebrates). Monitoring plants can document changing vegetation patterns due to a shifting climate or changes in flooding. Plants can also be sensitive to contaminants and can be monitored to see the types and quantities of contaminants that are accumulating. Animals living both in and near the water are also potentially good indicators of ecosystem health. For example, mink are sensitive to contaminants and can be exposed both in water and on the land primarily, in their diet.

Fish are also sensitive to contaminants and to changes to water levels and temperature. For example, lake trout are a cold-water fish and are sensitive to increases in water temperature. Some contaminants accumulate in fish organs, such as the liver. Fish organs, numbers of a species, incidence of deformities, and taste and texture of the fish are also examples of things to measure for assessing ecosystem health.

Figure A6-1. Mallard.
Source: Ducks Unlimited

Because of the waterfowl that migrate annually either through or to the Slave River Delta area, it has been classified as an important area for migratory birds (www.ibacanada.com). Waterfowl are sensitive to changes in wetlands. Documenting what these migratory birds eat and where they go, and relating this information to changes in the delta can contribute to assessing aquatic ecosystem health. Contaminant studies can be done on migratory birds. This type of monitoring provides information on the general level of exposure the birds receive. It does not always provide information about the contaminants found in specific areas because they travel long distances. Exposure of local contaminants can be detected by monitoring the eggs of nesting migratory birds. This method can provide information on the types of contaminants the birds are being exposed to in and around the nesting grounds. Indicators can be measured at the population and individual levels:

- *Abundance (how many)* - Monitoring programs can focus on measuring the abundance of an indicator species to see how successfully they are surviving in an area. Indicators include: numbers of animals, colonies, eggs, push-ups or any number of other indicators that can be counted to assist in determining the size of the populations;
- *Where the indicator species is living* - Monitoring programs can track where migratory birds come back to every year or where muskrats and beavers are living compared to where they have been in the past. These changes can be mapped over time to determine habitat and population status; and,
- *At the individual level* - Individual indicator species can be sampled to look at what contaminants it is being exposed to, the types of diseases that occur or the types deformities in the animals.

Once a list of indicators has been established they can be evaluated and prioritized. The indicators deemed most important can then form the foundation of the monitoring program. ENR has developed an "indicator poster" to assist in the discussions regarding indicators. The poster is a river transect with a number of suggested indicator species (see Figure A6.2)

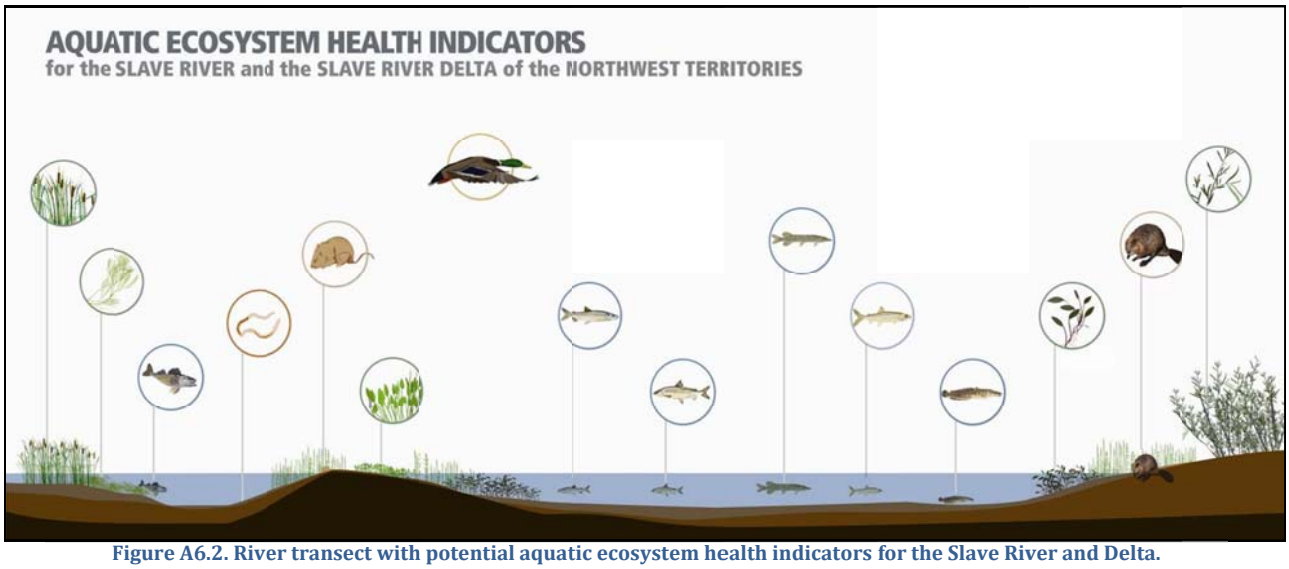


Figure A6.2. River transect with potential aquatic ecosystem health indicators for the Slave River and Delta. Source: Metagrafixdesign 2011.

This workshop gave participants the opportunity to think about the river in terms of types of monitoring needed to measure the health of the river and delta aquatic ecosystems. By identifying important criteria and prioritizing potential indicators, participants began developing the foundation for a more holistic monitoring system. Aquatic ecosystem health indicators can:

- Be included in a community-based monitoring program,
- Play an important part in the preparations for the negotiations of transboundary water agreements; and,
- Be considered in prioritizing changes for an updated AANDC Slave River Environmental Quality Monitoring Program.

Appendix 7: Detailed Results of Break-Out Session 1.

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

General Comments:

The interconnectedness of it all. It is all webbed together, cumulative – each activity has its impacts, but they all affect the environment. All living things

Human Activity and Associated Impacts

Oil Sands / Oil &Gas Activities

Impacts on the Land

- The size of the operation
- Changing natural environment to industrial / disturbances

Impacts of Impacts of the Camps

- Waste and Sewage from human use

Impacts of Humans

- Increased cancer in humans and animals
- Health concerns for those that live along the Athabasca and Slave rivers.
- Birth defects
- Loss of way of life

Impacts of Processing

- Use of chemicals
- Removal of top soil and over burden
- Steam impacts to ground water and earth are unknown

Impacts on Air Quality

- Stack emissions and airborne pollutants / dust
- Precipitation of air emissions into water bodies and ground water
- Concerns about refineries are also included in these comments

Impacts on Animals

- Contaminants in the Food Chain
- Fish – lesions, increased cancers in fish, deformed fish
- Birds, ducks
- Buffalo
- Muskrat
- Fauna
- Animal health including reproduction, lesions and survival

Impacts on Water Quantity

- Water use
- Including quantity taken from river
- Monitoring - They only monitor up-stream not down stream & only doing tributaries not the Athabasca
- Timing of water extraction because of habitat
- Are flow needs being met?
- Monitoring changes in the flow (including natural and from dams)
- There are lower water levels

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

Impacts of Tailings

- The lack of progressive management / reclamation
- Why are there no scrubbers?
- Leakage, spills, overflowing, dust, seepage in groundwater
- Why are tailings not consolidated?
- What is underneath the tailings? How deep do they go?
- Too close to the water

Impacts of Chemicals

- Pollutants in the rain, snow and water table
- Increased contamination
- Use of Fertilizers
- There are too many to list
- Discharge and unregulated effluent discharge (Suncor is grandfathered)
- Fracking uses hydrogen and other chemical mixes
- Fort Res has a high cancer rate from eating wild meat and fish from the land. – Need more annual testing.

Impacts of General Activities

- Ground water impacted by drilling – oil coming up & drilling muds
- Foot print from 'punching holes'
- Refineries – it is unknown if they have spills – What are the reporting mechanisms?
- Re-fracking and steam underground
- Is this use of steam and other chemicals impacting the ground water? Possible leaching?
- Spills – oil, gas, diesel, and blow-outs at the oil fields

Human Occupancy Activities

Impacts of Use of Water

- Increased water use
- Drawing from / on the system, municipal water use, trail building

Impacts of Population

- Increasing numbers of people means a fast rate of municipal growth, cities are getting larger and there are more:
- Pollutants
- Garbage
- Sewage – more people means more sewage lagoon effluents – the dilution factor changes in wet and dry seasons
- More people need more land so there are changes to the habitats
- More runoff in to water (sewage / landfills)
- Improper disposal of pharmaceuticals / medications

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

Impacts of General Activities

- Boating / cabins / hunting lodges
- Leakage from boats (oil and gas)
- Flushing sumps / holds from boats into water
- Boat launches
- Portages
- Municipal - waste water discharge and sewage lagoons
- Local sewage lagoons (Fort Res and Fort Smith)
- Grey water discharge from sewage – not knowing what is going into the water and its impact on fish / water
- Rock weirs in delta impacting water levels
- Spills
- Oil and leaks from vehicles leaking into snow and in melt
- Seepage from landfills – municipal and industrial
- Debris in River (garbage and machinery lost)
- Fishing (Commercial and Personal)
- Satellite debris on ice and in river
- Long range transport of contaminants from oil sands and other southern sources
- Potential reopening of transportation routes down the Mackenzie could lead to more local spills and invasive species
- Road salts

Forestry – Pulp and Paper

Impacts of Pollution

- Organics going into the water systems
- Increased nutrient levels
- Pulp mills adding bleach to paper – wood treatment chemicals (metals / clorophenols)
- Plankton like substance floating on surface (May into summer months)
- Contaminants that go into the water also affect the sediments and the biota
- Airborne pollution

Impacts of Forestry

- Logging changes the landscape
- No trees to purify - runoff is to fast – erosion increases – sediment increases and flow is affected
- Removes the natural filter
- Changes in fish habitat
- Increases in human access to broader areas
- Reduction on wildlife habitat through the chain of the ecosystem (people and animals)

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

WAC Bennett Dam

Impacts on Water Quality / Quantity

- Less water, less dilution of chemicals and effluents
- Mercury
- Some local residents won't drink the water from the Slave River – even after boiling
- Dam releasing water at the wrong times (see impacts muskrat / beaver)
- Low water levels in spring / summer
- Less flooding in the spring
- High water levels in the winter

Impacts on Navigation

- Limited access to hunting areas so trapping impacted
- 2 out of 15 channels are navigable by boat (fall 2010) because of sediment loading

Impacts on Sediments

- Decrease in sediment loading
- More disposition because water is moving slower
- More landsides because corners in rivers are being undercut

Impacts on Ice Quality

- Freeze up – not freezing like it used to
- Ice movements (riparian and inshore habitats)
- Open spots – uncertainty travelling on the ice of the water levels are low with currents in the delta.
- Ice road – Flooding of Peace River impacts winter road after construction
- Water releases by dam after natural freeze-up is causing double layer of ice separated by water. (see beavers / muskrats for related impacts)

Impacts on Fish

- Marks (blemishes) on the fish, spring pickerel – maybe from snow melt
- Whitefish – flesh is wet / not solid (mushy)
- Eggs are different – mud / blood inside – dried out
- Mercury in fish – people are advised to eat younger fish
- Spawning ground dried out and then flooded at the wrong time
- Water levels are so low affecting the sucker run
- Little buffalo river the Jackfish run by very little

Impacts on Beaver / Muskrat

- Decline in the populations
- The dam is releasing water after the beavers and muskrats build their winter homes and river freeze-up. This late flooding is causing a double layer of ice separated by water and drowning many muskrat and beaver in the river banks that can not escape.
- Decline in muskrat population- used to be thousands
- Beaver furs are not as nice - because of low water they are walking more on the ground and starving

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

Impacts on Trapping and traditional uses / access

- Trappers can not access the same areas because of low waters.
- Low waters and unnatural flooding are impacting the abundance and locations of traditional foods such as fish beaver and muskrat
- Can not longer access some traditional use areas or having to alter traditional transportation routes / methods
- Concern about the quality of traditional foods including
- Rabbits
- Muskrats
- Weasel
- Berries
- Herbal Medicines

Impacts on Vegetation

- Willow and small trees growing fast
- Soil has changed – no longer flooding in the spring – the whole delta has changed
- Berries dried up – impacts to moose, bear, people

Climate Change / Global Warming

Impacts on Weather Changes

- Precipitation cycle change lead to water level changes
- Warm winters with no snow and cold winters with lots of snow
- General snow changes – snow dust is different
- Difficulty in forecasting weather – planning difficult
- More and more severe storms (lightening where there never used to be any)
- Freezing rain
- Less / no flooding
- More forest fires (some are human caused – more access to remote areas)
- Changing flow conditions / low flows
- Water temperature is up affecting whole ecosystems
- Fish habitat
- Affects on wildlife, less furs
- More insect infestations
- Impacts animal birthing
- Changes to flora and fauna cycles
- Long range transport of pollutants / fallout of aerial emissions
- Ice changes
- Break up patterns – false break ups and freeze ups
- Freeze and thaw times affected
- Lake opening earlier by one month (way may 15 now June15) & River opening up earlier
- break ups are not getting bigger water
- General ice conditions are changing, less jagged

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

Impacts on Changes to the Land

- Access to traditional areas and domestic fishing areas has changes
- Physical changes to the earth including slumping, sink holes, permafrost
- Impacts on farming

Future Development – Hydro

Expected impacts

- Possible hydro development on the stave river
- Site C will affect everyone on the Slave River
- Water levels
- More impacts on animals
- Never see the Athabasca and Peace flood again
- Impact freezing because of flow changes
- Affect people both above and below the dam
- Access
- Traditional activities including medicine

Trans-boundary

No agreement

- No regulated
- NWT has no control over the impacts created by Alberta
- The agreement needs teeth – contravention of agreement: what can we do?
- Feds need to step up – because royalties don't show interest in slowing down

Old Contaminants

Historic impacts

- Caterpillar Machines sunk in water around Burnt Island (pulled one out 50 yrs ago – 20 yrs after sank)
- Old army deposits
- Leakage from transportation of ore and supplies (example – radio active materials / PCB at Bell Roc and Uranium on Great Bear Lake)
- Historic Uranium mining east shore of Lake Athabasca
- Barging of ore down river – trucked from Fitz to Bell
- Old army dumps – people are not aware of what is contained in them
- Bluish / purple water
- Need info from elders

Break-Out Session 1 -- Human Activities in the Slave River Basin

Question:

1. What are the human activities causing potential impacts to the Slave River and Delta?
2. Why do they matter to you?

Human Activity and Associated Impacts

Forest Fires

More fires

- More fires are human caused
- Global warming and associated storms are causing fires where there has never been fires before
- Bug infestations and low water tables
- Air Quality
- Dioxin in air
- Ash and Ash into run off affecting water quality
- Habitat – impacts to diversity with reforestation
- Affect winter range of caribou
- Fire retardants – ammonia / iron

Farming Agriculture

Practices

- Unknown if the agricultural sector water withdrawal is regulated
- Irrigation practices
- Changes in the landscape / runoff patterns– clearing land
- Animal operations
- Increased nutrient levels
- Antibiotics
- Increased CO2 and methane
- Pesticides and fertilizers from Peace County
- Impacts on plans and animals

Mining

Practices – Active and Historic

- Coal bed methane development – ground water contaminants
- Pine Point Not properly decommissioned – tailings ponds leaching and dust
- Now a processing plant for sulphur, coal and rare earth metals
- Tailings ponds – ground water affects – chemical additives
- Some are grandfathered
- Availability of metals to the environment once rock is broken up?
- Different kinds of mining – beryllium / Uranium City
- CO2 and carbon monoxide from the massive numbers of vehicles needed
- Contaminants in sediment in the delta – cancer reality
- Transportation of chemicals – What if a spill happens
- Impacts from changes are unknown – How do the individual metals impact the water?
- Abandoned mines – what is done to make sure they are stable

Appendix 8: Detailed Results of Break-Out Session 2.

Break-Out Session 2 -- Monitoring Priorities for the Slave River Basin

Question:

1. What are the indicators for measuring the health of the Slave River and Delta?
2. What would you measure and where/when would you find it?

General Comments:

Need a community collective within many communities, inviting trustworthy people to provide us with advice
People don't trust government
Need common language that people understand for these discussions
Need a map of the food chain and food web. Who is eating who? This needs answering.
What is natural change and what is man made? How do we answer this question?

Indicator Group/ Potential Ecosystem Health Indicator/Metric	When / Where you find it?
Fish	
- Jackfish – eat everything	- Are everywhere – spawn in spring
- Whitefish (flesh is mushy) – guts, tapeworms, spots, cysts, flesh, eggs	- Slave River
- Walleye or Pickerel – eggs, they eat everything, could be a good indicator - there are more then there used to be	- Anytime, any where – spawn spring
- Trout – guts	- Great Slave Lake – spawn spring
- Inconnu	- Slave River @ Smith, Resolution and Delta – spawn fall
- Suckers	- Salt River & Slave River – spawn fall
- Burbot / Loche – liver, eggs	- Fort Smith – spawn early winter
- General Measures	- General locations and timing for monitoring.
- Fish Back (spine)	- Are the fish safe to eat? Are the populations healthy?
- Guts / stomach and stomach contents – What are they eating?	- Need to use common names for fish
- Health Histopathy	- Can we get more tags where spawning?
- Lesions / tumours	- Compare monitoring results to studies elsewhere.
- Abundance	- Where
- Contaminants	- Rapids – impede the travel of fish. Fish only go above the rapids on high water years
- Numbers caught with abnormalities	- Eddies – anywhere along the river
- Food Chain for fish	- Come down river middle of March
	- Where they spawn and where they don't
	- Take the samples where locals fish
	- When
	- 4 time a year every year
	- Between Christmas and New Years starting November 1st

Break-Out Session 2 -- Monitoring Priorities for the Slave River Basin

Question:

1. What are the indicators for measuring the health of the Slave River and Delta?
2. What would you measure and where/when would you find it?

Indicator Group/ Potential Ecosystem Health Indicator/Metric	When / Where you find it?
Water Quality and Quantity	
- Water Quality	- Is the Water safe to Drink if boiled?
- Temperature	- Is the water quality and quantity sufficient to support the ecosystem functions?
- Turbidity (clarity)	- Monitor multiple locations from source to Slave River Delta – Above and beyond – including:
- Contaminants	- ½ way between Fort Smith and Fort Resolution
- Salty and Grey	- Close to the mouth of the main channel
- Foam	- Sloughs that drain into the river
- Industrial pollutants	- Open areas that don't freeze (flow locations and back water areas)
- Nitrates and nutrient levels	- Raw water well and treatment plan in Fort Resolution / Settling ponds in Fort Smith
- Algae	- The Peace River at Quatre Fourches just before entering the Slave River
- Crust at the edge of the shoreline when water retreats	- Near potential sources of contamination
- Municipal / community water sources	- Find a river similar or close to the Slave River with no development and also monitor to compare results
- Long range transportation of airborne pollutants	- Intake points 4 times a season –every season - Monitor every season – monthly would be better - Monitor in July and August also November and December when dam is releasing extra water
- Water Quantity	- Make sure to use municipal water operators for information
- Flow	
- Levels	
- Releases from dam	
- Measure the creeks going into the river	
- Monitor the locations of the channels in river	
- Changing sandbars	
- Precipitation	
- Seasonal distribution	
Human Health	
- Disease	- Exposure to contaminants – look at blood, hair, fatty tissues
- Cancer rates – various types	- Look in Fort Smith and Fort Resolution
- E. coli	- Fort Chipewyan cancer workshops

Break-Out Session 2 -- Monitoring Priorities for the Slave River Basin

Question:

1. What are the indicators for measuring the health of the Slave River and Delta?
2. What would you measure and where/when would you find it?

Indicator Group/ Potential Ecosystem Health Indicator/Metric	When / Where you find it?
Human Health (cont.)	
- General community / regional health patterns - Causes of death / disease - Exposure to contaminants - Beaver Fever (Giardia) - Traditional and non-traditional Activities - What are people comfortable eating, where are people comfortable drinking water from - How many people are drinking water - How many people are out on the land - How many people are drinking bottled water - Is the water safe to drink? - Where are the berries gone? - Are the fish safe to eat?	- Start with local health authorities - Need common language that people can understand
Ice + precipitation	
- Ice Quality - What is the ice composition? - Chemical quality - Sediments - Double ice from dam releases - Characteristics - jagged - Thickness - Safety - Break-up and Freeze up - Timing - Type - Snow and rain - Amounts - Texture of snow - Chemical quality	- Use TK and local knowledge to add info / data to collection - Core samples - Get a picture of what is falling from the sky (air borne) - At the Peace River - Quatre Fourches - Slave River up to the delta (at least 4 locations) - In winter monthly when it is safe to be on the ice
Vegetation	
- Contamination levels - Medicinal plants - Moose grass - Goose grass	- Use TK - Contamination levels - Trees – Core Samples - Berries Abundance and % of ground cover

Break-Out Session 2 -- Monitoring Priorities for the Slave River Basin

Question:

1. What are the indicators for measuring the health of the Slave River and Delta?
2. What would you measure and where/when would you find it?

Indicator Group/ Potential Ecosystem Health Indicator/Metric	When / Where you find it?
Vegetation (cont.)	
- Berries	- Nutrient levels, abundance of algae
- Trees – willow poplar, birch	
- Yellow Pond Lilly	
- Rat root	
- Cattail roots	
- Algae	
Insects (Benthic Invertebrates)	
- Fish Food	- Measure in Fall when water levels are lowest
- Changes in insect habits	- Measure in spring and summer when the bugs are most abundant
- Abundance	- In water, snyes, eddies, away from open water, at the edges of the water
- Species distribution	- Bees – TK knowledge – If bees build nests low there will be less snow. If bees build nests high there will be lots of snow that winter
- Toxicity of mud / sediments	
- Changes in what the fish are eating	
- Worms	
Aquatic Furbearers and other wildlife	
- Beaver	- In the spring
- Meat, tails, feet, kidney, liver and glands	- In delta along the river
- How many are killed by the changes in water levels caused by the late release (after freeze up) of water from Bennett dam (Drowning)	- Compare differences between pond beavers and river beavers
- Muskrat	- Snyes in the fall
- Population	- Sample in the delta
- Meat	- From march to may – they will travel in the fall when the water drops
- Are they safe to eat?	- Contents of push-ups
- Impacts of Bennett dam water releases after freeze up	
- Other Wildlife	- Sample where rabbits eat shoreline willows
- Bears	- Moose sampling in delta, lakeshore, side channels
- Rabbits – abundance, habitat use and availability	- During bring (June) and fall
- Moose – abundance, liver and marrow	

Break-Out Session 2 -- Monitoring Priorities for the Slave River Basin

Question:

1. What are the indicators for measuring the health of the Slave River and Delta?
2. What would you measure and where/when would you find it?

Indicator Group/ Potential Ecosystem Health Indicator/Metric	When / Where you find it?
Birds	
- Waterfowl - Worms found in meat of some spoonbills and mallards - Liver, heart, eggs, gizzards, guts, meat - Geese, swans, ducks, cranes, gulls, pelicans - Abundance - Migration patterns - Changes in species distribution - Habitat	- Summer - Contaminants
Air Quality	
- Quality - Contaminants – long range transport - Temperature - Wind speeds – now stronger in spring, direction, seasonal changes	- Measure lichens and core trees - What other parts of the ecosystem are sensitive to air quality changes?
Frogs	
- Abundance - Deformities	- Fort Resolution and near Fort Fitz - Local knowledge – photo-document deformities so they can be sent off to experts - Excellent early indicator – check with Parks and Environment Natural Resources for past study – also check DezeEnergy Study on leopard frogs
Sediment Quality	
- Contaminants - Toxicity	- River, delta, - Sand bars - Where rivers open up into lakes – compare rivers that flood and don't flood
Permafrost	
- Where is it? - How far south does it go now? - Not here any more	- Location and changes mapping

Appendix 9: Detailed Results of Break-Out Session 3.

Break-Out Session 3 --
Community Participation in Aquatic Monitoring in the Slave River Basin

Question:

1. How can communities' best contribute to such monitoring activities?
2. Why do they matter to you?

General Comments:

When can we get started? Right Now
Time is running out, water is running low.
Keep this momentum moving.

Specific Comments (Recommended Tasks and Activities)

Involve communities

- Have a public band or community meeting in communities to explain what is going on
- Ask community members what they would like to see monitored and allow them to take ownership of the program
- Build trust in the communities to empower monitoring programs
- Attendees continue to communicate amongst ourselves
- Develop a community strategy – bringing messages to the communities and elders – educate and develop support
- Have working groups in each of the communities to develop a plan for their area and link to other groups to share info and not duplicate
- Join representatives from each of the community groups work together to develop regional level priorities
- Involve youth in monitoring programs – inform and educate – build on successes using course curriculum and summer field camps for kids
- Prioritize all of the information collected at / by workshop
- Community members taking pictures or bringing in the abnormalities they find

Find funding

- Price out what we need / do up a budget
- Finding sources of funding for monitoring is a key first step
- Funding for a TK study along the Slave River and Delta
- Solicit in-kind and financial support for AANDC, GNWT, AAROM, Aboriginal Fishing Strategy
- Identify potential other sources of financial and in-kind support
- Develop a calendar of potential funding sources including application deadlines
- Need a champion at the territorial and federal levels to make the money tree yield resources
- Accountability for reports and processes to our funding sources and community members. Follow up.

Create a work plan

- Put concerns on paper. Build a proposal / work plan
- Prioritize types of monitoring and resources needed as well as why we are doing this and any potential additional partners
- Create a Working Committee to conduct needs assessment, do planning, seek funding, get the message out, develop a Terms of Reference and agreement

Break-Out Session 3 -- Community Participation in Aquatic Monitoring in the Slave River Basin

Question:

1. How can communities' best contribute to such monitoring activities?
2. Why do they matter to you?

Specific Comments (Recommended Tasks and Activities)

Create a work plan (cont.)

- Advisory Committee with trained staff, elders and TK to give feedback to the Working Committee
- Liability insurance must be dealt with from GNWT or other source
- Establish a local office to brings concerns to and to get information from
- Knowledgeable staff who know the area and are trained
- Proper equipment and space
- Ensure transparency of hiring community members
- Database manager and infrastructure needed – funding required – to hold all the data collected – clearing house for program data
- Establish a Monitoring Board for water governors

Build partnerships

- Communities must be involved from beginning to end: from planning to implementation, reporting and through decision making
- We need to speak with one voice on the importance of this work and how it is implemented. Act as true partners at work.
- Be driven at the community level and supported at the political level
- Think brand new, work together
- Partnership amongst all groups along the river and delta, including the Athabasca
- There should be an advisory committee to keep the momentum going
- Continue bringing these groups together to share and grow the partnership
- Formalize the agreement among partners in monitoring efforts
- Get letters of support from local Aboriginal organization to show their commitments
- What committees already exist?
- Work with communities south of the boarder to get broader coverage of the watershed – from source to delta
- Build partnerships between land users and western scientists, accompanying monitors to build relationships, for training and sharing information

Include TK throughout

- TK must be involved in all activities
- TK indicates change - Advisors can express what they have seen
- TK advisors understand regional differences and protocols

Coordinate research

- Find established standards and guidelines for monitoring protocols to ensure consistent data and information is collected throughout the watershed
- Collect and sort all existing data so that we know clearly what we have
- Identify gaps in information and prioritize filling - create strategy

Break-Out Session 3 -- Community Participation in Aquatic Monitoring in the Slave River Basin

Question:

1. How can communities' best contribute to such monitoring activities?
2. Why do they matter to you?

Specific Comments (Recommended Tasks and Activities)

Coordinate research (cont.)

- Get / organize baseline data
- Identify people in the communities who want to participate
- Get proper equipment
- Use consistent person / place and or lab to do analysis
- Hire a research consultant
- Communities direct agency-based monitoring and communities do their own community based monitoring to reduce duplication

Make sure to communicate

- Communications must be timely – including researchers following up with community members about their work (could use an advisory committee for this)
- Keep the lines of communications open for sharing, to reduce confusion and create community awareness
- People must know the protocols and processes (particularly around reporting what they find)
- Provide education and training to land users on monitoring and sampling
- Work with colleges to ensure transfer of information
- Find champions in the communities and bands
- Bring communities together for an annual conference on the health of the Slave River and Slave River Delta.
- Hold a symposium on the health of the whole river including people from the headwaters to the delta. Include broader communications to the Canadian public.
- Hold a big event on Water Day

Identify and provide training

- Communities decide what monitoring they want to do, then decide on the right training
- Set everything up so that it can keep running
- Potential youth focused camps and training programs
- Do training in partnership (like CABIN)
- There is a 5 week training program with Aurora College
- Have training in communities either through AAROM or ASSETS
- Sampling Kits – need to know how to use these kits in Smith landing, Fort Resolution, DKFN, Salt River First Nation, NWT Métis Nation
- Fish sample training for communities 3 times a year (funding sources from Aboriginal Fishing Strategy)
- Be sure to train the water treatment people and identify who else wants training
- Monitoring kits that land users and water users are trained to use properly

Break-Out Session 3 -- Community Participation in Aquatic Monitoring in the Slave River Basin

Question:

1. How can communities' best contribute to such monitoring activities?
2. Why do they matter to you?

Specific Comments (Recommended Tasks and Activities)

The tools for success

- Funding commitments – creative funding catalogue
- Political support
- Using completed studies – 1980's Fort Resolution Rat Study
- Develop partnerships because everyone in accountable to everyone else
- NGOs
- Capacity building
- TK and elders
- Find and use in-kind support
- Appropriate training
- Proposal writing
- AAROM
- CIMP
- ALS
- Networking
- Aurora college Renewable Resource course
- Existing sampling protocols
- Sampling kits

Appendix 10. Detailed Input Provided by Public Meeting Participants

The following is a summary of the points made by the public during the public meeting held the evening of March 2 (2011). The points were captured on flip charts as the discussion occurred. The following input was provided on the question:

"What are the Issues and Concerns in the Slave River and Slave River Delta?"

- Why is industry not part of the discussion? They need to hear what is happening in the communities;
- We need to tell our story to southern Canadians and Politicians. Monitoring results need to tell the story to Canadians, as well as protect the ecosystem;
- Monitoring needs to identify what contaminants are coming down the river and where they are coming from;
- There is a need to combine this monitoring with source monitoring;
- A coalition of participants is needed to speak with a common voice – the Slave River Partnership is a start. A coalition would need a common voice regarding:
    1. National energy policy;
    2. Food Policy; and,
    3. Water policy.
- Local groups and communities want to be able to comment on the new aquatic monitoring program that Environment Canada is developing to monitor oil sands activities;
- What are mechanisms for enforcement?
    1. Transboundary Agreement?
    2. Substantially Unaltered?
- Barn door is open – Horses are gone! How do we change this?
- We need solid monitoring programs to get consistent data that can look at trends;
- We also have treaties in place:
    1. Need to think outside the box. There are other tools: Constitution, Bill of Rights, and the Way of Life.
- Parallel path with the Transboundary Agreement efforts - Use Constitution;
- Are there more compliance officers at Alberta Environment? An Oil Sands group has been established;
- Site C dam is a concern - Could Aboriginal groups have teeth to intervene in Environmental Assessment in BC?
- Can we trust the Federal government to protect the people?
    1. The federal government needs to stop protecting oil companies;

g in Fort

2. The federal government needs to represent Canada on protection of water – Minister needs to protect Canada not industry.

- Tell government to stop the seven new plants;
- As flows drop due to climate changes, dilution reduces and contaminant levels go up;
- We must keep hope; and,
- Need to look at the quality of water coming down river – both Athabasca and Peace. We need to define the quality that what we want.

Next, participants provided the following input on the question:

"How can Communities Best Contribute to Ecosystem Health Monitoring?"

- Communities approach: Need to lobby the feds to stop protecting the oil companies;
- Monitoring program for the tar sands: We have time, but we have to do it together. Put in letters to have our say. Request Canada to protect us and the water; and,
- Partners could put information on their websites about how to work in partnerships.

Appendix 11. Workshop Evaluation Summary

A total of 26 of the people at the workshop completed the evaluation forms. The following questions were included on the workshop evaluation form with the associated responses:

Q1. Did the meeting rooms meet your needs or expectations?

Yes	20/26 = 77%
Somewhat	5/26 = 19%
No	1/26 = 4%

Q2. Did the overall design of the workshop meet your needs or expectations?

Yes	20/26 = 77%
Somewhat	6/26 = 23%
No	0/26 = 0%

Q3. Did the technical presentations provide sufficient background information on monitoring the health of the Slave River and Slave River Delta?

Yes	11/26 = 42%
Somewhat	13/26 = 50%
No	2/26 = 8%

Q4. Were the speakers informative and interesting?

Yes	22/26 = 85%
Somewhat	4/26 = 15%
No	0/26 = 0%

Q5. Were the Break-Out Sessions useful in fostering discussion on monitoring ecosystem health in the Slave River Basin?

Yes	26/26 = 100%
Somewhat	0/26 = 0%
No	0/26 = 0%

Q6. What component of the Workshop was most useful? Why?

The workshop participants indicated the workshop was helpful for:

- Gathering knowledge;
- Providing lots of information that I was not aware of;
- Break-out sessions: great way to gather information from delegates;
- Break-out sessions were the more useful;

- Break-out session were very informative – made me really think about the quality of our rivers;
- Group discussion were good;
- I have a much better picture of the monitoring of the Slave River;
- Working together was the best thing – we all face the same problems on the Slave River;
- The break-out sessions gave me a chance to express my concerns;
- The small groups allowed me to voice my concerns;
- Develop trust first!
- Sharing of info from different bands, and Métis was good;
- Educating the group on what is taking place;
- Break-out groups were good to challenge and explore issues;
- Focus questions generated ideas and discussions;
- The science work being done right now; and,
- TEK of the area and identifying missing gaps.

Q7. Are there additional topics/materials that you would have found useful for this Workshop?

The input that was provided by workshop participants on this question included:

- Unaware of the little monitoring in the Slave River despite the concerns;
- More handouts of presentations;
- Need to know more about muskrat situation;
- Need to know more about baseline water quality;
- A listing of all previous reports on the Slave River;
- DFO should have been here;
- Copies of presentations should be made available;
- More reps from other communities should be here;
- Need updated studies;
- All participants should park their affiliations at the door – free and open discussions result;
- More resources materials about studies of the past;
- Want to know more about activities on the Slave River;
- Better maps;
- DFO should be here;
- What is PADEMP doing?
- A glossary of sorts for terminology;
- Historical data on the status of the river (past, present and what is expect in the future);
- What are the effects of industry and climate change on our health and environment? and,
- More about climate, cumulative impacts.

Q8. Do you have any suggestions for future Workshops on the Slave River?

The input that was provided by workshop participants on this question included:

- Should have annual workshops;
- Need a sound system;
- We should partner with the tar sands and BC Hydro to secure funding for future monitoring;
- Next meeting should be in Fort Resolution;
- Should have someone from Fort Chipewyan here – they are more affected than us;
- Next one in Fort Resolution;
- We want to know about contaminants!
- Studies on human health are needed;
- Expand to include upstream groups too;
- Need books and info before the meeting to come prepared;
- Need translation services;
- Have a symposium with all communities on the Slave River and Delta;
- Sound system, translation;
- Look at Bennett Dam, and upstream developments to facilitate costs for the meetings;
- Invite people from the tarsands and pulpmills as well as Alberta Government;
- Hold more meetings;
- Regular meetings and gatherings;
- More youth at the meeting;
- Bring some data for review;
- Look for changes in the river;
- Invite NGOS, Universities, and experts in chosen fields, have renowned guest speakers;
- Need a champion, need a working group to keep things going; and,
- Need a communications strategy.

Q9. Do you have additional comments for the Workshop organizers?

The input that was provided by workshop participants on this question included:

- Thanks for all the work by the organizers, have another workshop soon!
- Keep up the momentum – best of luck!
- Who will be the driving force from here? Where do we go from here?
- Well done bringing the groups together!
- SRFN wants more involvement cause we are the only FN in this town;
- The organizers did a great job but we need to keep this going!
- Great to see everyone at the table;
- You are welcome to Fort Smith anytime!
- Good facilitators;
- Good food!

- Next time plan a 2 day workshop, but fund for 3 days – usually not enough time to get through everything in 2 days;
- Do not duplicate the studies and follow up with the results;
- Finish the studies, inform the people;
- Do these corporations hear our concerns? How do we get our message to them? Who is responsible? Need to explain the impact their actions are having on the basin's people;
- Need to unify – and finalize the Transboundary Agreements;
- We need bottled water;
- Need funding at the community and regional level;
- At times the meeting got off track…also sometimes people were talking while presentations were being made which made it hard to hear;
- Looking forward to the next one!
- Find a way to incorporated TK into the uniqueness of the situation at hand regarding industry and processes;
- Have industry here to hear our concerns;
- Use some of the existing traditional knowledge we still have on the river;
- Involve more scientific knowledge on key health concerns – keep up the good work! and,
- Need to establish clear and committed next step and approach that brings us closer to a world class monitoring program.

Appendix 12. Media Coverage

Slave River Monitoring Needs Community Support

By: Shawn Bell, Slave River Journal, March 8, 2011

It is being touted as a unique partnership that will turn environmental monitoring on its head.

It has been called grassroots, community-based, local.

Some even claim that upcoming environmental monitoring of the Slave River and delta will be a model for the NWT, and perhaps the country, to follow.

The public in Fort Smith and Fort Resolution had a first glimpse into the community-monitoring plan for water pollution and other environmental factors in and around the Slave River at public meetings last week.

Organizers, including the Government of the NWT's Environment and Natural Resources Department and Canada's Department of Indian and Northern Affairs, hope the meetings will be the first step towards true public involvement in monitoring the environment around the communities.

"Under the NWT's new water strategy, we're all partners," said Dr. Erin Kelly, one of the scientists who worked on Athabasca River studies with Dr. David Schindler last year. Kelly now works on implementing the NWT's water strategy.

The public meetings followed a two-day workshop in Fort Smith where a range of organizations, including Aboriginal governments from Fort Smith and Fort Resolution, Parks Canada, Aurora College, the GNWT and the federal government, met to discuss the main environmental concerns of people in the area.

The key questions are whether the water of the Slave River is safe to drink, if the animals and fish that live on or around the Slave River are safe to eat, and if the ecosystem as a whole is healthy.

Partners in the work claim that the efforts underway have turned the traditional relationship between government and local communities on its head.

As Tim Heron of the NWT Métis Nation explained, normally government representatives come to the communities to tell people what is going to be studied.

Those studies end up happening in isolation from local people, before being compiled into reports that sit on someone's desk far away, he said.

In this case, however, the studies are going to be conducted either by local people, or in conjunction with local people, and the areas to be examined will be determined by local people using traditional knowledge.

"It's not science for the sake of science," Heron said. "Now it's community based monitoring coming from community and Aboriginal groups. Everybody is a partner now. Everybody has responsibility."

Heron added that all funding applications associated with the work have to have an Aboriginal partner, assuring that governments cannot go ahead and do work without the support of communities.

As Kelly outlined at the public meeting, the first step is to compile a 'state of the Slave' report, detailing all studies and information available about the health of the Slave River and delta.

Following that, the group plans to identify gaps in the research, and determine the communities' priority areas to study.

From there, she said, it will be up to communities to decide how to do the monitoring work.

"People said they want to be full partners, and that's what we're doing," Kelly said.

The main upstream concern expressed at the workshop and meeting was Alberta's oilsands development. As Salt River First Nation elder representative Victor Marie said, Fort Chipewyan's concerns with upstream development are well documented, but Fort Smith's concerns – only 300 km downstream – have long been ignored.

"It goes beyond Fort Chip, right down to the Delta," Marie said. "Everybody who wakes up in the morning, all the way to Inuvik is affected."

Another major concern was low water levels due to dams on the Peace River in British Columbia.

The GNWT plans to use the information from these monitoring efforts to inform their negotiations with BC and Alberta on transboundary water agreements.

A baseline Health of the Slave River report, where the water crosses into the NWT, would provide the government with comparison data for any changes seen in the ecosystem in the future.

ENR hopes to have a transboundary agreement with BC before the Site C dam on the Peace River gets built. Work on an agreement with Alberta is also underway.

Monitoring the Health of the Slave River and Delta

By Shawn Bell, Slave River Journal, March 1, 2011

Potential indicators of the health of the Slave River, such as plants, bugs, fish and wildlife, will be discussed at a community meeting and workshop in Fort Smith this week.

The workshop and meeting are intended to gather community input on what governments should be monitoring in the area, while figuring out ways that the community can contribute in that monitoring.

The workshop will be co-hosted by Indian and Northern Affairs Canada (INAC) and the Government of the Northwest Territories. Aboriginal groups living along the Slave River and the Slave River Delta have been invited to participate.

INAC is also looking for feedback about their Slave River Environmental Quality Monitoring Program. In the early 1990's the INAC program assessed the health of the river around Fort Smith, including fish sampling.

That study found higher than normal levels of polycyclic aromatic hydrocarbons (PAHs) in suspended sediment, but it concluded the PAHs were caused by natural sources. Since the original study was completed in 1994, massive expansion of Alberta's oil sands industry on the Athabasca River has led to concerns that downstream locations are being polluted.

Fort Chipewyan's concerns about the health of Lake Athabasca and the Peace Athabasca Delta, which both feed into the Slave River, were confirmed last year by an independent team of world-renowned scientists including Dr. David Schindler of the University of Alberta.

In two related studies, the scientists first found high levels of PAHs in the Athabasca River, and then documented a range of toxic chemicals in the river system as far downstream as Lake Athabasca and the Peace Athabasca Delta. In both cases the studies showed that levels of toxins were higher downstream of oilsands facilities than

upstream, and were related to oil sands development.

Now one of the scientists who did much of the work on those two studies, Dr. Erin Kelly, has joined the government of the NWT to work on implementing its nationally-acclaimed water stewardship strategy.

"I would like to see as many members of the public from Fort Smith at the meeting as possible, to tell us what they think would be good indicators of the health of the Slave River and Delta," Kelly told The Journal. "This workshop is one example of the Water Strategy being put into action. Another is community-based monitoring. ENR is committed to supporting community-based monitoring initiatives along the Slave River and Delta."

Part of the GNWT's efforts in monitoring the Slave River relate to ongoing negotiations over transboundary water agreements with Alberta and BC.

Environment and Natural Resources Minister Michael Miltenberger has said he would like to have an agreement in place with BC before the Site C dam gets built, which is expected to happen within two years.

Miltenberger and his Alberta counterpart Rob Renner have also initiated discussions on the Alberta-NWT water agreement, although those discussions are still in preliminary stages.

One issue the jurisdictions need to deal with is the water quality crossing the border from Alberta, and the information Alberta is collecting on that water quality.

Recent criticisms of the Regional Aquatics Monitoring Program (RAMP), the industry-funded monitoring body for north-eastern Alberta, have raised serious concerns about the program's ability to detect water quality problems in the Athabasca River system. Miltenberger has also criticized the federal government for its lack of involvement in transboundary water issues.

The two-day workshop in Fort Smith with Aboriginal and community leaders will be capped by a public meeting on March 2 at 7:00 pm. All members of the public are invited to attend to provide input on potential indicators to monitor the health of the Slave River and Delta.