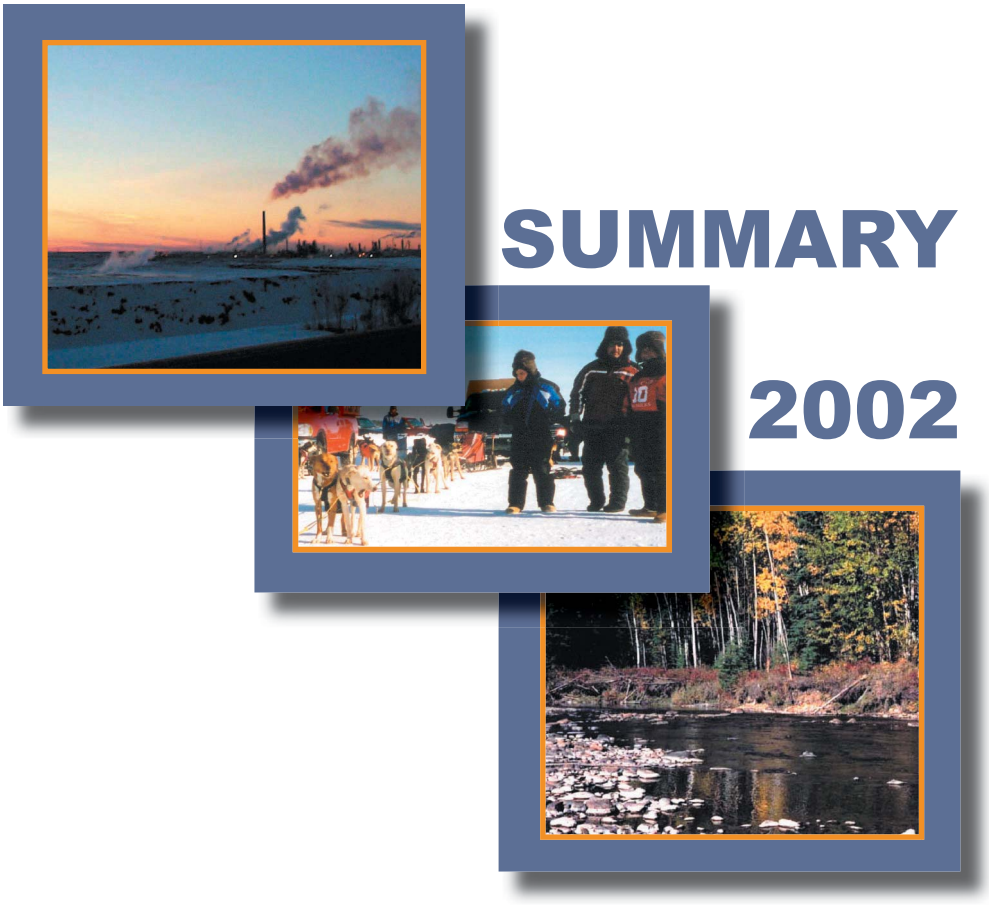
Regional Aquatics Monitoring Program

RAMP



SUMMARY

2002

ACKNOWLEDGEMENTS

The 2002 RAMP Summary Report was prepared on behalf of the RAMP Steering Committee by Hatfield Consultants Ltd. The report summarizes key findings presented in the 2002 RAMP annual technical report written by Golder Associates Ltd.

Thanks to those who reviewed earlier versions of the report including, the Athabasca Tribal Council, representatives from the regional Industry Relations Corporations, and Syncrude Canada Ltd.

Report development, layout and production were conducted by Daniel Moats, Susan Stanley, Erin Johnston, Grant Bruce and Wade Gibbons of Hatfield Consultants Ltd.

Front Cover Photos:
- Syncrude Canada Ltd., Mildred Lake
- Dogsled reaces, Fort Chipewyan
- Steepbank River

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Regional Aquatics Monitoring Program

RAMP

The Regional Aquatics Monitoring Program (RAMP) is a joint environmental monitoring program that assesses the health of rivers and lakes in the oil sands region.

RAMP was initiated in 1997, and has continued to grow and adapt to the needs of the environment, communities, regulators and industry.

RAMP has responded to past monitoring results, oil sands development, technological advances and community concerns.

Objectives of RAMP

- Monitor rivers and lakes in the oils sands area to assess potential effects of oil sands development;
- Collect environmental data to better understand the oil sands region;
- Compare actual monitoring data with Environmental Impact Assessment predictions;
- Respond to community concerns; and
- Incorporate traditional ecological knowledge into monitoring programs.

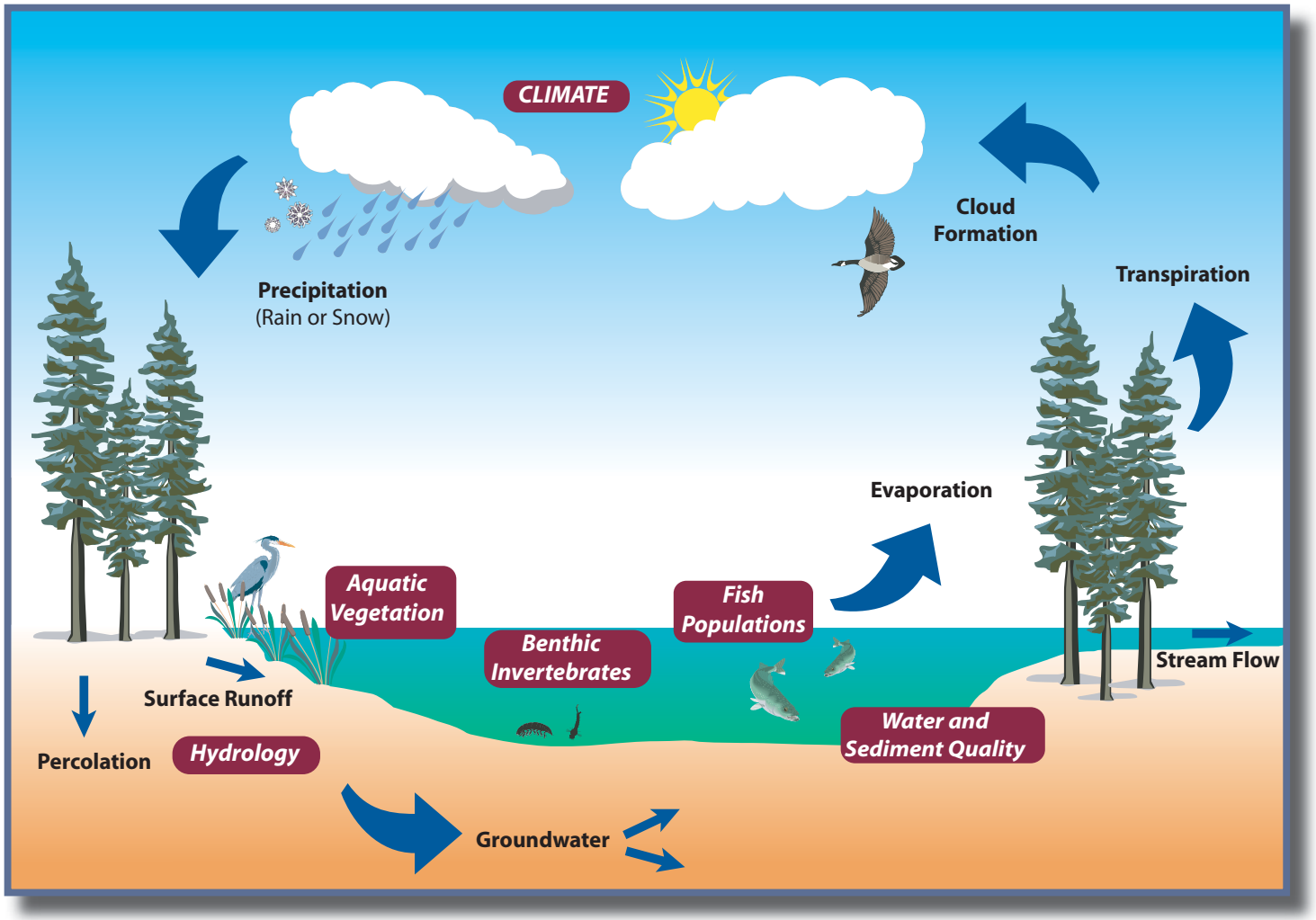
Athabasca River

What Does RAMP Monitor?

In 2002, RAMP conducted monitoring of:

- Fish and fish habitat;
- Water and sediment quality;
- Benthic invertebrates (small animals at the bottom of lakes and rivers);
- Wetland vegetation;
- Lakes sensitive to acidification; and
- Hydrology (water flow) and climate.

The Components of RAMP Are All Parts of the Aquatic Ecosystem



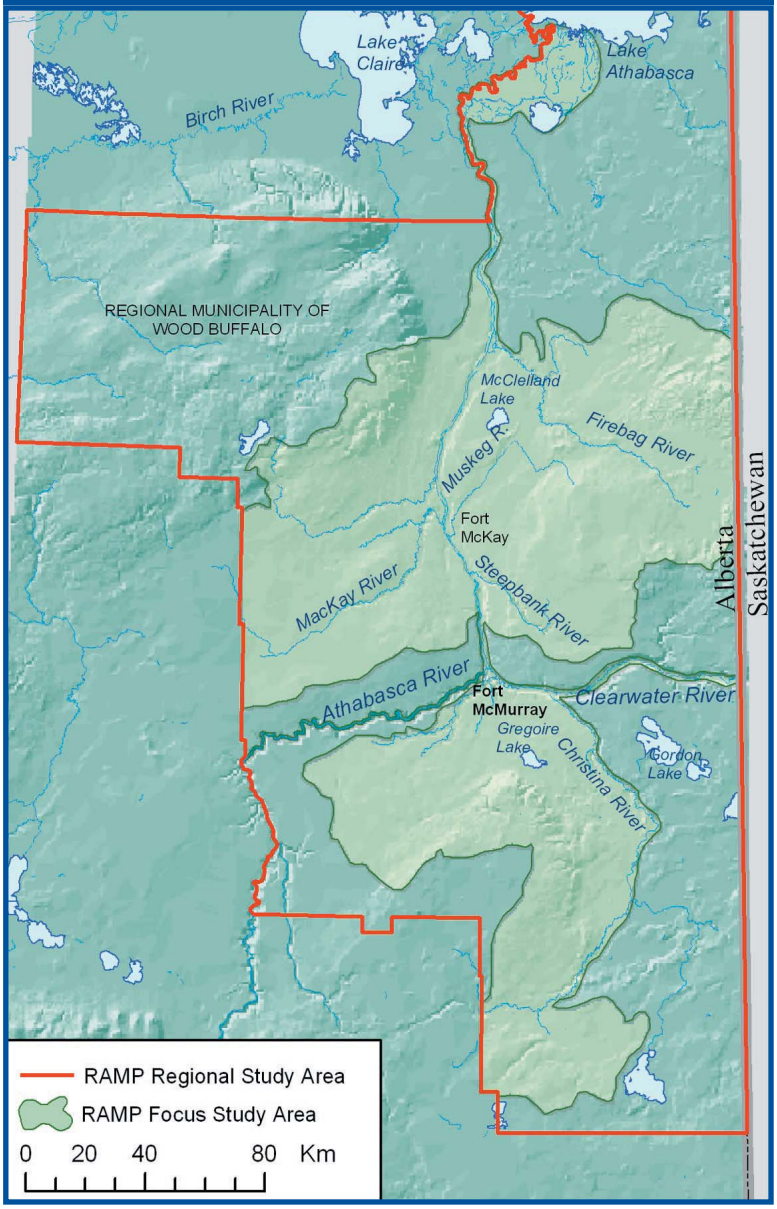
Where is the RAMP Study Area?

The Regional Municipality of Wood Buffalo in northeastern Alberta defines the RAMP regional study area. Within this study area, sampling effort is focused in areas where oil sands development is occurring or planned.

In 2002, RAMP focused on the following waterbodies:

- Athabasca River and Peace-Athabasca Delta;
- Tributaries to the Athabasca River, including the Steepbank, Muskeg, Calumet, Clearwater, Ells, Firebag, MacKay and Tar rivers and McLean, Poplar, and Fort creeks;
- Small tributaries of the Muskeg River including Jackpine, Muskeg, and Wapasu creeks;
- Christina River (tributary of the Clearwater River);
- Wetlands in the vicinity of current and proposed oil sands developments; and
- Acid sensitive lakes in northeastern Alberta.

RAMP Study Area



Who Was Involved in the 2002 RAMP?

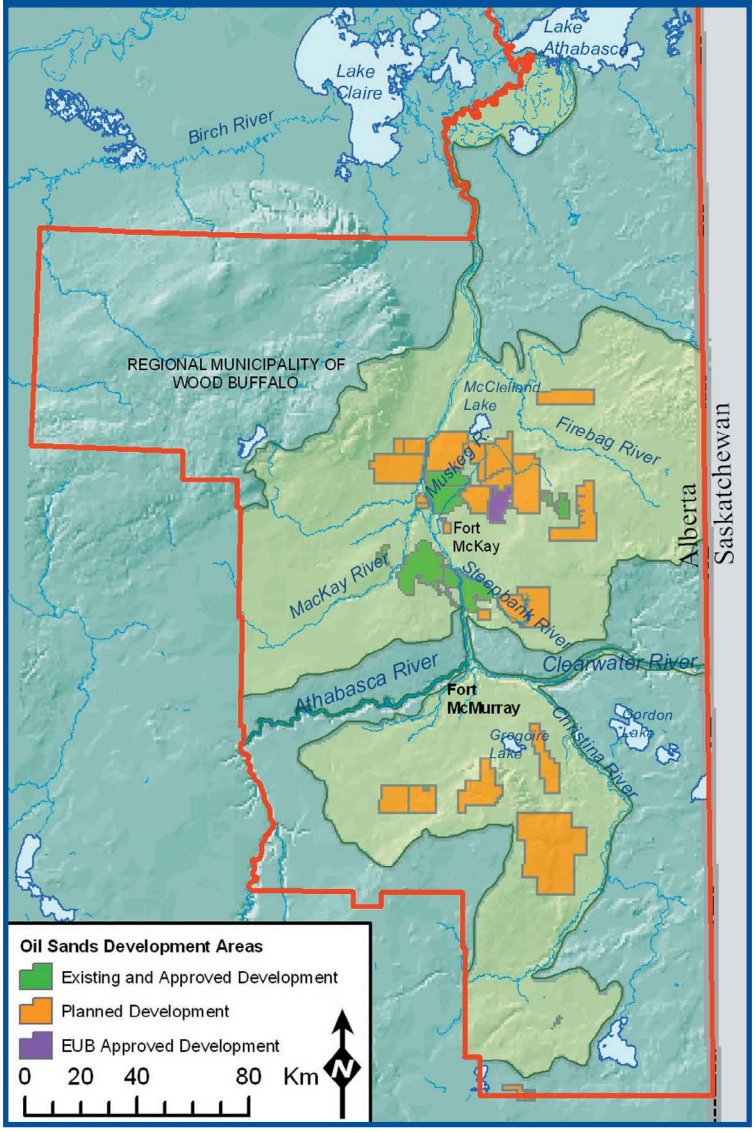
RAMP consists of representatives from industry, Aboriginal groups, all levels of government and environmental non-governmental organizations.

Industry	Stakeholders	Government
Alberta Pacific Forest Industries Inc.	Athabasca Chipewyan First Nations	Alberta Environment
Albian Sands Energy Inc.	Athabasca Tribal Council	Fisheries and Oceans Canada
Canadian Natural Resources Limited.	Chipewyan Prairie First Nations	Environment Canada
Devon Energy Corporation	Fort Chipewyan Metis Local #125	Regional Municipality of Wood Buffalo
ExxonMobil Canada Ltd.	Fort McKay First Nations	Alberta Energy and Utilities Board
OPTI/Nexen Canada Inc.	Fort McKay Metis Local #122	
Petro-Canada Oil and Gas	Fort McMurray First Nations	
Shell Canada Limited.	Mikisew Cree First Nations	
Suncor Energy Inc.	Oil Sands Environmental Coalition	
Syncrude Canada Ltd.		
True North Energy (1999 - 2002)		

Finance Subcommittee	Technical Subcommittee	Communication Subcommittee	Investigators
All funding participants, and any interested Steering Committee members.	Representatives from industry, communities, government, and investigators.	Representatives from industry, communities, government, and investigators.	Consultants, Aboriginal community representatives, and Alberta Environment

Technical Program Implementation	Communication Plan Implementation
➤Preparation of technical program for review by Steering Committee ➤Technical workshops	➤Newsletters ➤Annual Report ➤Community meetings

Oil Sands Development Areas



- The oil sands region near Fort McMurray has experienced a substantial increase in oil sands development since the start of RAMP in 1997;
- During this time, industry participation in RAMP has increased to ten companies representing 17 different oil sands projects;
- As a result, RAMP has also expanded in response to the increased development; and
- As new members join RAMP, the monitoring program will continue to adapt to ensure regional aquatics monitoring needs are being met.

Suncor Firebag

2 - CLIMATE AND HYDROLOGY

The information gathered from the RAMP climate and hydrologic monitoring stations is used to increase our understanding of how streams and lakes react to rain and snow events. This knowledge allows for more accurate modeling of "typical flows", as well as flooding, drought and other irregular events, including changes in flows resulting from human activities like mining.

2002 Climate Monitoring

The behavior of streams, lakes and wetlands is influenced by rainfall, snowfall, temperature, humidity, solar radiation and wind speed. Monitoring this climatic information provides a better understanding of the potential environmental impacts associated with oil sands development.

Aurora Climate Station

The Aurora Climate Station monitors rainfall, snowfall, temperature, humidity, wind speed, wind direction and solar radiation (sunshine) in the vicinity of the Muskeg River. The station is located near Jackpine Creek at the Canterra Road.

Air Temperature Sensor

Aurora Climate Station

Tipping Bucket Rain Gauges

Tipping bucket rain gauges were installed at the Aurora Climate Station, Calumet River, Iyinimin Creek, Tar River, Christina River and McClelland Lake to measure differences in rainfall within the RAMP study area.

For example, total rainfall for Calument River was measured at 301.4mm. This number is 10% lower than the total measured at Aurora Climate station. This illustrates the variation in rainfall within the oil sands region and the relationship between rainfall and stream discharge.

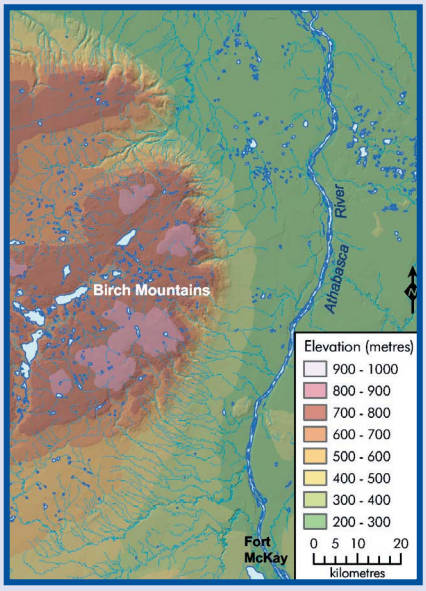
Tipping bucket rain gauge

Snow Pack Survey

Snow pack surveys measure snow depth and density within different terrain types. This information allows prediction of how much water will be released during spring melt.

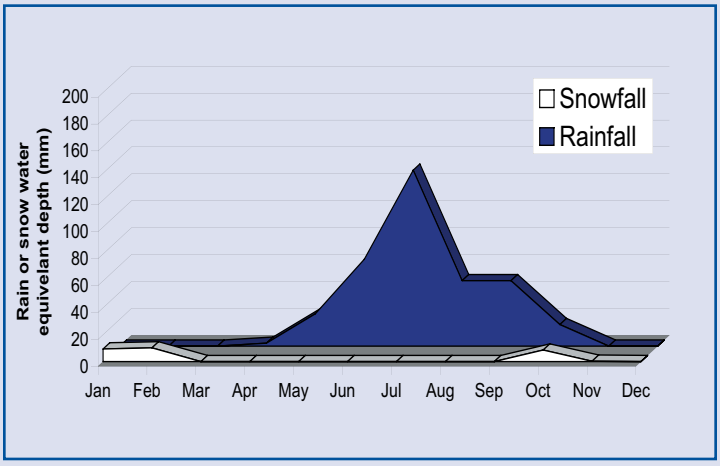
2002 marked the second year of snow pack surveys for the east slope of the Birch Mountains (CNRL Horizon Project Area) to determine how much potential meltwater accumulates over the winter.

Geographic extent of Birch Mountain east slope

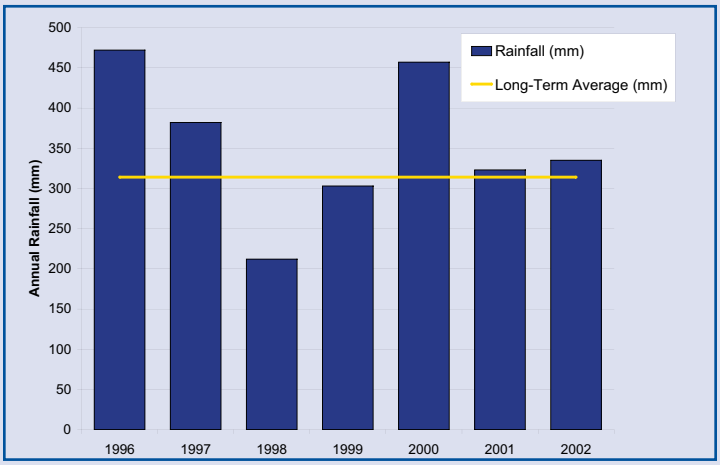


2002 Climate Results

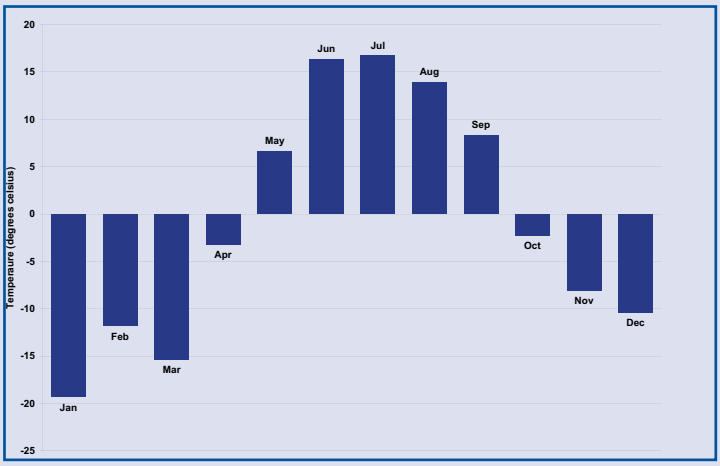
Average monthly rainfall and snowfall at the Aurora Climate Station, 2002.



Total yearly rainfall recorded at Aurora Climate Station, 1996 - 2002.



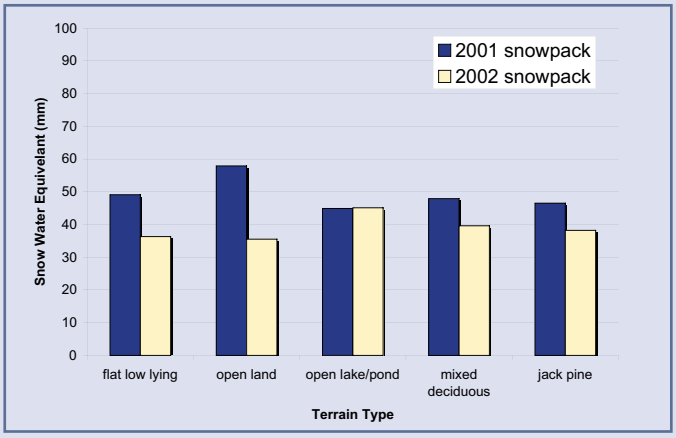
Average monthly temperature at Aurora Climate Station, 2002.



- The first rain of 2002 was measured on April 21;
- The first snowfall measured for the winter of 2002/2003 occurred on October 18;
- In 2002, snowfall accounted for 8% of the precipitation measured at the Aurora Climate Station;

- The total rainfall for 2002 was 335mm. This is the second consecutive year where total rainfall has been near the long-term average, after four drier-than-average years (1998-2001); and
- The average monthly temperature was below freezing for 7 months of the year (January to April, October to December).

Snow pack results for the Birch Mountains east slope basins snow course survey, 2001-2002.



- In 2002, overall snow-water-equivalent along the east slope of the Birch Mountains was 20% lower than in 2001.

Birch Mountain snow survey

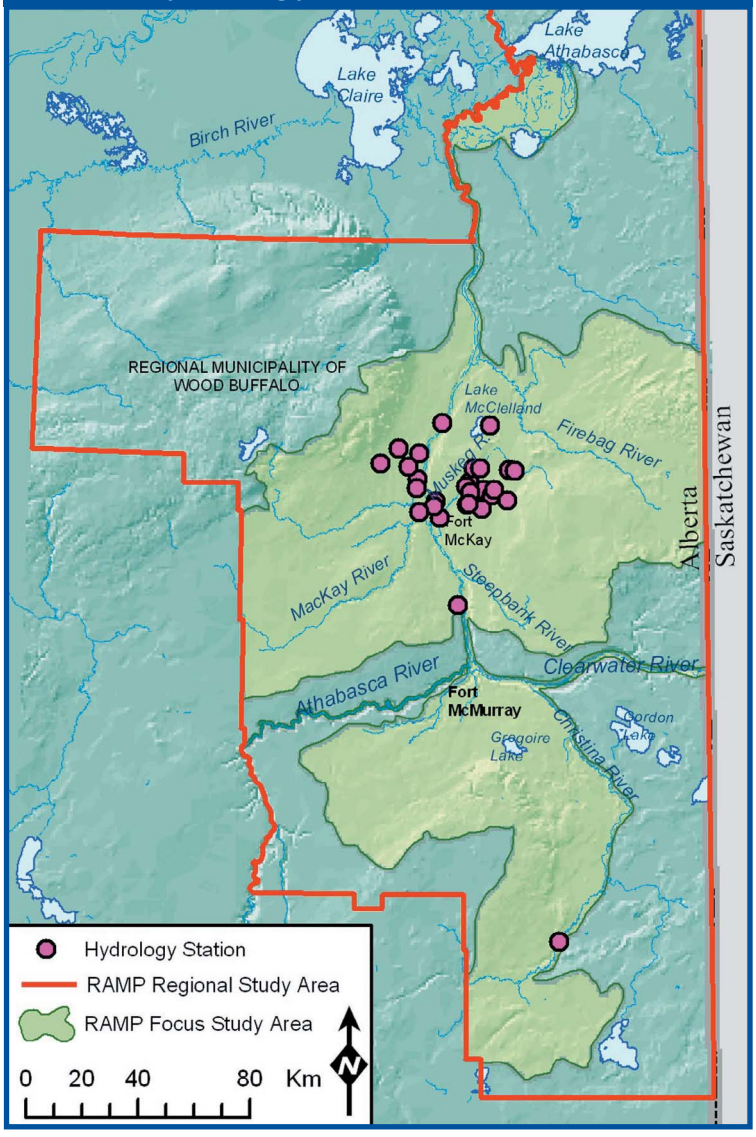
2002 Hydrology Monitoring

The RAMP Hydrology Program uses water level and ***discharge*** monitoring equipment combined with regular field visits to measure stream flow, ice thickness, and water depth of selected lakes and streams in the oil sands region.

Prior to development, information is collected to identify the natural changes in water flows within watersheds from year-to-year. Then, if an area is developed, the information is used to determine whether surface waters are affected as a result of the development activities.

DISCHARGE
The volume of water that passes by a given location on a stream in a given period of time. Discharge is usually measured in cubic metres per second.
(1 cubic metres = 1,000 litres)

RAMP Hydrology Stations

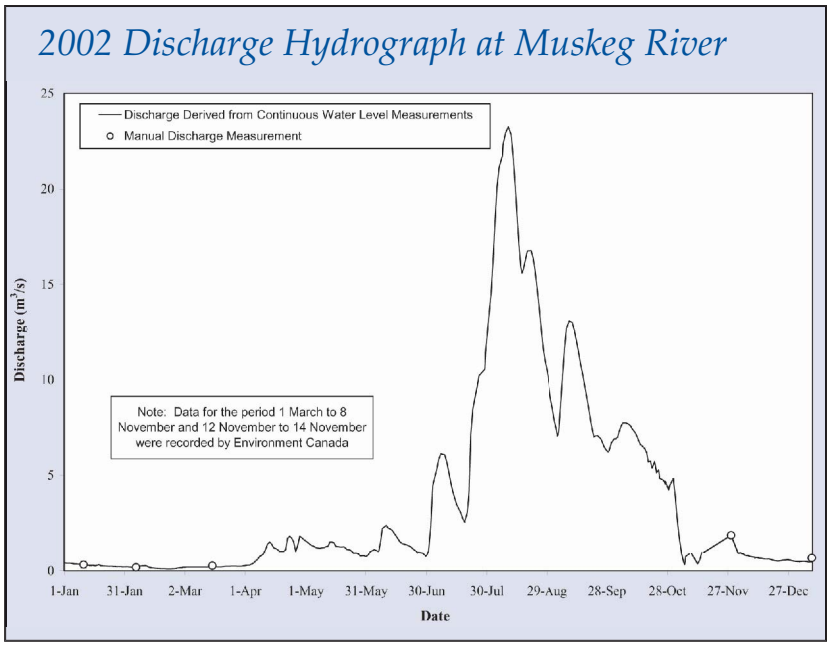


Hydrology Monitoring Station

Sites were equipped with remote downloading capability, allowing investigators to view real time data from the office.

2002 Hydrology Monitoring Results

Most of the rivers and streams sampled in 2002 recorded flows near the long-term average. Notable exceptions were the MacKay and Athabasca rivers, both with flows much lower than expected in a typical year.



A hydrograph shows the discharge of water at a single location over time. The hydrograph shown is representative of many streams in the RAMP study area. It depicts low winter flows, which increase in the spring as a result of snowmelt. In the summer, the flows are moderate, resulting primarily from rain and groundwater flow. Autumn marks a transition period from moderate summer water volumes back to low winter base flows.

Hydrology monitoring at Christina River

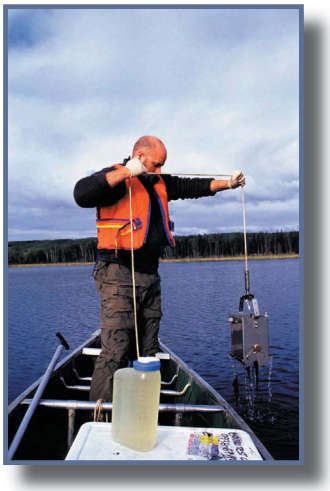
Mills Creek

Water and Sediment Quality

Monitoring the physical and chemical characteristics of water and sediment provides insights into how natural and human activities affect the health of aquatic ecosystems. Water quality measurements provide a snap-shot view of current conditions, while sediment quality measurements show how chemicals accumulate over time. Together, these data act as indicators of aquatic ecosystem health and integrity.

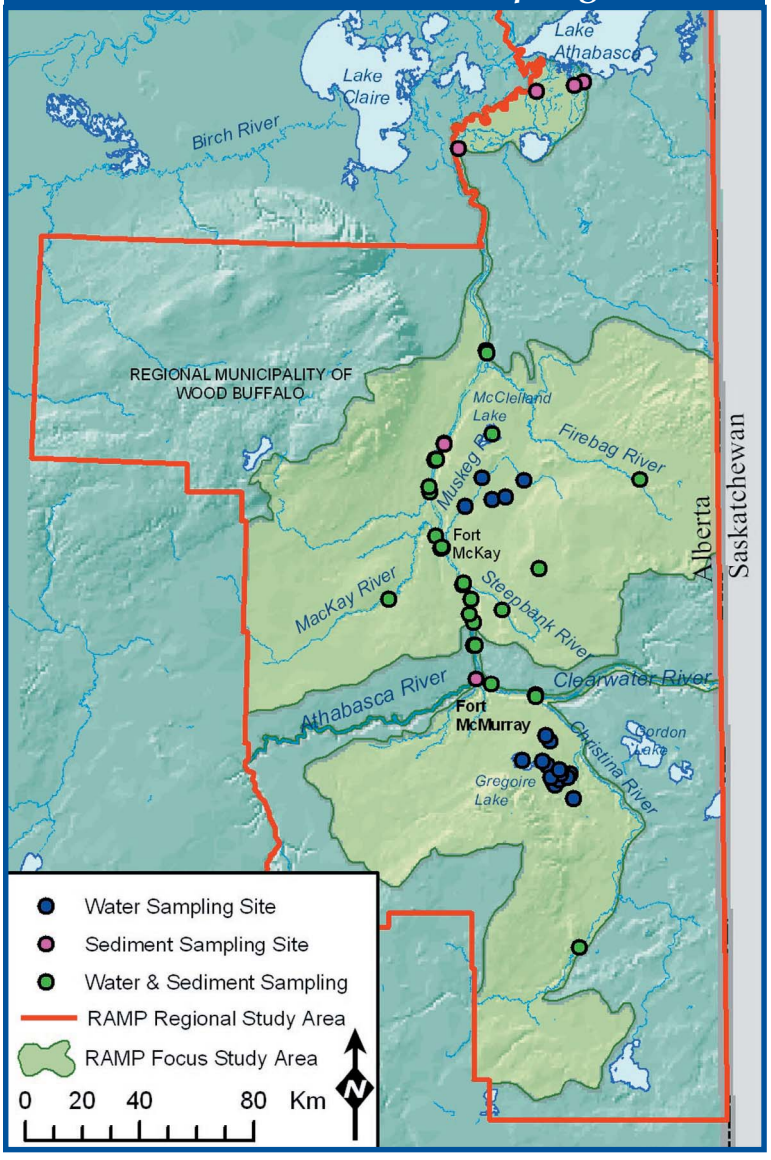
Why Are Water and Sediment Quality Monitored?

- To establish the chemical and physical features of waterbodies in the RAMP study area;
- To identify changes in water and sediment quality over time; and
- To evaluate whether changes in water and sediment quality are impacting aquatic organisms, such as algae, bugs and fish, which depend on these resources.



Sediment sampling

2002 Water and Sediment Sampling Stations



What Chemical Parameters Did RAMP Analyze in 2002?

RAMP monitors numerous chemical and physical parameters of streams and lakes in the oil sands region. Water samples are analyzed four times a year to see if there are differences from season to season. Sediment quality is analyzed in the fall.

A number of water and sediment samples are also sent to a biological laboratory for toxicity testing to see how they affect the ability of different aquatic organisms to survive and grow. Algae, water fleas and fathead minnows were used to conduct water toxicity tests, and midge larvae, amphipod crustaceans and oligochaete worms were used for sediment toxicity testing.

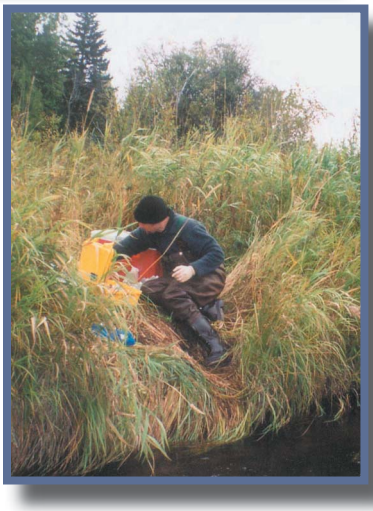
Water

- pH, conductivity, hardness, dissolved oxygen and other conventional parameters
- major ions
- nutrients
- total and dissolved metals
- recoverable hydrocarbons
- chlorophyll *a*
- naphthenic acids
- total phenolics

Sediment

- carbon content
- percent sand, silt and clay
- total metals
- recoverable hydrocarbons
- total volatile hydrocarbons
- total extractable hydrocarbons
- polycyclic aromatic hydrocarbons

Sampling at Firebag



Field sampling

What Do These Chemicals Tell Us About Water and Sediment Quality?

pH is an indication of the acidic or basic (alkaline) nature of water. Neutral waters have a pH near 7.

Hardness and total dissolved solids (TDS) are two indicators related to the concentrations of major ions (electrically charged atoms) in surface waters.

Dissolved oxygen (DO) is a measure of how much oxygen is available in water for aquatic organisms to breathe.

Nutrients include a variety of nitrogen and phosphorus compounds that are required in very small amounts for plant growth.

Metals often occur in small quantities (<1 mg/L) in surface waters, since they are usually associated with suspended sediments and tend to settle down to the bottom substrate. Higher levels of metals can be harmful to aquatic organisms.

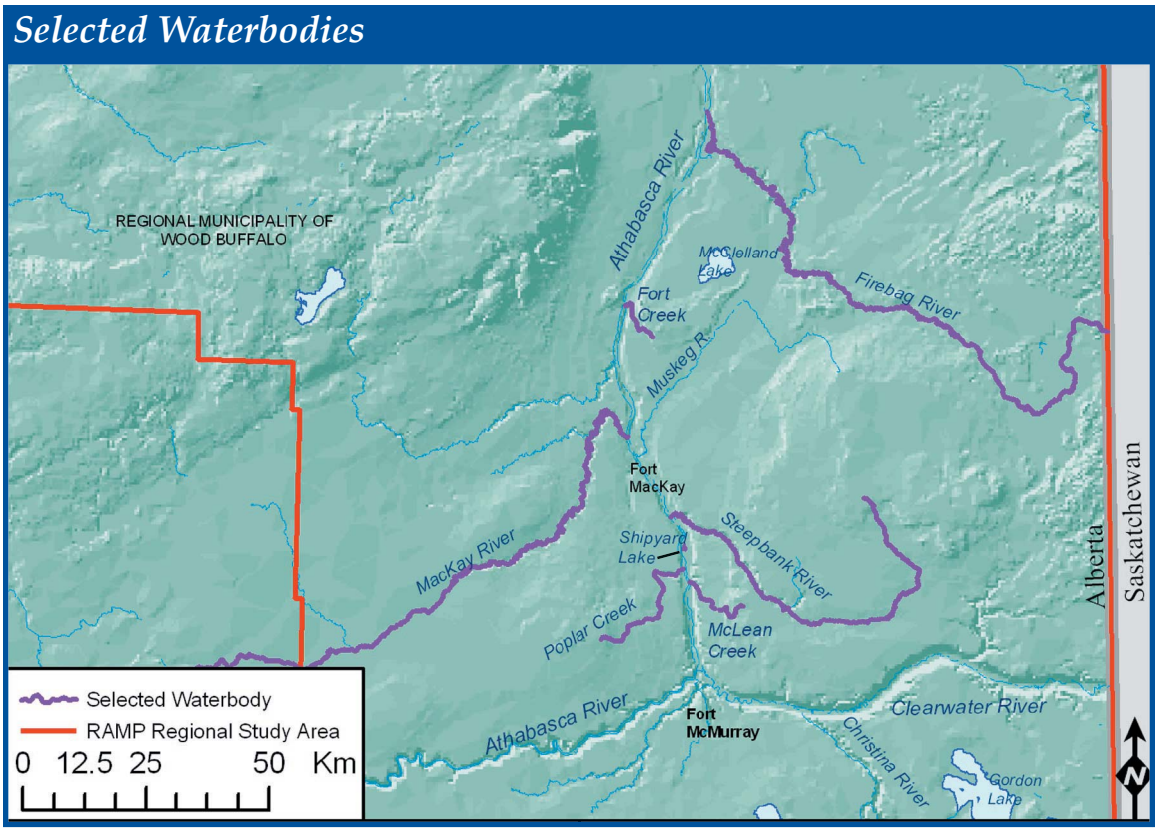
Chlorophyll *a* is a photosynthetic algal pigment found in green plants that can be used to check the productivity of a waterbody.

Suspended solids are the amount of material located in the water column of a stream or lake.

Organic compounds include chemicals consisting of chains or rings of carbon atoms, such as hydrocarbons, phenols, polycyclic aromatic hydrocarbons (PAHs) and naphthenic acids. These compounds may originate from natural sources such as oil sands deposits and forest fires, or they may be the result of industrial activities.

2002 Water Quality Results

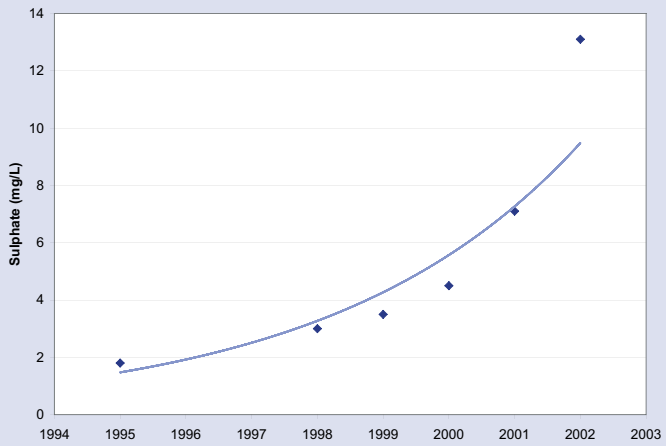
Although many waterbodies were monitored for water and sediment quality in 2002, seven waterbodies were selected for in-depth analysis.



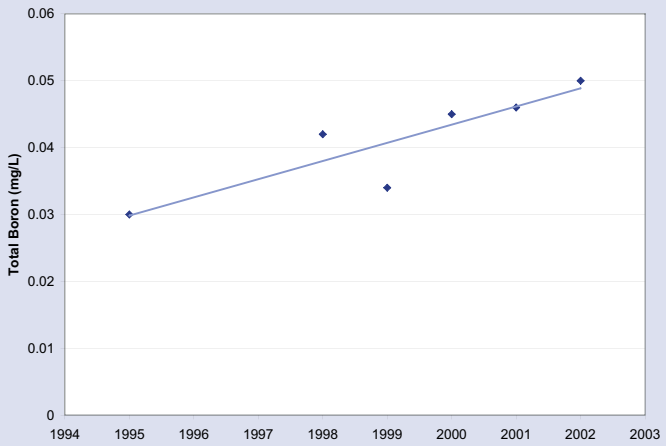
Firebag River:	Nitrogen concentrations at the mouth have increased over time; however, this trend is directly related to changes in water flow.
Fort Creek:	No significant trends in water quality over time.
McLean Creek:	No significant trends in water quality over time.
Steepbank River:	No significant trends in water quality over time.
MacKay River:	No significant trends in water quality over time.
Poplar Creek:	pH levels have increased over time at an estimated rate of 0.02 pH units per year. However, it has been recommended that more data be collected to determine whether this is a natural fluctuation, or indeed a long-term trend.

Shipyard Lake: Sulphate and boron concentrations in water have increased over time. The source of the sulphate and boron entering Shipyard Lake has not yet been identified, but the rate of increase suggests that these changes are not natural. It should be noted that increased concentrations have not been observed in either McLean Creek or Steepbank River, two waterbodies located near Shipyard Lake.

Change of sulphate concentration observed in Shipyard Lake based on summer sampling from 1995-2002



Changes in boron concentration observed in Shipyard Lake based on summer sampling from 1995-2002



The lack of trends in water quality parameters over time in most waterbodies suggests that oil sands development is having limited impact on water quality.

Shipyard Lake

2002 Sediment Quality Results

In 2002, sediment data were examined to determine how composition (percentages of sand, silt and clay), metal content and hydrocarbons influence sediment toxicity.

The following relationships were observed:
Freshwater oligochaete worms:

- Survival and growth increased as silt and clay content increased;
- Survival and growth decreased as sand content increased; and
- Growth increased when concentrations of certain hydrocarbons (naphthalene and C1 substituted naphthalene) increased.

Survival Rationale for Worms

The relationship between oligochaete growth and survival and sediment composition are likely a reflection of their habitat requirements. These worms move through small tunnels that they excavate in the upper sediment zone, which tend to become unstable and collapse when the substrate is composed of larger particle sizes.

Amphipod crustaceans:

- Survival rate increased when concentrations of certain hydrocarbons (naphthalene and C1 substituted naphthalene) increased; and
- Survival rates appeared to be negatively affected by the presence of mercury and/or molybdenum.

Midges (Chironomids):

- Responses to sediment toxicity testing do not appear to be related to sediment composition, metal content or PAH concentration.

The 2002 RAMP program continues to show the potential for a slight effect limited to sediment quality; however, the results to date may reflect natural variations over time. RAMP will continue to investigate the possible link between oil sands related activities and aquatic sediment quality.

4 - BENTHIC INVERTEBRATE COMMUNITY

What are Benthic Invertebrates?

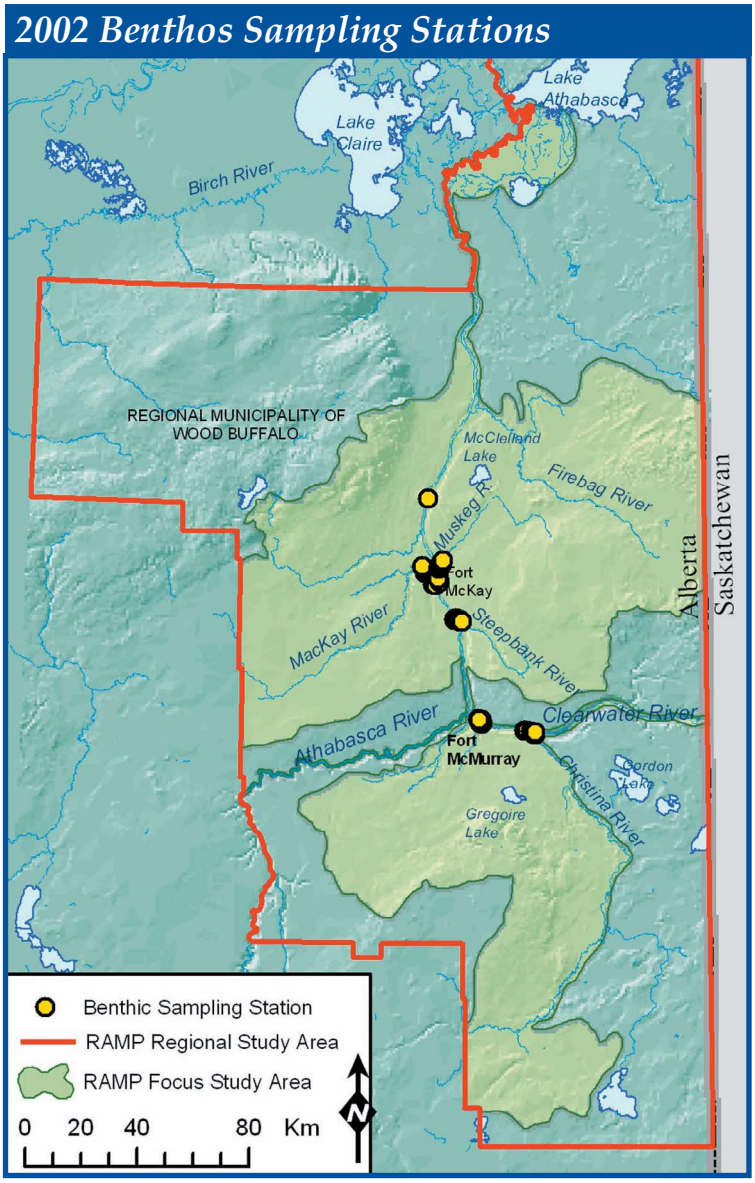
Benthic invertebrates, or benthos, are aquatic organisms that spend part of their life in or on the bottom of rivers, lakes and wetlands. Typical benthos include insects, snails, clams, and worms. These animals are a food source for many species of fish and are an important part of fish habitat.

Benthic invertebrates living at a specific location in a stream or lake are referred to as a benthic invertebrate community. The number and types of benthic animals in a community reflect the characteristics of their surroundings, which makes them sensitive indicators of environmental effects. In general, benthic communities in unpolluted waters consist of a large number of animals (abundance) and a wide range of species (richness), including those known to be sensitive to pollution. RAMP monitors benthic invertebrate communities as a measure of water, sediment and habitat quality. The purpose of the RAMP benthic survey is to:

Mayfly

Midge

- Collect information on benthic communities before extensive oil sands development begins within select drainage basins; and
- Monitor the potential effects of development within drainage basins where oil sands development has already begun.



Sieving benthic samples in the Athabasca Delta

2002 Benthos Monitoring Program

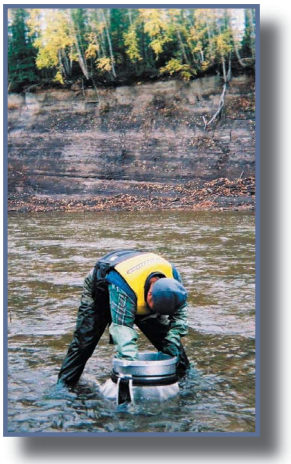
In 2002, benthic monitoring was conducted at the following locations:

- The upper and lower portions of the Muskeg and MacKay rivers;
- Stations on the Steepbank River and Fort Creek;
- Two stations within the Peace-Athabasca Delta; and
- Stations throughout Shipyard and Kearl lakes.

2002 Benthos Monitoring Results

Benthic Invertebrate Summary

Waterbody	Habitat Type	Number of Animals	Number of Species	Abundant Species
Lower MacKay	Erosional	14,550	75	Worms, mayflies, and midges
Upper MacKay	Erosional	28,863	70	Worms, midges, and water mites
Steepbank River	Erosional	1,757	52	Midges, mayflies, and worms
Muskeg River (near mouth)	Erosional	7,613	85	Worms, water mites, and midges
Lower Muskeg River	Depositional	33,147	60	Midges, nematode and ostracoda
Upper Muskeg River	Depositional	9,881	41	Midges, clams and seed shrimp
Fort Creek	Depositional	41,632	32	Midges
Peace-Athabasca Delta (Fletcher Channel)	Depositional	11,834	21	Midges
Peace-Athabasca Delta (Goose Island Channel)	Depositional	35,776	26	Midges and clams
Kearl Lake	Depositional	8,480	27	Crustaceans, midges, and seed shrimp
Shipyard Lake	Depositional	19,264	33	Midges, seed shrimp, and clams



Erosional benthic sampling using a Neill-Hess sampler

Erosional habitat – shallow rocky area with fast water;
Depositional habitat – area with slow moving water and soft sediment.

5 - FISH POPULATIONS

Fish are an important part of RAMP because they are good ecological indicators and a highly valued resource. RAMP monitors fish populations in the Athabasca River and its tributary streams in the oil sands region to see if they are being affected by oil sands development and to check that fish are safe to eat.

The RAMP fisheries program monitors:

- The presence and abundance of fish species in the oil sands region;
- Where the fish go and how much time they spend in the oil sands region;
- Fish habitat;
- Fish health; and
- Fish tissue (fillets) chemistry.

The 2002 Fisheries Program Included the Following Tasks:

Task	Study Period	Watercourse or Waterbody				
		Athabasca River	Muskeg River	Muskeg/ Wapasu Creeks	Jackpine Creek	Gregoire Lake
Fish inventory	spring 2002	✓				
	summer 2002		✓		✓	
Fyke net monitoring	spring and fall 2002			✓		
Fish tissue collection and analysis	fall 2002	✓	✓			✓
Sentinel species monitoring	fall 2002	✓				

Arctic grayling

Fish Inventory

Fish inventory studies are conducted because certain fish species are more easily stressed by increased chemical levels. Therefore, changes in the composition and abundance of fish species act as an indicator of ecosystem health.

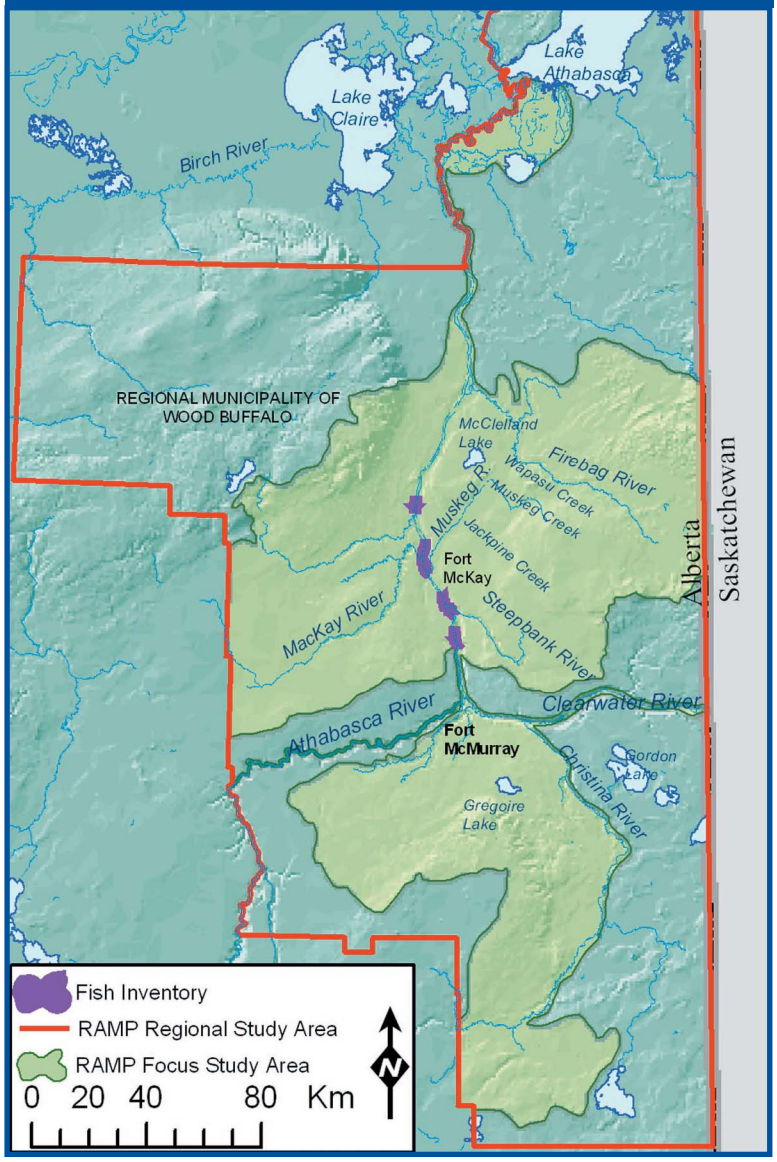
2002 Fish Inventory Program

The 2002 fish inventory program consisted of the following components:

- The Athabasca River was monitored to document species presence and relative abundance;
- The lower Muskeg River and Lower Jackpine Creek were monitored to document species presence and relative abundance with a special emphasis on Arctic grayling; and
- Small fish fences (Fyke nets) were placed on Muskeg and Wapasu creeks to evaluate upstream movement in the spring and downstream movement in the fall.

Muskeg River Walleye

Fish Inventory Reaches for the Athabasca River



Electrofishing

Electrofishing is most commonly conducted with portable back-pack units or specially equipped boats. These units produce electrical pulses, which are passed through an insulated conductor and into the water, immobilizing any fish within a three to five metre radius. The fish then float to the surface where they are easily netted.

2002 Fish Inventory Results

Historical surveys combined with RAMP efforts have resulted in the current list of fish species that have been found in the oil sands region of the Athabasca River.

Fish Species of the Athabasca River Region

- Arctic grayling
- Brassy minnow
- Brook stickleback
- Bull trout
- Burbot
- Emerald shiner
- Fathead minnow
- Finescale dace
- Flathead chub
- Goldeye*
- Iowa darter
- Lake chub
- Lake cisco
- Lake whitefish*
- Longnose dace
- Longnose sucker*
- Mountain whitefish
- Ninespine stickleback
- Northern pike*
- Northern redbelly dace
- Pearl dace
- River shiner
- Slimy sculpin
- Spoonhead sculpin
- Spottail shiner
- Trout-perch*
- Walleye*
- White sucker
- Yellow perch

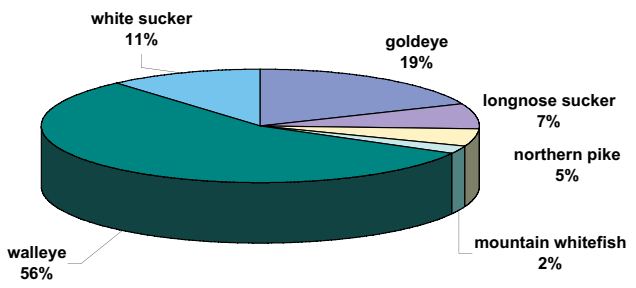
* Key fish indicators of the Athabasca River (CEMA 2001)

Most Abundant Fish in the Spring of 2002

Athabasca River Winner
- Walleye = 54 fish per hour

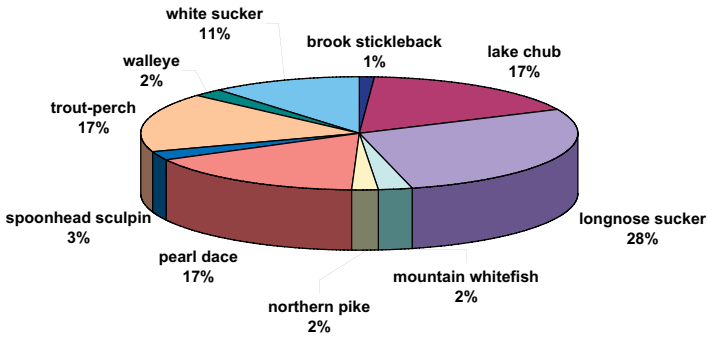
Muskeg River Champ
- Longnose sucker = 27 fish per hour

Composition of Athabasca River large-bodied fish captured during the RAMP 2002 Spring fish inventory.



Note: Arctic grayling, lake whitefish and burbot were present at < 1%.

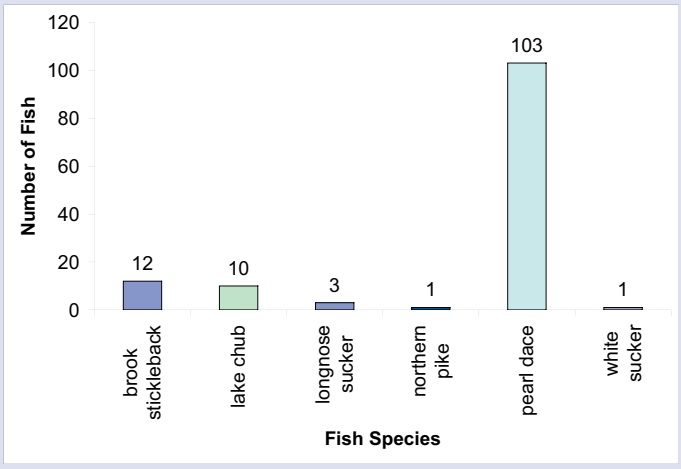
Composition of lower Muskeg River and lower Jackpine Creek fish captured during the RAMP 2002 Spring fish inventory.



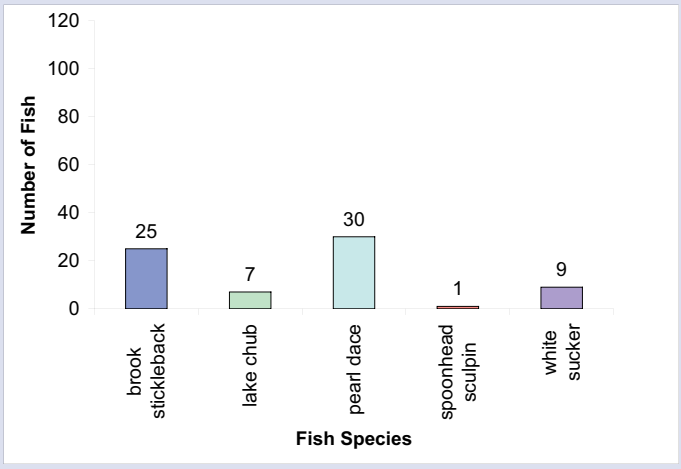
Note: goldeye and longnose dace were present at < 1%.

Number of fish captured at the Muskeg Creek fish fence, 2002.

Upstream Migration (Spring)



Downstream Migration (Fall)



- The number of fish species captured in the Athabasca River in 2002 was similar to past years. The abundance of most species was also similar to past years, although the catch of longnose sucker was the lowest yet recorded;

- The lower Muskeg River and lower Jackpine Creek were dominated by small-bodied species. A small number of sportfish were present, most of which were juvenile. No Arctic grayling were captured in either watercourse, suggesting that grayling may not have used the Muskeg River for spawning, rearing, or feeding in 2002; and

- Both Muskeg and Wapasu creeks were dominated by small-bodied species along with small numbers of young-of-the-year or juvenile suckers. Most of the spring captures occurred just after ice-out, indicating that these fish may begin their migrations while the river is still frozen.

Fish Tissue

In the RAMP fish program, fish species were tested for chemicals to see if they were safe to eat. The species tested included lake whitefish and walleye from the Athabasca River; northern pike from the Muskeg River; and northern pike, lake whitefish, and walleye from Gregoire Lake. Fish were analyzed for metals (including mercury) and tainting compounds.

Tainting
Tainting is defined as abnormal odour and/or flavour detected in the edible tissues of fish.

Chemical Concentrations in Fish Tissue

In Canada, the government provides guidelines regarding consumption limits of mercury. Mercury is a metal that occurs naturally in many rocks, soils and waterbodies throughout the world. Mercury is also a by-product of many industrial activities.

In 1999, Health Canada issued the following mercury consumption guidelines:

Occasional Consumer (3 servings per week)	Fish should contain, at a maximum, 0.5 milligrams of mercury per kilogram of fish tissue
Subsistence Consumer (8 servings per week)	Fish should contain, at a maximum, 0.2 milligrams of mercury per kilogram of fish tissue

An occasional consumer eats an average of 3 servings of fish (100 g per serving) per week over their lifetime compared to a subsistence consumer who eats an average of 8 servings per week over their lifetime.

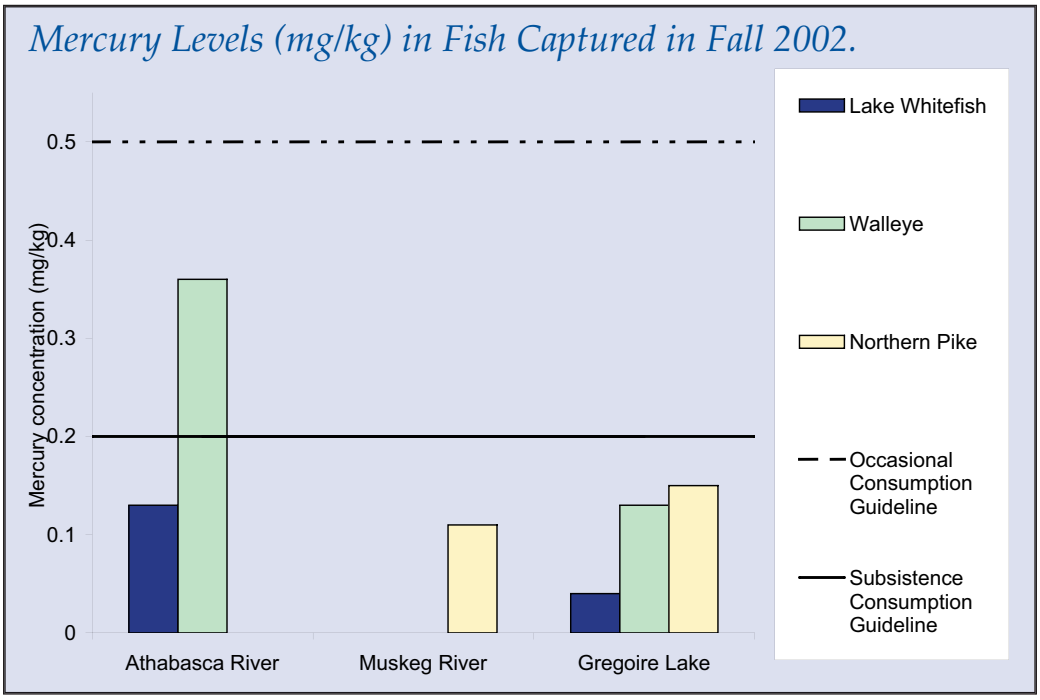
In 2003, the province of Alberta issued the following mercury guidelines for consumption of walleye caught in the Athabasca River:

- Women of child-bearing age and children under the age of 15 should not eat walleye captured from the Athabasca River; and
- All other people should not eat more than one meal of these fish per week.

(source: 2003 Alberta Guide to Sportfishing Regulations)

2002 Fish Tissue Results

In 2002, tissue analyses were conducted on fish from the Athabasca River, Muskeg River and Gregoire Lake.



- Historical records of mercury concentrations within the oil sands region indicate that current mercury levels are within the range of natural variability, and that these concentrations do not appear to be increasing over time. The values observed are representative of naturally high concentrations, which have been historically documented both upstream and downstream of current oil sands developments.

- No trends for increasing or decreasing levels of metals were observed, with the possible exception of strontium in Athabasca River fish, which appears to have declined from higher levels recorded in 1998.

In general, chemical levels in fish tissue samples from the Athabasca River, Muskeg River, and Gregoire Lake were below levels that would affect fish health, the suitability of the fish for human consumption, or fish flavour.

Sentinel Species Monitoring

Sentinel fish species monitoring is commonly used to see if industry is having any effect on wild fish populations. The approach compares the growth, survival and reproduction of a specific ***sentinel species*** that lives in an area influenced by industry relative to fish from an area not influenced by industry. RAMP conducts sentinel species monitoring because the status of a sentinel species is a sensitive indicator of the health of it surroundings.

The sentinel species survey focused on a small-bodied fish species, the trout-perch, because it is found in high numbers throughout the oil sands region. It has a small home range and stays in the lower Athabasca River throughout the year. The health of trout-perch was monitored at three "exposure" sites and two "reference" sites on the Athabasca River.

SENTINEL SPECIES
Fish species chosen for monitoring because they are good indicators of what is happening in their environment. They are usually non-sportfish species that will stay in a defined area instead of migrating.

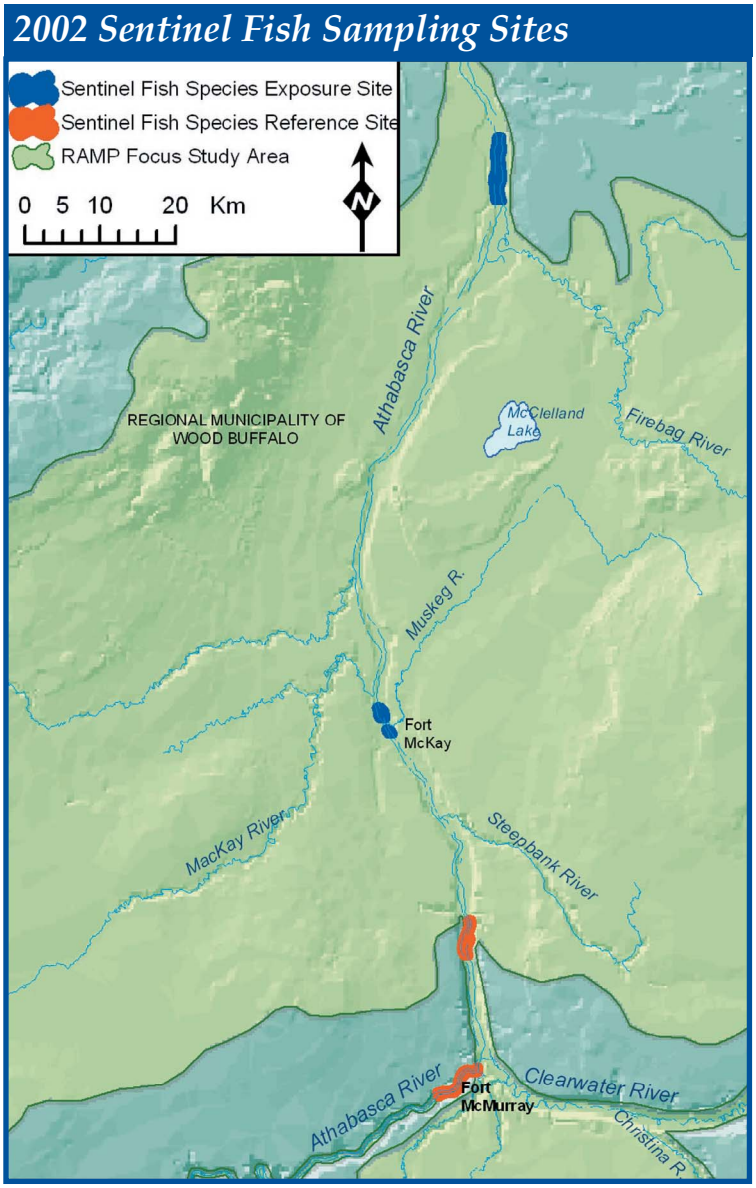
- "Exposure" sites are located in areas of current/future mining developments. In 2002, the exposure sites were below the Suncor/Syncrude area, the Muskeg River mouth, and the Firebag River mouth.

- "Reference" sites are located away from mining activities. In 2002, reference sites were located upstream and downstream of Fort McMurray.

Fish Sampling Methods

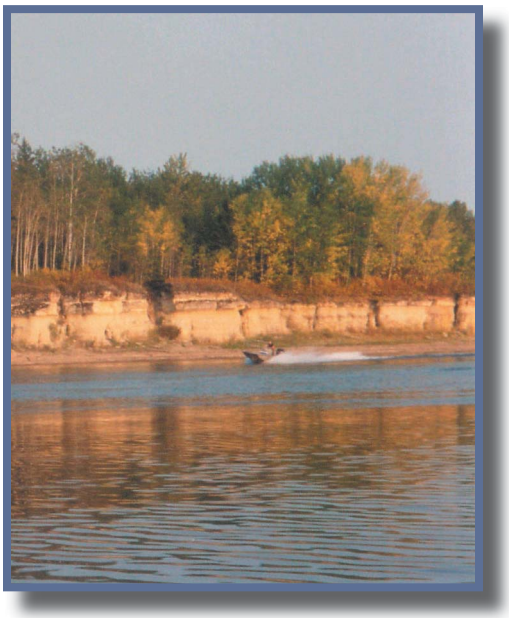
- 40 male and 40 female trout-perch were captured by boat electrofishing and beach seining;
- All fish were measured for total length, whole body weight, liver weight, gonad weight, gutted weight, and total number of eggs (female fish);
- A complete external and internal health assessment was conducted on each fish; and
- Ageing structures were collected from each fish.

2002 Sentinel Fish Sampling Sites



- The health of trout-perch from different monitoring sites was assessed by comparing the following characteristics:
  - Age;
  - Size and growth;
  - Size of female ovaries or male testes;
  - Number of eggs per female fish; and
  - Size of the liver.

Athabasca near Firebag



Athabasca near McKay River

Muskeg River

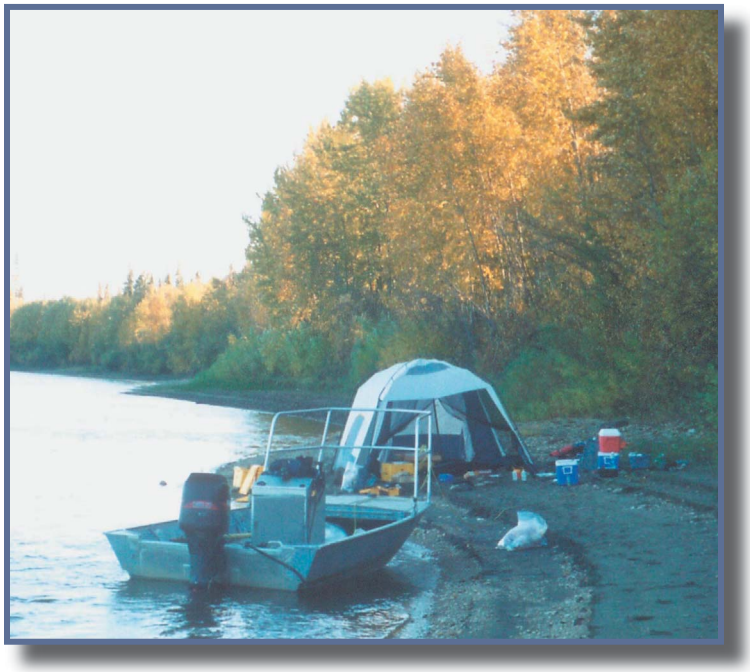
2002 Athabasca River Sentinel Species Survey Results

- Trout-perch were numerous at all monitoring stations;
- Characteristics of trout-perch caught immediately downstream of Fort McMurray and the sewage treatment plant were similar to fish upstream of the town.
- Some differences in fish from the oil sands exposure sites were observed:

Characteristics of Trout-perch From Oil Sands Exposure Sites Relative to Unexposed Sites

Characteristics	Athabasca River Oil Sands Exposure Sites		
	Suncor/Syncrude	Muskeg River	Firebag River
Age	younger	younger	younger
Size	same	same	same
Growth	same	same	same
Energy Reserves	same	same	same
Testes Size	larger	larger	larger
Ovary Size	same	same	same
# of Eggs	fewer	fewer	same

- Differences observed in characteristics of trout-perch collected from exposure areas may be due to natural and/or human influences. Future work will be conducted to determine the nature of these differences.



Fish Sampling Tent.

6 - ACID SENSITIVE LAKES

Acid sensitive lakes are waterbodies that are vulnerable to increasing acidity through the ***deposition*** of acidic and acid-forming compounds. Examples of acid-forming compounds released by industry include sulphur dioxide (SO_2) and oxides of nitrogen (NO_x). These compounds can cause the water to become more acidic, which can harm the health of many fish, bugs and plants. The goal of the acid sensitive lakes monitoring program is to identify the early signs of acidification before lakes and the organisms within them are harmed.

2002 Acid Sensitive Lakes Monitoring Program

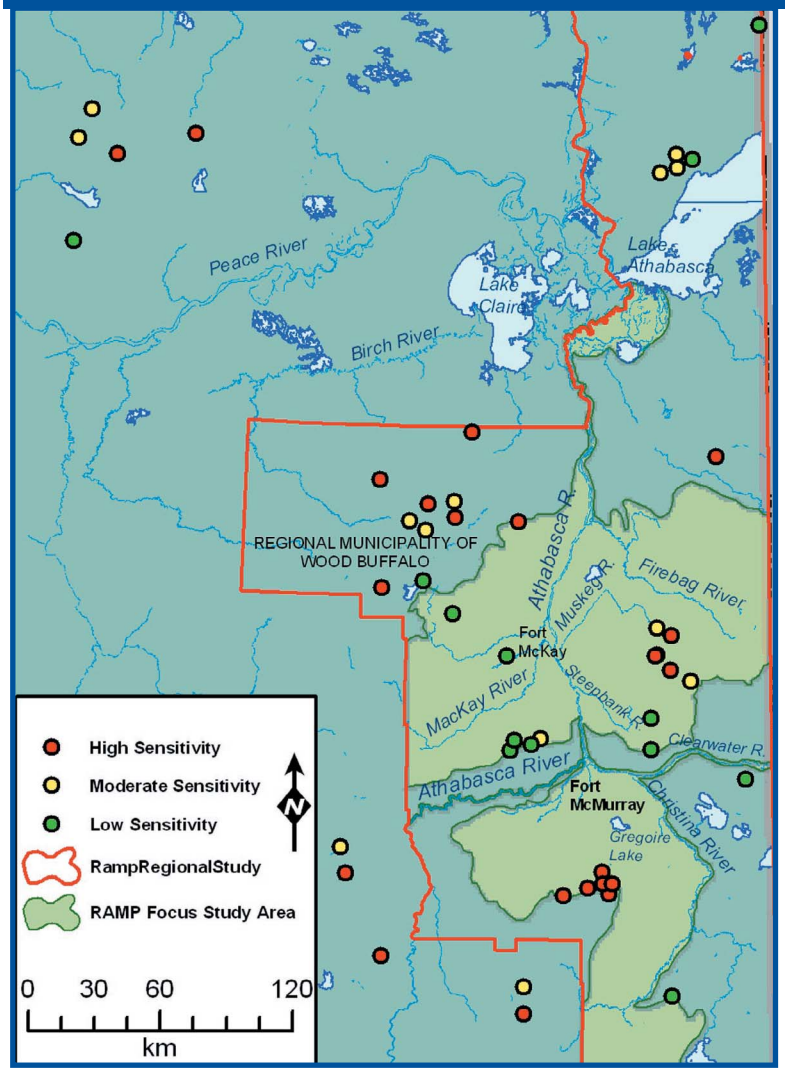
The acid sensitive lakes program measures lakes once a year for the following qualities:

- Water acidification (pH levels);
- Water quality measures (colour, carbon levels, suspended solids, and nutrients); and
- Alkalinity measures a lake's level of protection from acidification.

A lake is generally considered to be affected by acidification when pH drops below 6, and when pH falls below 4 or 5, species diversity becomes restricted.

ACID DEPOSITION
Rain, as well as snow, hail and dew can be sources of acid deposition.

2002 Acid Sensitive Lake Monitoring Stations



In 2002, RAMP measured 49 lakes for acid deposition. Of these lakes, 17 were added to the program in 2002 in order to measure the lakes located near the heaviest oil sands development. Alberta Environment specialists conducted the monitoring activities on behalf of RAMP.

2002 Acid Sensitive Lakes Study Results

- 11 of the 49 lakes had pH levels less than 6;
- 21 lakes became more acidic between 2001 and 2002; however, only one of these lakes declined more than 0.5 pH units (from 6.7 to 6.1); and
- Compared to previous years, alkalinity and pH results generally showed no significant signs of lake acidification; however, at current deposition rates, some lakes may be affected by acidification in the future.

Isadore's Lake

Kearl Lake

7 - AQUATIC VEGETATION

RAMP studies aquatic vegetation and water quality in wetlands located close to oil sands development. Aquatic vegetation is an important indicator of the overall environmental health of wetlands. Changes in abundance and distribution of aquatic vegetation may influence the use of a wetland by fish, bugs, birds and wildlife.

Wetlands are an important component of the environment because they:

- Filter out sediment and pollutants from water;
- Recharge the water table;
- Reduce soil erosion of downstream waterbodies; and
- Provide food and shelter for aquatic organisms.

How was aquatic vegetation monitored in 2002?

In 2002, wetland monitoring focused on Kearl Lake, Isadore's Lake and Shipyard Lake. Aerial photography was used to see whether there were any changes in plants and water levels between 1997 and 2002.

Aerial photographs were collected with a special camera mounted on a plane. Each wetland is photographed at a similar altitude each year so that the pictures can be easily compared. The photographs are scanned into a computer program used to calculate the total extent of each vegetation type and the results are compared to previous years data.

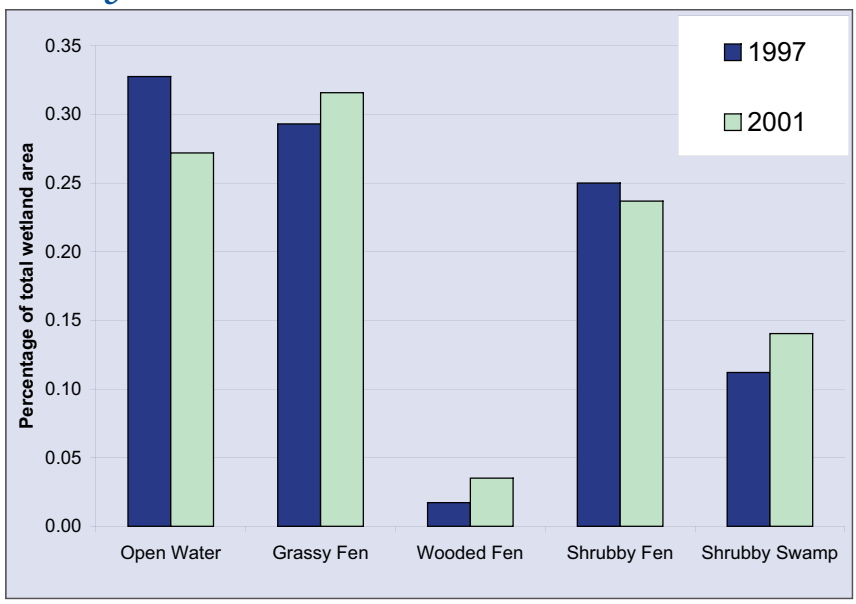
Aquatic vegetation monitoring

2002 Aquatic Vegetation Study Results

Isadore's Lake

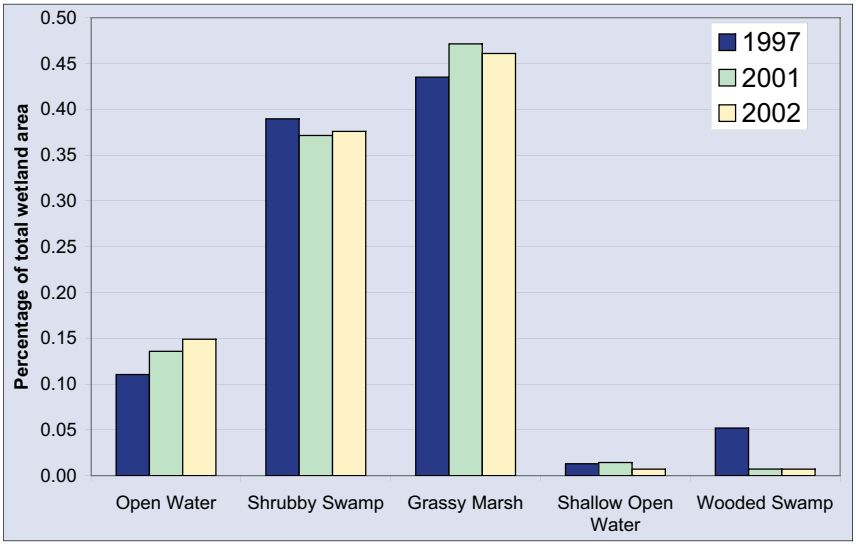
The grassy *fen* vegetation appears to be expanding and replacing the open water. All other vegetation types have remained relatively similar since 1997.

FEN
A wetland with neutral to slightly acidic water quality and low to moderate amounts of nutrients, most of which are received from slow moving surface waters.



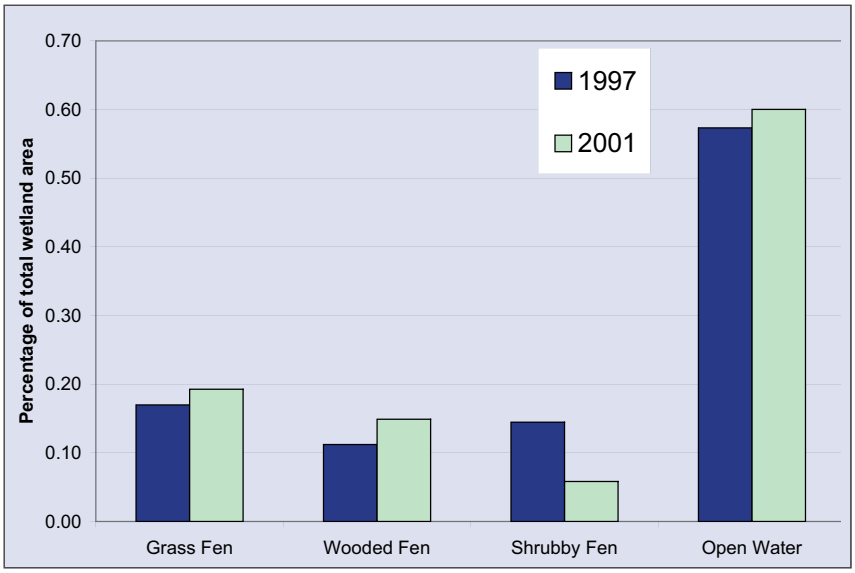
Shipyard Lake

There appears to be a gradual increase in the overall size of Shipyard Lake from 1997 to 2002. Additionally, the channel that flows from the open shrubby swamp into the open, grassy marsh appears to be filling in.



Kearl Lake

The composition of wetland vegetation in Kearl Lake remained relatively stable between 1997 and 2001.

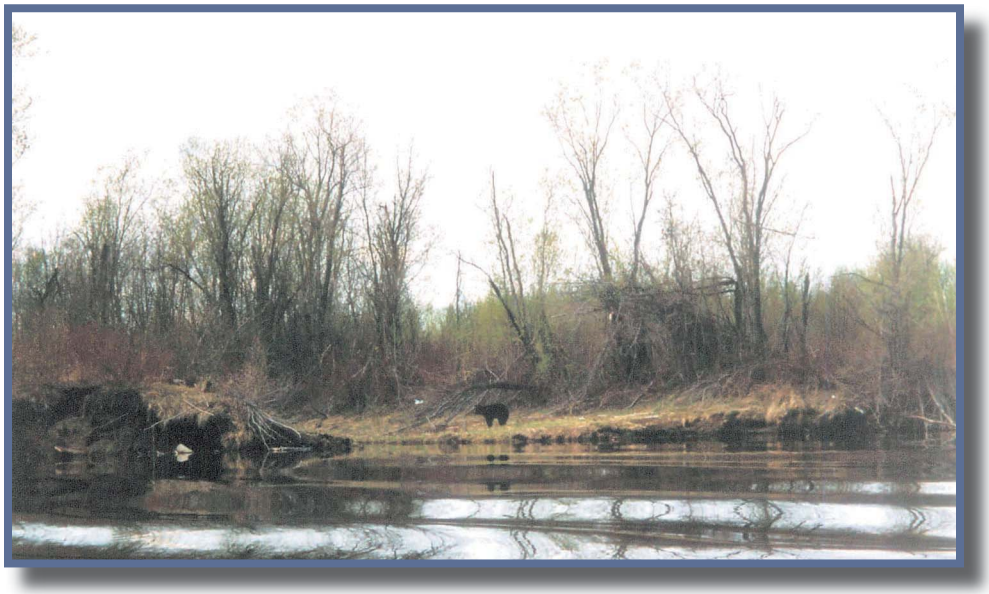


Quality Assurance

Quality assurance and quality control (QA/QC) is a process that is used to ensure that the information obtained in field and laboratory studies is useful, accurate and comparable to the quality of information from other studies.

RAMP has developed a QA/QC plan for its field programs, laboratory analyses and office procedures. All RAMP components strictly follow the procedures described in the QA/QC plan.

RAMP always follows consistent procedures for sample collection, transportation, storage and analysis to ensure the quality of data collected.



Bear at Firebag

Fort Chipewyan dogsled races

In addition to the core monitoring components, RAMP also strives to promote community participation and to effectively communicate findings to the public. Some of the activities that the public are encouraged to take part in include the following:

- Fish Tagging Program;
- Fish Abnormalities Program;
- River Response Network; and
- RAMP Webpage (www.ramp-alberta.org).

Fish Tagging Program

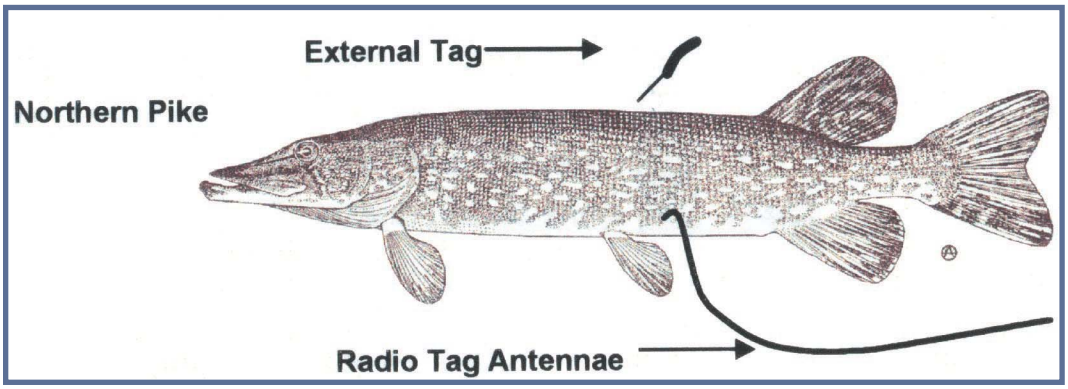
Have you seen these fish?

Walleye/Pickerel | Northern Pike/ Jackfish | Burbot | Goldeye | Lake Whitefish

A number of fish in the Athabasca River basin have been fitted with radio transmitters and/or external tags. The tagged fish are part of a collaborative fish movement study for the oil sands Regional Aquatics Monitoring Program (RAMP) and the Cumulative Environmental Management Association's (CEMA) Surface Water Working Group. Members of the public can be an integral part of the study by reporting any tagged fish that are caught.

The external tag is located near the dorsal fin (see diagram) and may be coloured brown (RAMP), pink (Syncrude) or blue/yellow (Fish and Wildlife Division).

Radio tagged fish have an antennae protruding from the side of their body.



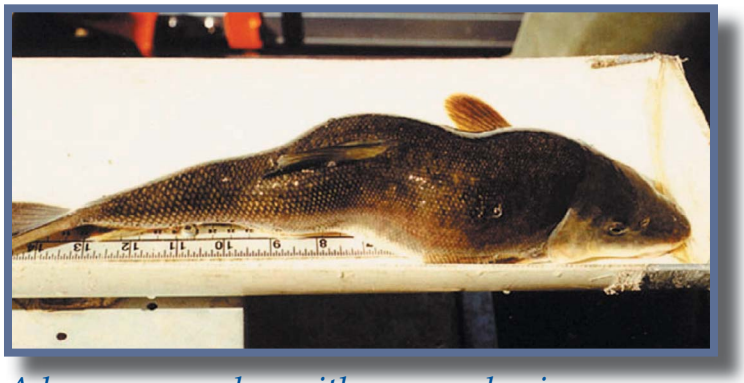
The tag number, the tag colour, and the fish's length and weight are important details to report. Other information on the tags can include company name, address, and phone number.

External fish tag

Fish Abnormalities Program

Abnormalities occur in all fish populations and can be the result of natural or human influences. Some of the more common causes of abnormalities include parasites, infections, injuries, genetics, and presence of chemicals in the water.

Common fish abnormalities include lesions, growths, scarring, unusual scale patterns, body colour changes and physical deformities like missing fins, curved spines or blindness.



A longnose sucker with a curved spine

If a fish with an external tag is caught, please phone one of the following people:

Please release live radio tagged fish and report the external tag number and fish information to help keep the study moving! If the fish is kept, please return radio tags. The radio transmitter can be found implanted in the abdomen of the fish.

Communities within the oil sands region have teamed with RAMP to gather information about abnormal fish found in the area. Individuals within each community will be trained to sample fish with abnormalties and send these samples to the Department of Fisheries and Oceans (DFO) in Winnipeg for further evaluation. If people in the community discover fish that look abnormal, they can contact one of the following people for assistance:

Tagged and Abnormal Fish Contact List

Athabasca Chipewyan First Nations (ACFN) Caroline Adam (located in Fort Chipewyan) (780) 697-3300
Chipewyan Prairie First Nation Shannon Crawley (780) 715-3471
Fort McKay First Nation Lisa Schaldemose (780) 791-2505
Fort McMurray First Nation Ian Walker (780) 334-2828
Mikisew Cree First Nation Melody Lepine (780) 714-6500
Alberta Sustainable Resource Development Larry Rhude (780) 743-7200
Athabasca Tribal Council Eric Davey (780) 791-7445
Alberta Environment Scott Flett (780) 697-3733

River Response Network

Occurrences of foam, scum, turbidity and other events, many of which are of natural origin, occur in rivers throughout the world. Events of this type have occurred on the lower Athabasca River in recent years and have prompted questions about their nature and source. Because of the expansion of the oil sands industry and the concerns of local residents, RAMP has developed the River Response Network to respond to reports of non-spill type phenomena on the lower Athabasca River.

- RAMP will provide a co-ordinated investigation of reported non-spill events. There is a network of member contacts along the lower Athabasca River that will respond to reports of this type.
- Currently, the River Response Network is intended to operate only during the open-water season on the lower Athabasca; however, the program could be expanded for events during any season and on any waters in the RAMP area.
- The River Response Network will be activated by calls from the public or a RAMP member's observations.

Should you see something on the river that is of concern, please call toll free 1-800-222-6514 or contact one of the following:

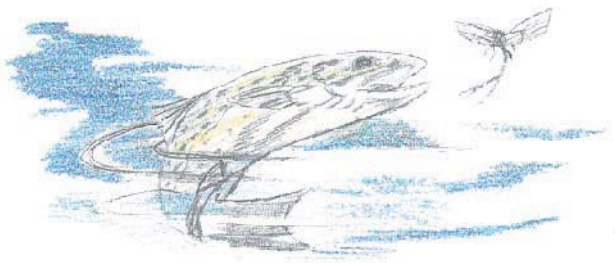
River Response Network Contact List

Fort Chipewyan	Scott Flett (AENV)	(780) 697-3733
Fort McKay	Marc Symbaluk (Syncrude) Carmallee Farn-Baker (Albian)	(780) 790-5638 (780) 713-4440 / (780) 714-0509
Tar Island	Laura Smithies	(780) 743-6658
Fort McMurray	Larry Rhude (ASRD) Roger Rancharita (AENV)	(780) 743-7339 (780) 743-7470 / (780) 714-8415
Upstream of Fort McMurray	Mark Spafford (AlPac)	(780) 525-8160 / (780) 689-9347

The RAMP Webpage

The RAMP webpage provides easy access and useful tools for people interested in the program. Visit the webpage to see the latest news, maps, sample site locations, past RAMP reports and current contact information. There are also online reporting forms for people to fill out in the event that they observe a fish with abnormalities or a tag.

Please visit the RAMP webpage at http://www.ramp-alberta.org



Regional
Aquatics
Monitoring
Program

RAMP

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