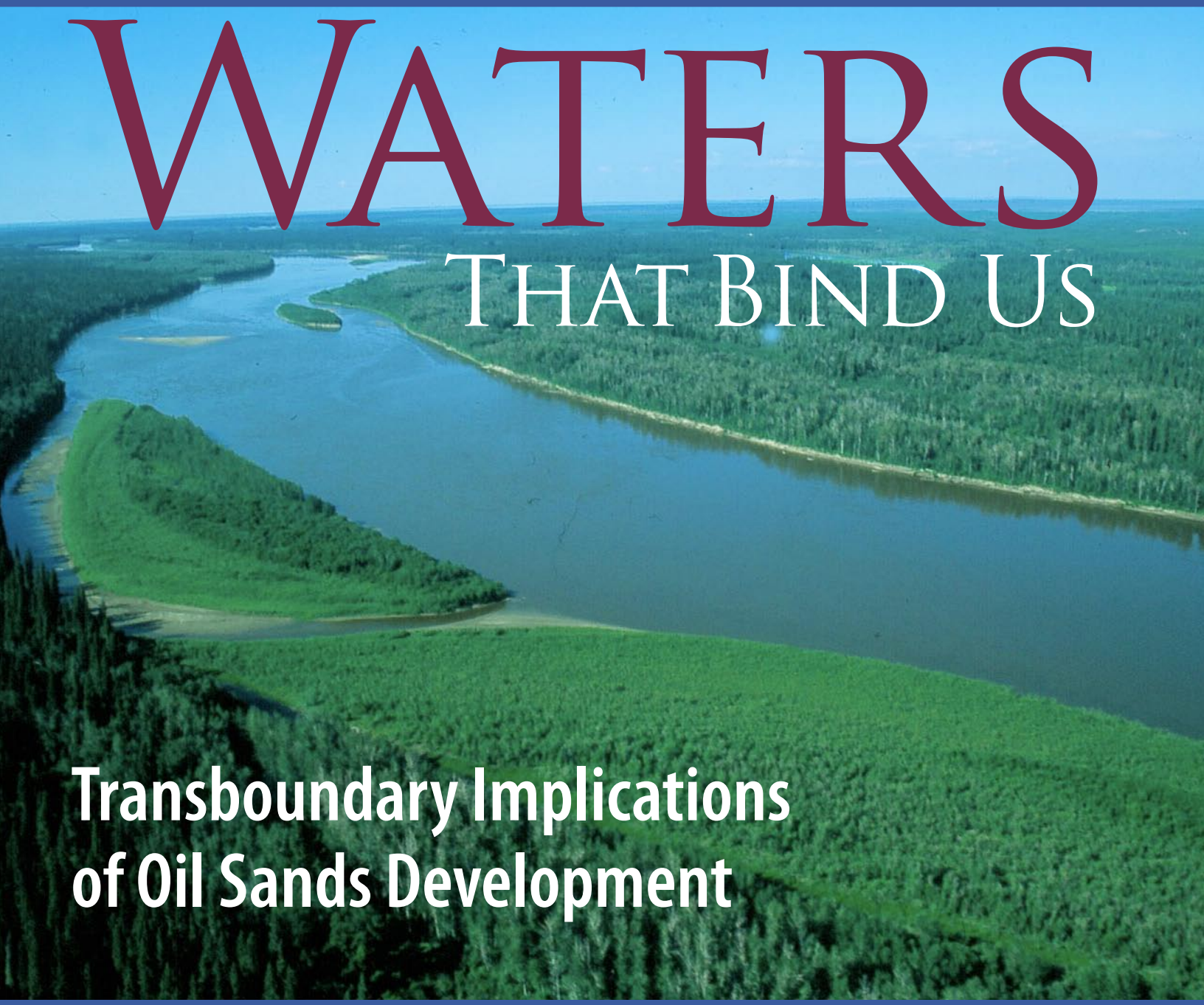
The Waters That Bind Us



Transboundary Implications of Oil Sands Development

Peggy Holroyd
Terra Simieritsch

the PEMBINA institute
Sustainable Energy Solutions

The Waters That Bind Us

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The Waters That Bind Us

Transboundary Implications of Oil Sands Development

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Summary

Water sustains us and provides us with life. While many of us take water for granted, the health of water resources and surrounding ecosystems is a primary concern for people living downstream of oil sands development in northeastern Alberta. The oil sands industry uses large quantities of water and produces large amounts of toxic waste, both of which have an impact on the ecosystem and could, by association, impact people's health, traditional subsistence activities and ways of life.

Residents of northeastern Alberta are becoming increasingly politically active in an effort to protect the region's water resources. A number of legal challenges have been issued against the provincial and federal governments for mismanagement of oil sands development and for infringing on treaty rights, culture and human health.

Downstream in the Northwest Territories, there is also concern about the long-term impacts of oil sands development on water resources. Residents want effective and strong water management standards put in place now, so that the region can avoid the water problems occurring in northeastern Alberta.

Impacts on Water Resources from Oil Sands Development

Oil sands deposits underlie an area of 140,000 square kilometres in northeastern Alberta. Proceeding at a rapid pace, oil sands production is expected to more than triple by 2030.

Oil sands are extracted by one of two processes: mining or in situ development. Both processes have a number of impacts on water. Clearing forests and wetlands for mine pits, roads, well sites and pipelines destroys vegetation and its ability to maintain ecosystem health by storing and filtering water.

Oil sands development also requires large amounts of water to extract the bitumen from the sand and to process or upgrade the bitumen. This water is drawn in part from the Athabasca River and underground aquifers, reducing the availability of water for local and downstream ecosystems.

Waste water from the extraction and processing of oil sands is stored in large tailings "ponds" or in deep wells. The toxic water in tailings ponds is known to leach into the surrounding water systems, and may also leak from deep wells, posing a risk to water quality in the region. As of June 2008, 720 million cubic metres of tailings were contained in tailings ponds. Oil sands projects continue to be approved even though the tailings reclamation strategy of using "end pit lakes" is untested and poses a significant risk to the long-term health of the ecosystem.

Any changes to water quality can significantly impact the health of residents in the region. A number of studies have found higher levels of arsenic and other metals in the Athabasca River Delta. Arsenic exposure is associated with bile duct, liver, urinary tract, and skin cancers, vascular diseases, and Type II diabetes.

Water Management

The Government of Alberta and the Government of Canada work together on oil sands issues through the environmental assessment processes, joint policy (like the Lower Athabasca River Water Management Framework), and multi-stakeholder bodies such as the Cumulative

Environmental Management Association (CEMA) and the Regional Aquatics Monitoring Program (RAMP).

Yet increasingly, these processes are receiving criticism. A number of environmental and Aboriginal organizations have criticized CEMA and RAMP for being inefficient, biased and ineffective. There is still no land use plan that protects wildlife and the regional ecosystem; no lower limit on flows of the Lower Athabasca River below which oil sands water withdrawals would be prohibited; and no certification standards for oil sands reclamation. These groups are calling for clear environmental limits, reclamation guidelines and independent, integrated monitoring of water resources.

Water management is an important issue for communities located downstream from oil sands development. The Government of the Northwest Territories has released a discussion paper on water management in the territory, which suggests using the natural capital approach to water management. This approach considers the value of water to multiple users and for its ecosystem services.

A transboundary bilateral agreement between Alberta and the Northwest Territories was first discussed in the 1980s. The agreement is intended to set guidelines for cooperative water management between jurisdictions and to set water quality and quantity criteria for water that flows into the Northwest Territories. However, the approval of new projects and water licenses and the ongoing incremental use of water and production of toxic tailings by the oil sands industry make negotiating an agreement difficult.

Recommendations

There are a number of ways that governments, industry, Albertans, Northerners and Aboriginal groups can contribute to the protection of water resources in the Mackenzie River Basin. Each of us has a role to play. The following are recommendations for improving water management and minimizing risks to water resources from oil sands development:

1. Suspend new oil sands lease sales and oil sands approvals until environmental rules protecting water are in place.
2. Stop granting new water licenses to oil sands projects until a transboundary agreement is complete.
3. Complete a transboundary agreement between Alberta and the Northwest Territories that is enforceable by law, and includes a number of elements including criteria for water quality and quantity and protection of aquatic ecosystems and a commitment by Alberta to notify downstream users about oil sands projects and associated risks.
4. Implement a water management framework for the Athabasca River and Slave River that sets a protective Ecological Base Flow (EBF) below which water withdrawals are prohibited
5. Prohibit the production of liquid tailings for new oil sands projects – industry should be required to use and further develop technologies that do not produce wet tailings.
6. Establish a consistent, transparent and integrated monitoring system, at arms length from industry, to assure acceptable water quality and quantity and protect aquatic ecosystems in the Athabasca River, the Peace-Athabasca Delta, Lake Athabasca and the Slave River.

The impact of oil sands development on water resources is no longer acceptable to many people in Alberta and beyond. There is mounting evidence that oil sands development is affecting water

resources in Alberta in a way that has exceeded, or will soon exceed, environmental and social limits. Human and ecological uses of water should be valued first. New transboundary environmental rules are needed to protect water resources, complemented by new technologies to minimize industrial water use and integrated, transparent water monitoring.

1. Introduction

"Whereas we the people, both here and outside the basin, rely on the gifts from our Creator, which are the resources that Mackenzie River Basin provides. Our traditional land and water users tell us that the environment they know is changing…The increasing development in the Mackenzie River Basin is a growing threat, not only here, but to all who live on the lower reaches of the river. The basin habitat and its biological diversity are of central importance to the livelihood and socio-cultural integrity of the people of the basin who use the area for hunting, trapping, fishing, gathering, transportation, teaching youth and spiritual purposes."

—Resolution Akaitcho Territory Government Annual General Assembly, August 12, 2008

"We the peoples gathered in Fort Chipewyan have come together as Keepers of the Water, as peoples living in the vast Arctic watershed, to reaffirm that water is our lifeblood and must be protected."

—Keepers of the Water III Declaration, August 14, 2008

"We join the many communities of the Mackenzie Basin in affirming that water is a sacred trust and a fundamental human right, and support and advance the resolutions made in Weledeh (Yellowknife River), Liidlii Kue (Ft. Simpson), Ft. St. John (BC), Thebacha (Ft. Smith), and Ft. Chipewyan to advance the Keepers of the Water movement. And we resolve to: 1) As downstream communities which will be directly affected by those developments, to join in support of those communities which are calling for a moratorium and initiating legal action to halt further expansions of the tar sands."

—Excerpt from Radili Ko resolution, Fort Good Hope, September 4, 2008

"Water is boss," a Mikisew Cree Elder once said.[1] This statement epitomizes the importance of water in an ecosystem. The health of plants, animals and communities is determined by the availability and quality of water resources. The consequences of poor water quality and limited quantity are wide ranging and impact the whole ecosystem.

Ecosystem health is a primary concern for the residents of Fort Chipewyan, Alberta, including the Mikisew Cree First Nation, the Athabasca Chipewyan First Nation, the Metis Local #125 and others. Fort Chipewyan is situated on the edge of Lake Athabasca in northern Alberta at the confluence of the Athabasca River and the Peace River. The extraction and processing of oil sands — one of the largest industrial ventures in human history — takes place upstream from Fort Chipewyan. The oil sands industry uses large quantities of water and produces large amounts of toxic waste, both of which could have an impact on the ecosystem and by association, people's health, traditional subsistence activities and ways of life.

Downstream from Fort Chipewyan, in the Northwest Territories, poor water quality has the potential to affect drinking water, traditional subsistence activities, tourism, commercial fishing and transportation. "We are downstream of all development activity occurring upstream. We in the Northwest Territories need to be consulted and have these impacts recognized. There are also Aboriginal Treaty rights being affected," says Diane Giroux, a Northwest Territories resident.[2]

[1] Athabasca Chipewyan and Mikisew Cree First Nations, "First Nations Alarmed by Increasing Trend in Tailings and Effluent Mishaps: Industry presentation raises concerns about ongoing toxic releases," media release, Fort Chipewyan, AB, May 7, 2008.

[2] The Pembina Institute, *Athabasca River Expedition: Connecting the Drops*, http://www.connectingthedrops.ca/ (accessed September 24, 2008).

There are two main reasons that residents of Alberta and the Northwest Territories are increasingly concerned about the cumulative impacts of oil sands development on water:[3]

- concern that acceptable limits for environmental and/or socio-economic impacts have been reached or passed
- lack of trust in the current water management processes to protect water resources from the impacts of oil sands development

Residents in northeastern Alberta are becoming increasingly politically active in an effort to protect the region's water resources. A number of legal challenges have been issued against the provincial and federal governments for mismanagement of oil sands development and for infringing on treaty rights, culture and human health.[4] Downstream in the Northwest Territories, residents want effective and strong water management standards put in place before local water resources are irreversibly harmed by oil sands development.

This report explores the potential impacts of oil sands development on water and ecosystems downstream in the Northwest Territories. While it is acknowledged that other land uses along the Athabasca and Peace Rivers, such as forestry, agriculture and recreation, also affect water resources, this report focuses specifically on the risks from oil sands development for two main reasons: 1) oil sands development is expected to more than triple by 2030,[5] and 2) oil sands development creates large lakes of toxic tailings that are stored on site.

Chapter Two will examine the current extent of oil sands development in the Athabasca River Basin in Alberta, as well as the current and potential impacts of this activity on the river. Chapter Three describes water management practices in Alberta and the Northwest Territories, and cooperation between jurisdictions on transboundary water management issues. The final chapter makes recommendations for improving management to reduce risks to water resources in northern Alberta and the Northwest Territories.

1.1 Description of the Region

The Athabasca River flows north through the municipality of Wood Buffalo and the middle of the Athabasca oil sands deposit in northern Alberta to the Peace–Athabasca Delta. The Peace–

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[3] L. B. Lawe, J. Wells and Mikisew Cree First Nations Industry Relations Corporation, "Cumulative effects assessment and EIA follow-up: a proposed community-based monitoring program in the Oil Sands Region, northeastern Alberta," *Impact Assessment and Project Appraisal*, 23, no 3 (September 2005): 205-209.

[4] CBC News, "First Nation takes Province to Court Over Oil Sands Leasing," December 11, 2008, http://www.cbc.ca/canada/north/story/2008/12/11/edm-athabasca-chipewyan.html (accessed December 12, 2008); Chipewyan Dene First Nation, "Chipewyan Prairie Dene First Nation: First Nation Files Lawsuit Challenging Oilsands Tenure and Regulatory Approval System," press release, June 4, 2007; Beaver Lake Cree First Nation, "Beaver Lake Cree Nation Draws a Line in the (Oil) Sand," press release, May 14, 2008, http://www.beaverlakecreenation.ca/upload/documents/pressrelease.pdf; Woodland Cree First Nation, "First Nation Challenges Alberta's Policy on Oil Sands Tenures and Development" press release, October 7, 2007, http://www.marketwire.com/press-release/Woodland-Cree-First-Nation-Wcfn-776128.html.

[5] Due to the economic downturn in 2008, the Canadian Association of Petroleum Producers projected that it would take an additional two years — from 2017 to 2019 — to reach the three million barrel a day oil sands production; D. Healing, "Oilsands output target pushed back two years," *Calgary Herald*, December 16, 2008; Government of Alberta, "Alberta's Oil Sands," Alberta Energy Website, http://www.energy.gov.ab.ca/OurBusiness/oilsands.asp (accessed December 8, 2008).

Athabasca Delta is on the Ramsar List of Wetlands of International Importance and is part of Wood Buffalo National Park, a UNESCO world heritage site.[6] The Athabasca River and water from Lake Athabasca flow into the delta. Contaminants can collect in the delta, as water slows and deposits sediment at this point.

Figure 1 The Athabasca River.
Photo: David Dodge, The Pembina Institute

From the delta the water flows north via several channels towards the Peace River and the Slave River. The Peace River is renamed the Slave River as it turns north and continues into the Northwest Territories. The Peace River contributes approximately 65% of the water flow to the Slave River. The Athabasca River and water flowing from Saskatchewan into Lake Athabasca contribute the rest of the water flow.

Every seven or eight years on average, when the river is flowing high and/or there are spring ice jams, the water from the Peace River flows backwards into the delta region.[7] This flooding

[6] The Ramsar Convention on Wetlands, "The List of Wetlands of International Importance," fact sheet (The Secretariat of The Convention on Wetlands, 2008), http://www.ramsar.org/sitelist.pdf (accessed September 24, 2008); UNESCO, "World Heritage List" website (UNESCO, 2008), http://whc.unesco.org/en/list (accessed December 8, 2008).

[7] Mackenzie River Basin Board, *Mackenzie River Basin State of the Aquatic Ecosystem Report 2003* (2004), http://www.env.gov.bc.ca/wsd/plan_protect_sustain/interprov/mackenzie_river_basin.html (accessed October 22, 2008).

provided critical water to isolated wetlands and abundant habitat for waterfowl and muskrat populations.[8]

Along the Slave River, on the border between the Northwest Territories and Alberta, is the town of Fort Smith. The water volume in this area is so high that it has long been proposed as a hydroelectric site.[9] The river drops here by 33 metres over 25 kilometres, forming four sets of rapids, a world class whitewater kayaking site and summer habitat for the unique Slave River white pelican colony.[10] At the north end of the 434 kilometre Slave River lies the Slave Delta, on the southern shore of Great Slave Lake. From there the water flows north in the Mackenzie River to the Beaufort Sea, as shown in Figure 2. The entire Mackenzie Basin is 1,790,000 square kilometres and covers 20% of the land mass of Canada.[11]

Figure 2 The Mackenzie Basin.

Source: Mackenzie Basin Impact Study (MBIS) Map by Eric Leinberger at the University of British Columbia

[8] Ibid.

[9] G. Jaremko, "Aboriginal partners sought for hydro plan; Run-of-river power project years away, but could replace coal-fired plants," *Edmonton Journal*, May 9, 2008; Northern River Basins Study Board, *Northern River Basins Study Final Report*, (Northern River Basins Study Board, 1996), http://www3.gov.ab.ca/env/water/nrbs/sect1/sect15.html (accessed September 24, 2008).

[10] Spectacular Northwest Territories.com, "Slave River Rapids," http://spectacularnwt.com/wheretoexplore/woodbuffalo/rapids; Fort Smith Tourism, http://www.fortsmithtourism.ca/

[11] Natural Resources Canada, "Drainage Patterns," Atlas of Canada, http://atlas.nrcan.gc.ca/site/english/maps/freshwater/distribution/drainage/1 (accessed December 8, 2008).

1.2 Accelerating Impacts on Water Resources from Oil Sands

Oil sands deposits underlie an area of 140,000 square kilometres in northeastern Alberta, as shown in Figure 3.

Oil sands are extracted by one of two processes: mining or in situ development. Both processes can have a number of impacts on water resources. Clearing forests and wetlands for mine pits, roads, well sites and pipelines destroys all vegetation, as well as its ability to maintain ecosystem health by storing and filtering water. Oil sands development requires large amounts of water to extract the bitumen from the sand and to process or upgrade the bitumen. This water is drawn in part from the Athabasca River and underground aquifers, which can reduce the availability of water for local and downstream ecosystems. Finally, the practice of storing waste water from the extraction and processing of oil sands in large tailings "ponds" or in deep wells poses a risk to water quality in the region. Toxic water from tailings ponds is known to leach into surrounding water systems, and may also leach from deep wells.

Figure 3 Map of oil sands deposits in Alberta.

Source: S. Fick, Canadian Geographic

In the early 1990s, the Government of Alberta, Government of Canada and Government of the Northwest Territories initiated the Northern Rivers Basin Study (NRBS)[12] to address ecological concerns about industrial development along the Peace and Athabasca Rivers. At the completion of the NRBS, a number of recommendations were made on basin management. One recommendation called for "formal arrangement [to] be made to ensure land use planning and water use planning are integrated as basin management planning throughout the northern river basins."[13] Achieving this objective would require the ongoing review of agriculture, oil and gas, forestry, and other land use impacts on surface water, rivers, groundwater and fish, while considering the context of a changing climate and atmospheric sources of contaminants.

In 1996, to address the recommendations from the NRBS, the Northern Rivers Ecosystem Initiative (NREI) was established.[14] NREI was a science-based effort to learn more about human impact on aquatic ecosystems. NREI was a five year initiative, from 1998 to 2003, that focused on fish, water flows and quality, contaminants, nutrients, safe drinking water and enhanced environmental monitoring.

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[12] Northern River Basins Study Board, *Northern River Basins Study Final Report*, (Northern River Basins Study Board, 1996), http://www3.gov.ab.ca/env/water/nrbs/sect1/sect15.html (accessed September 24, 2008).

[13] Government of Alberta, Government of Canada and Government of the Northwest Territories, *Canada – Alberta – Northwest Territories Response to The Northern River Basins Study*, recommendations 8.1 http://www3.gov.ab.ca/env/water/nrbs/response/1-12.html (accessed September 24, 2008).

[14] Environment Canada, Alberta Environment, Government of the Northwest Territories, *Northern Rivers Ecosystem Initiative, Key Finding* (Toronto, ON: Federal Publications Inc., 2004), http://www.environment.gov.ab.ca/info/library/6374.pdf (accessed September 24, 2008).

According to the NREI:

> "The oil sands industry in northern Alberta has a major impact on the land, but so far has had little impact on the Athabasca River. Natural oil sands outcrops are present along the Athabasca River and its tributaries. NREI scientists found that there was a slight to moderate impacts on the plants and animals in the river from these natural sources, but there was no evidence that industrial oil sands operations were having an effect." [15]

However, in another report citing the results of NREI, Gummer, et al (2006) note that effluents from the oil sands industry, if not properly controlled, could become an issue in the future, given the rapid pace of growth in the region.[16]

Oil sands development is occurring at a rapid pace. When the NREI was completed in 2003, there were three mine projects, three upgrader projects and five in situ projects in operation.[17] In August 2008, there were seven mine projects, nine upgrader projects, and nineteen in situ projects in operation or scheduled for start up within the year. By the 2030s, there may be as many as 40 upgraders, 33 mines and 83 in situ projects, based on what has been announced, applied for, or is currently in operation.[18] The production of oil sands, as shown in Figure 4, is expected to grow from 1.7 million barrels a day production in 2007 to 5 million barrels a day in 2030.[19]

The further expansion of the oil sands industry may have an effect on the amount and quality of water and the health of the ecosystems in the Mackenzie River Basin. These effects will compound the changes already experienced as a result of climate change in the region.

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[15] Environment Canada, Alberta Environment, Government of the Northwest Territories, *Northern Rivers Ecosystem Initiative, Key Findings* (Toronto, ON: Federal Publications Inc., 2004), 5 http://www.environment.gov.ab.ca/info/library/6374.pdf (accessed September 24, 2008).

[16] W. Gummer, F. M. Conly and F. Wrona, "Northern Rivers Ecosystem Initiative: Context and Prevailing Legacy," Environmental Monitoring and Assessment 113, no. 1-3 (2006): 71–85.

[17] Each phase of a project is considered a separate project. Calculations do not include Peace River and Cold Lake Projects. R. B. Dunbar, *Existing and Proposed Canadian Commercial Oil Sands Projects, August 2008,* (Strategy West Inc., 2008), http://www.strategywest.com/downloads/StratWest_OSProjects.pdf (accessed September 24, 2008).

[18] Ibid.

[19] Due to the economic downturn in 2008, the Canadian Association of Petroleum Producers projected that it would take an additional two years — from 2017 to 2019 — to reach the three million barrel a day oil sands production; Dan Healing, "Oilsands output target pushed back two years," *Calgary Herald,* December 16, 2008; Canadian Association of Petroleum Producers, *Crude Oil Forecast, Markets and Pipeline Expansions* (Calgary, AB: Canadian Association of Petroleum Producers, 2008); Government of Alberta, "Alberta's Oil Sands," Alberta Energy Website, http://www.energy.gov.ab.ca/OurBusiness/oilsands.asp (accessed December 8, 2008).

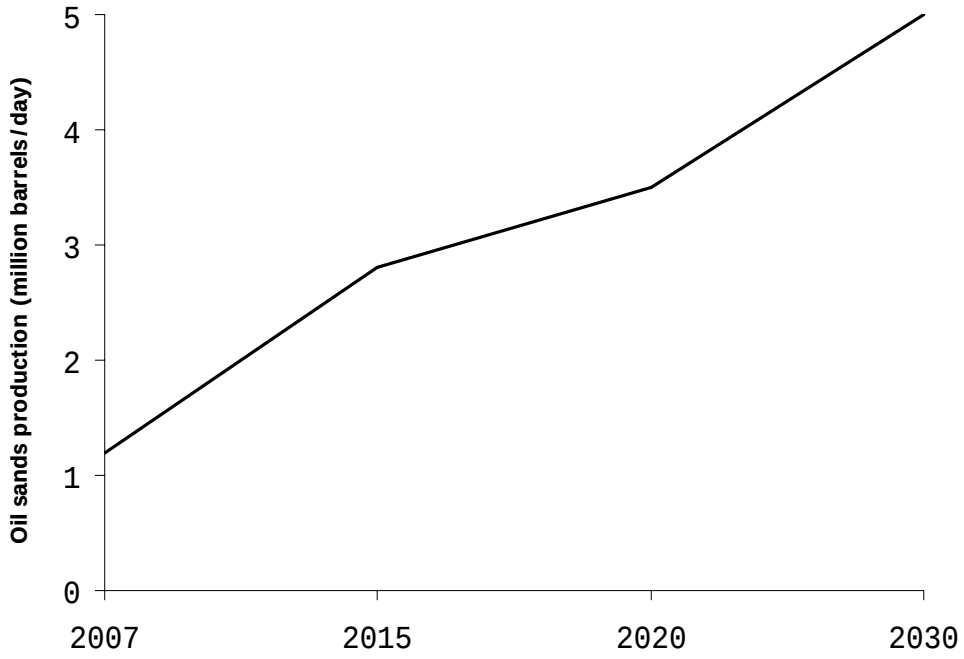

Figure 4 The production of oil sands is expected to more than triple by 2030.

1.3 Climate Change

The changing climate is having a profound effect on water resources in Alberta and the Northwest Territories. The Northern Rivers Ecosystem Study concluded "Global warming is the greatest threat to the northern environment."[20] Climate change affects river flows, lake levels, pollutant concentrations, and freeze-up and break-up dates. Fort McMurray and Fort Chipewyan experienced temperature increases of 2.2 C and 3 C respectively between 1945 and 2005.[21] According to Environment Canada, the Mackenzie District experienced the most warming, with an increase of 2.4 C between 1948 and 2007 — the biggest temperature increase of any region in Canada.[22]

Temperature increases cause a decline in the supply of water and, inversely, an increase in demand. Summer flows in the Athabasca River declined by 29% between 1970 and 2005.[23] At

[20] Environment Canada, Alberta Environment, Government of the Northwest Territories, *Northern Rivers Ecosystem Initiative, Key Findings* (Toronto, ON: Federal Publications Inc., 2004), www.environment.gov.ab.ca/info/library/6374.pdf (accessed September 24, 2008).

[21] D. Schindler, W. Donahue and J. P. Thompson, *Running Out of Steam* (The Munk Centre for International Studies and Environmental Research and Studies Centre, University of Alberta, 2007), http://www.powi.ca/pdfs/running_out_of_steam_final.pdf (accessed September 24, 2008).

[22] Environment Canada, Annual temperature trend, extremes and current season ranking, 1948–2007 (60 Years) (Government of Canada, 2007), http://www.msc-smc.ec.gc.ca/ccrm/bulletin/annual07/rsummarytable_e.html?table=temperature&season=Annual&date=2007&nyears=60 (accessed September 24, 2008).

[23] D. Schindler, W. Donahue and J. P. Thompson, *Running Out of Steam* (The Munk Centre for International Studies and Environmental Research and Studies Centre, University of Alberta, 2007), http://www.powi.ca/pdfs/running_out_of_steam_final.pdf (accessed September 24, 2008).

the source of the Athabasca, in the Columbia Icefields of Jasper National Park, shrinking glaciers, declining snowpacks and earlier spring melt will result in even lower water flows in the summer months. Across the prairies, temperature increases are projected to reach 6 C by the end of the next century (see Figure 5),[24] which will further decrease flows in the northern rivers.

Schindler, Donahue and Thompson (2007) projected that water flows in the watersheds of the oil sands region would decrease by an additional 8 to 26% with an average temperature increase of 3 C by 2050. The combined impact of climate change and water use by the oil sands and other industries could irreparably affect the ecological health of the Peace–Athabasca Delta and ecosystems downstream. This could have important implications for the availability of water for the Mackenzie River system.[25]

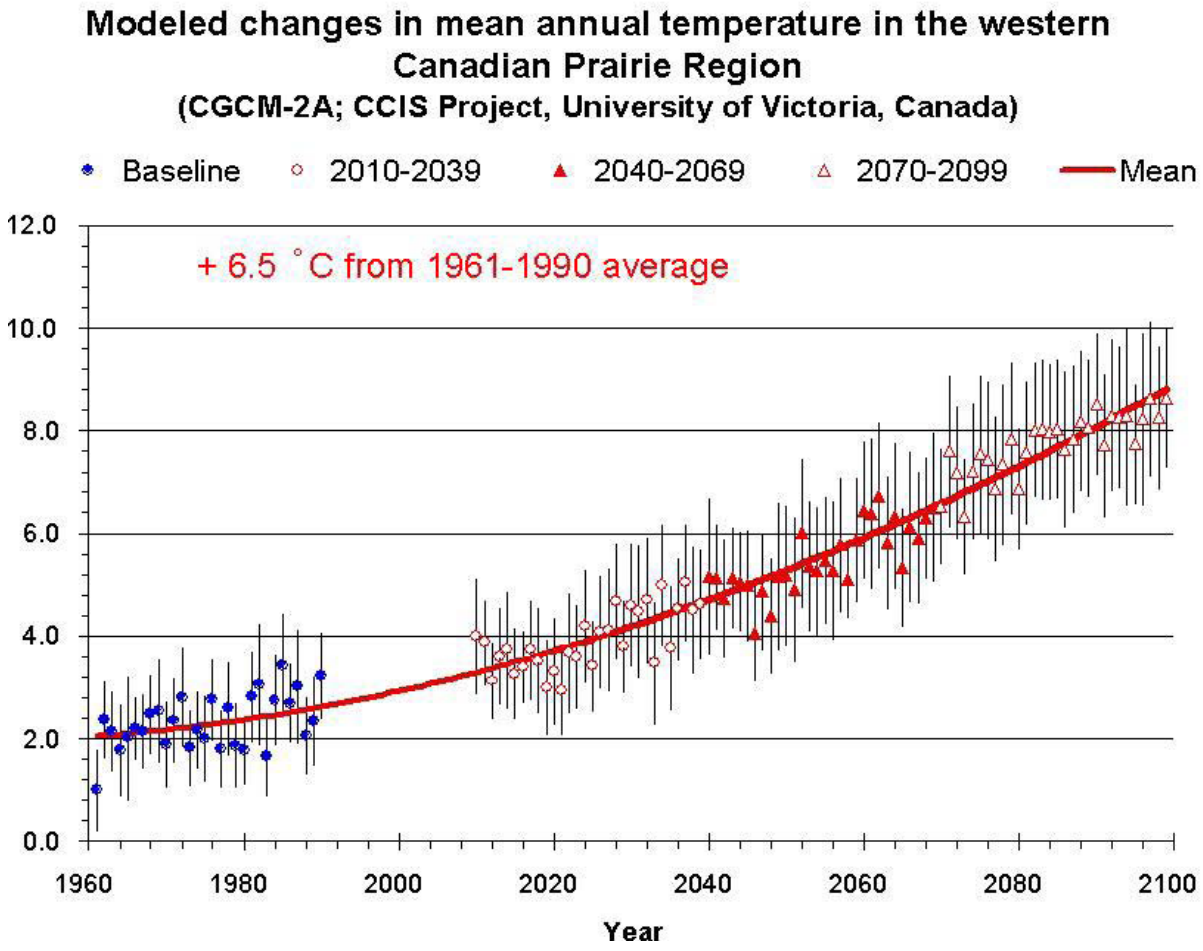

Figure 5 Temperature averages in the Canadian Prairies are expected to increase by 6 C by the year 2100.

[24] Ibid.

[25] World Wildlife Fund, *Implications of a 2°C global temperature rise on Canada's water resources* (2006), http://wwf.ca/AboutWWF/WhatWeDo/ConservationPrograms/GlobalWarming/reports/WWF_2degArctic.pdf (accessed September 29, 2008).

1.4 Impacts From Other Activities

While this report focuses on the impact of the oil sands industry on water, it is important to acknowledge the full spectrum of activities that impact water in the region.

Upstream of oil sands development, other land uses along the Athabasca River include agriculture, coal mining, forestry, sawmills, panel board factories, pulp and paper mills and a newsprint mill. Agriculture is a significant land use in the Athabasca Basin, taking up 12% of the land.[26]

The building of the W.A.C. Bennett Dam on the Peace River in British Columbia in 1967 was responsible for lowering water levels in the Athabasca/Delta, Slave River and Great Slave Lake. As a result, much of the marsh areas in the Delta are drying and turning into land with willows and sedges.[27] The Slave River Delta experienced lower peak flows and decreased amounts of sediment,[28] even though it is 1,500 km from the Bennett Dam. Figure 6 shows how the mean daily flow of the Slave River has changed since the Bennett Dam.[29]

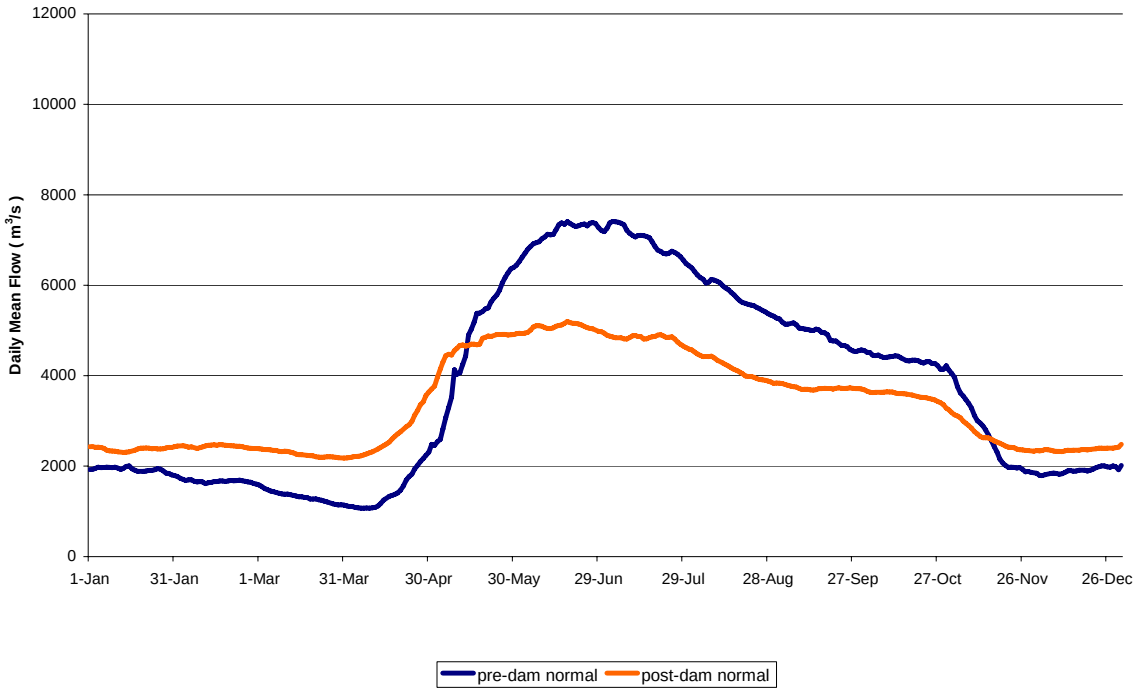

Figure 6 The mean daily flow of the Slave River pre- and post- W.A.C. Bennett Dam.

[26] D. Schindler, W. Donahue and J. P. Thompson, *Running Out of Steam* (The Munk Centre for International Studies and Environmental Research and Studies Centre, University of Alberta, 2007), http://www.powi.ca/pdfs/running_out_of_steam_final.pdf (accessed September 24, 2008).

[27] Government of Alberta, *Northern River Basins Study Final Report*, (Government of Alberta, 2002), http://www3.gov.ab.ca/env/water/nrbs/sect1/sect14.html (accessed September 24, 2008).

[28] Government of Alberta, *Northern River Basins Study Final Report*, (Government of Alberta, 2002), http://www3.gov.ab.ca/env/water/nrbs/sect3/sect35.html (accessed September 24, 2008).

[29] Indian and Northern Affairs Canada, Water Resources Division, data received December 2008

Uranium mining has taken place around Lake Athabasca in Saskatchewan since the 1950s. More than twelve mines and three mills operated in the Beaverlodge area north of Lake Athabasca. The last mine in the Beaverlodge area closed in 1985.[30] Three mines still operate in Saskatchewan southeast of Lake Athabasca at the eastern edge of the Mackenzie River Basin.[31]

[30] J. Kneen, "Uranium Mining in Canada – Past and Present: Background notes for a presentation to the Indigenous World Uranium Summit, November 30–December 1, 2006" (Ottawa, ON: MiningWatch Canada, 2006), http://www.miningwatch.ca/updir/Uranium_Canada_web.pdf (accessed September 24, 2008).

[31] The three mines are McClean Lake Mine, Eagle Point Mine (ore processed at Rabbit Lake Mill) and McArthur River Mine (ore processed at Key Lake Mill); Government of Saskatchewan, *Saskatchewan Exploration and Development Highlights 2008* (Saskatchewan Ministry of Energy and Resources, 2008), http://www.er.gov.sk.ca/adx/aspx/adxGetMedia.aspx?DocID=3445,3440,3385,5460,2936,Documents&MediaID=24648&Filename=SaskExplorationHighlights2008.pdf (accessed December 5, 2008).

2. Water and Oil Sands Development

2.1 Oil Sands Extraction and Processing

Oil sands extraction affects water both directly and indirectly. There are two processes used to extract oil from the oil sands: mining and in situ. The depth of the deposits underground determines which process is used for extraction. Mining occurs when the oil sands are relatively close to the surface, within 100 metres. When the deposits are deeper than about 100 metres, in situ processes are used.[32] The two processes impact water resources in different ways.

2.2 Impacts of Mining on Water

Mining activities in northeastern Alberta have a direct impact on the Athabasca River. Large volumes of freshwater are removed from the river and used in the oil sands extraction process. During the extraction process, the freshwater comes into contact with heavy metals and hydrocarbons, resulting in toxic waste water that is stored in tailings ponds.

Mining of oil sands affects water resources by

- removing forests, draining wetlands and digging mine pit areas;[33]
- draining the basal aquifer, which could reduce groundwater discharge and lower the water levels in nearby wetlands and other surface water bodies;
- withdrawing freshwater from the Athabasca River;
- converting freshwater into tailings waste water from oil sands extraction process;
- potentially contaminating water due to spills or leaks from oil sands operations;
- leaking pollutants from the tailings ponds into the surrounding environment and groundwater;
- releasing emissions such as nitrogen oxide and sulphur dioxide that may travel, deposit and raise the acidity of soil and water in other regions.

Through its effects on water quantity as well as water quality, oil sands development can have far-reaching impacts on both adjacent and downstream ecosystems and communities.

In order to produce a single barrel of oil from the oil sands through mining, between 2 and 4.5 barrels of water are required (net figures, including upgrading).[34] Two-thirds of all water

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[32] E. Isaacs, *Canadian Oil Sands: Development and Future Outlook* (Calgary, Alberta: Alberta Energy Research Institute, 2005).

[33] The draining of wetlands and peatlands is done by building draining ditches or using drainage pumps. The water is left to settle in polishing ponds and then released into streams and rivers. Some operators use this water as a source of process water or spray it on exposed surfaces to reduce dust. The operator is not required to collect data on how much water is drained unless it plans to use or retain the drainage water and then a water license is required. M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 31.

allocations from the Athabasca River are for oil sands operations. Current oil sands projects are licensed to divert more than 550 million cubic metres[35] of freshwater from the Athabasca Basin each year — enough water to meet the needs of a city of three million people for one year. Over 80% of that allocation is for water from the Athabasca River.[36] The water use from the Athabasca Basin by the oil sands industry is expected to double by 2010. [37] The actual volume diverted in 2007 was 129 million cubic metres, as several projects have not yet started or are in early stages of operation.[38]

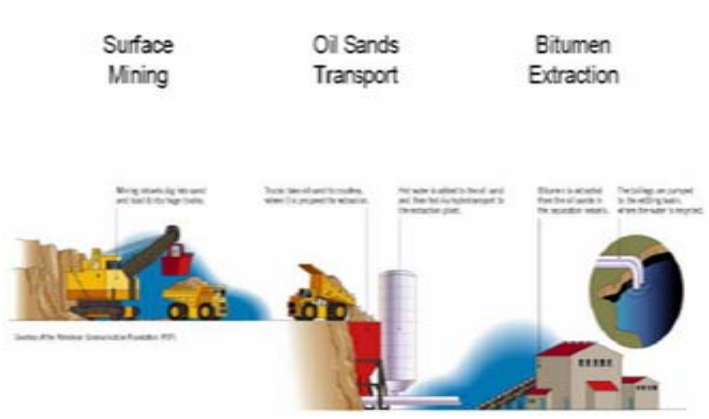

Figure 7 The process of extracting bitumen (oil) from the sand has many steps, including several which require the use of water.

After processing the oil sands, fine sediment remains suspended in the water, requiring it to be contained in tailings ponds.[39] About 1.8 million cubic metres of toxic tailings are produced every day.[40] This number is expected to increase as the oil sands industry grows. As of June 2008, 720 million cubic metres of tailings were contained in tailings ponds.[41]

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[34] Approximately 12 barrels of water are required to produce one barrel of oil by surface mined oil sands operations. About 70% is recycled leaving a net requirement of between 2 to 4.5 barrels of water per barrel of bitumen production; R.J. Mikula, V.A. Munoz and O. Omotoso, "Water Use in Bitumen Production: Tailings, Management in Surface Mined Oil Sands," paper presented at the World Heavy Oil Congress March 10-12, 2008 (Edmonton, AB: World Heavy Oil Congress); National Energy Board, *Canada's Oil Sands*: *Opportunities and Challenges to 2015: an Update* (Calgary, AB: The National Energy Board, 2006).

[35] Alberta Environment, "Water Diversion by Oilsands Mining Projects in 2007"data received September 2008.

[36] Ibid.

[37] Alberta Environment, *Water for Life: Current and Future Water Use in Alberta* (Edmonton, AB: Alberta Environment, 2007), 457, http://www.waterforlife.gov.ab.ca/watershed/docs/WFL-Current_Future_Water_Use-full.pdf (accessed September 24, 2008).

[38] Alberta Environment, "Water Diversion by Oilsands Mining Projects in 2007"data received September 2008; Alberta Environment data shows that neither Imperial Oil nor Fort Hills diverted any water in 2007; CNRL diverted a small portion of their allocation from the Athabasca River and Shell diverted only surface runoff.

[39] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 30.

[40] J. Grant, D. Woynillowicz and S. Dyer, *Fact and Fiction* (Drayton Valley, AB: The Pembina Institute, 2008).

[41] Ibid.

While the Government of Alberta continues to grant approvals for oil sands projects, a number of unanswered questions remain about wetlands and tailings pond reclamation and management, water quantity, water quality, watershed impacts, aquatic health and the health of downstream communities.

Figure 8 A Syncrude oil sands mining operation in Alberta.
Photo: David Dodge, The Pembina Institute

2.2.1 Wetlands: Lost Forever?

A large portion of the undisturbed landscape in the oil sands region of northern Alberta is covered by wetlands. These wetlands perform important ecological functions. The wetlands reduce flooding, erosion and sedimentation by absorbing water, and recharge water tables in times of drought. Wetlands also act as natural water filters. Certain types of wetlands also store carbon, acting as carbon sinks.[42] There are five types of wetlands in the Athabasca region: bogs, fens, swamps, marshes and ponds.[43]

Mining pits cannot function when they are filled with water. Surface water is therefore removed before development, and surrounding aquifers are drained to prevent seepage into the mine pit during operations. When wetlands are drained they are no longer able to support the same

[42] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 79.

[43] Government of Alberta Environment, *Water for Life – Alberta's Strategy for Sustainability* (Edmonton, AB: Alberta Environment 2003).

community of plants and wildlife. Plant species and soil chemistry can change drastically. Plants and animals that have adapted to moisture saturated conditions can no longer survive.[44]

There is currently no way of reclaiming peat wetlands.[45] Alberta Environment's Provincial Wetland Restoration/Compensation Guide has deemed it impossible to restore the wetlands to their original state.[46] Therefore, a shift from wetland to upland forest types is expected when the landscape is no longer required for resource extraction.

2.2.2 Tailings: A Toxic Legacy

Water is required for numerous stages in the production of bitumen (oil) from oil sands. Oil sands are extracted by truck and shovel once large open pits have been excavated. The material collected is then mixed with hot water to separate the bitumen from the sand. After the bitumen has been extracted, the remaining sand and contaminated water are pumped into settling basins, called tailing ponds.

Tailings ponds cover more than 130 square kilometres — the equivalent of 82,330 hockey rinks — and are among the largest man-made structures on earth.

The waste water from the extraction process is known as "tailings," which are toxic and therefore cannot be released back into the environment.[47] During the extraction process, compounds such as naphthenic acids that occur naturally in bitumen become concentrated in the water, making it poisonous to aquatic organisms and mammals.[48]

The size and toxic contents of the tailings ponds — which are so large they are more like lakes than ponds — are a cause of deep concern for members of local communities, especially for those who live downstream from the ponds. Residents downstream are worried that pollutants from the tailings ponds may travel into the surrounding environment and the groundwater system.[49] The water in the tailings ponds is toxic to wildlife, and repeated exposure may cause adverse health effects.[50] Migratory birds have to be scared away from the giant "lakes" by cannons and scarecrows. The risk was recently illustrated when cannons were not deployed on a Syncrude tailings pond immediately after the ice melted. Five hundred ducks on their migratory route were killed when they landed on the tailings pond.

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[44] United States Environmental Protection Agency, *Wetlands, Oceans and Watersheds* (Washington D.C.: United States Environmental Protection Agency, 2008), http://www.epa.gov/owow/wetlands/wqual/woody.html (accessed September 24, 2008).

[45] N. Chymko, ed., *Guideline for Wetland Establishment on Reclaimed Oil Sands Leases* (Edmonton, AB: Information Centre, Alberta Environment, 2000), http://environment.gov.ab.ca/info/library/6854.pdf (accessed September 25, 2008).

[46] Alberta Environment, *Provincial Wetland Restoration/Compensation Guide* (Edmonton, AB: Government of Alberta, 2005).

[47] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006).

[48] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 3.

[49] Ibid.

[50] D. Woynillowicz, C. Severson-Baker and M. Raynolds, *Oil Sands Fever* (Drayton Valley, AB: The Pembina Institute, 2005), 31.

Duck deaths will hurt Alberta: Harper

'It's a terrible tragedy'

Jason Fekete, with files from Jon Harding, Calgary Herald, Calgary Herald

Published: Friday, May 02, 2008

Prime Minister Stephen Harper condemned Thursday the deaths of 500 ducks at a toxic tailings pond as a "terrible tragedy" that's unacceptable to Canadians and will only hurt Alberta's environmental image as an energy superpower.

Harper said there's no excuse for what happened at the tailings pond at the Syncrude Aurora mine site north of Fort McMurray, adding it's another example of why greater environmental legislation is needed across the country.

"It's obviously a terrible tragedy and I think we and a lot of people are upset about it," Harper told reporters in Edmonton at the official opening of the Mazankowski Alberta Heart Institute.

"We expect better, to be quite honest. This kind of thing shouldn't be happening."

Figure 9 A hunter retrieved this oiled duck near Fort Chipewyan shortly after the Syncrude incident. It has not been determined how many other birds were affected by landing in the Syncrude tailings pond.

The practice of storing waste water in tailings ponds and the long-term management of tailings ponds present a huge environmental and human health challenge. Tailings ponds cover over 130 square kilometres and are among the largest man-made structures on earth.[51] Oil sands companies are required to contain their waste under a zero discharge policy to prevent the tailings or water being released to the environment.[52] Despite this policy, pollutants have been found to leak from the tailings ponds into the surrounding groundwater, soil and surface water.[53] Even though seepage from tailings is known to occur, there is little accessible public information

[51] J. Grant, D. Woynillowicz and S. Dyer, *Fact and Fiction* (Drayton Valley, AB: The Pembina Institute, 2008).

[52] Alberta Environment, *Pollution Prevention and Control: Industrial Initiatives in Northern Alberta* (Edmonton, AB: Alberta Environment, 2001), http://environment.gov.ab.ca/info/library/6649.pdf (accessed September 25, 2008).

[53] L. I. Bendell-Young, K. E. Bennett, A. Crowe, C. J. Kennedy, A. R. Kermode, M. M. Moore, A. L. Plant, A. Wood, et al., "Ecological Characteristics of Wetlands Receiving an Industrial Effluent," *Ecological Applications*, Vol. 10, No.1 (Feb., 2000), 310-322.

on where and how much.[54] Environmental impact assessments for oil sands projects acknowledge that seepage will occur, but often state that the amounts are minor and insignificant.[55] Still, the cumulative impact of tailings pond seepage is cause for concern. A recent study found that as much as 11 million litres of contaminated water leaks from the tailings ponds everyday.[56] Preston McEachern, the head of oil sands research for Alberta Environment, said, "We know they leak and we capture these leakages or let some fall into poor-quality water formations...but it's the long term. What do we do as they build up?"[57]

Several tailings ponds are built directly beside the Athabasca River, posing a threat to the river and ecosystems downstream if the tailings pond dams breach. Should one of the pond walls (called dykes) breach, an ecological disaster would occur. Dr David Schindler, a well known water scientist, has predicted that a breach would have a greater effect on the ecosystem than the Exxon Valdez oil spill in 1989, in which 40.9 million litres of oil were spilled from a tanker into the ocean near Alaska.[58] The disaster soiled over 1,100 kilometres of shoreline and killed 36,000 migratory birds.[59] Although the likelihood of a dyke failure is considered low, it will remain a concern long after operations cease. In 1992 Bruce Friesen, Environment Manager for Syncrude wrote, "the possibility of a sudden failure of a fine tails containment dyke is a major concern. Were such a failure to occur, the rapid release of a large quantity of fluid tailings could cause severe damage to buildings, vegetation and wildlife. Aquatic organisms would suffer from high turbidity and siltation and from the acute toxicity of the water in the tails."[60] The Mackenzie River Basin Board wrote in 2003, "an accident related to the failure of one of the oil sands tailing ponds could have a catastrophic impact on the aquatic ecosystem of the Mackenzie River basin due to the size of the ponds and their proximity to the Athabasca River."[61]

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[54] The need for further research on tailings seepage is cited in: Government of Alberta, *EPEA Approval #26-02-00 for Syncrude Mildred Lake Oil Sands Processing Plant and Mine, Aurora North Oil Sands Processing Plant and Mine and Aurora South Oil Sands Processing Plant and Mine* (June 24, 2007), 86.

[55] Shell Canada Limited, *Application for Approval of the Jackpine Mine Expansion & Pierrer River Mine Project — Environmental Impact Assessment* (Calgary, AB: Shell Canada Ltd., 2007); Imperial Oil Resource Ventures Ltd., *Kearl Oil Sands Project — Mine Development: Regulatory Application* (Calgary, AB: Imperial Oil Resource Ventures Ltd., 2005); Shell Canada Ltd., *Application for Approval of the Muskeg River Mine Expansion Project: Supplemental Information* (Calgary, AB: Shell Canada Ltd., 2005); Suncor Energy Inc., *Voyageur South Project Application* (Calgary, AB: Suncor Energy Inc., 2007).

[56] M. Price, *11 Million Litres a Day: The Tar Sands Leaking Legacy* (Toronto, ON: Environmental Defense, 2008) http://www.environmentaldefence.ca/reports/tarsands_dec_2008.html (accessed December 10, 2008).

[57] A. Nikiforuk, "Liquid asset: could the oil sands, Canada's greatest economic project, come undone simply because no one thought about water?" *Globe and Mail, Report on Business*, March 28, 2008, 3, http://www.reportonbusiness.com/servlet/story/RTGAM.20080327.wrob-0408-liquidasset/BNStory/specialROBmagazine/home?cid=al_gam_mostemail (accessed September 25, 2008).

[58] A. Nikiforuk, "Dirty Secrets," *Explore*, March 2007, 28; Encyclopedia of the Earth, "Exxon Valdez Oil Spill" (2008), http://www.eoearth.org/article/Exxon_Valdez_oil_spill.

[59] U.S. Environmental Protection Agency, "Exxon Valdez History," Website, http://www.epa.gov/history/topics/valdez/02.htm (accessed December 16, 2008).

[60] B. C. Friesen, "Solving the Fine Tails Challenge" (Syncrude Canada Limited, 1992).

[61] Mackenzie River Basin Board, *Mackenzie River Basin State of the Aquatic Ecosystem Report 2003* (2004), iv, http://www.env.gov.bc.ca/wsd/plan_protect_sustain/interprov/mackenzie_river_basin.html (accessed Oct. 22, 2008).

Tailings ponds are used in a variety of mining operations, and there have been cases where ponds' walls have cracked or broken altogether[62] as a result of slope instability, earthquakes, erosion, or weaknesses in the dam structure.[63] The risk of instability in tailings ponds increases with the amount of water in the pond.[64] Some tailings have been contained by building a second wall to redirect liquid materials to another site in the case of failure. Norbert R. Morgenstern, a professor at the University of Alberta and researcher on tailings management, wrote, "A well intentioned corporation employing apparently well-qualified consultants is not adequate insurance against serious incidents."[65] He went on to say, "Uncertainty is a perpetual component of geotechnical design and construction."[66]

In 1993, the tailings from the Suncor and Syncrude mines totaled 300 million metres cubed. It has been estimated that tailings will total over 11,648 million metres cubed once the existing and planned mines are built (based on calculations as of July 2008).[67] The tailings ponds would cover over 220 square kilometres.[68] There is no demonstrated means to reclaim this volume of tailings in a way that is environmentally, technically and economically viable.[69]

Oil sands mining operations have proposed depositing tailings to the bottom of the mine pits. The mine pits will then be filled with water, to create an end pit lake. In theory, the depth of the lake (65 to 100 metres) will prevent the surface waters from mixing with the tailings at the bottom. Any water discharge from the lakes will have to meet Alberta Surface Water Quality Guidelines. Companies have stated that the lakes will be healthy aquatic ecosystems, with fishing and recreational opportunities.[70] Oil sands projects continue to be approved even though this reclamation strategy is untested and poses a significant risk to long-term ecosystem health.

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[62] A crack in the dyke wall holding back tailings from Trans Alta's coal-fired Keephills Power Plant was discovered June 28, 2008, in the Wabamun Lake, west of Edmonton, Alberta. A second dyke was built to redirect any waste water to another lagoon. The Canadian Press, "TransAlta warns of dyke breach at Keephills power plant west of Edmonton," July 28, 2008. For a list of tailings ponds failure worldwide, check out Tailings.info, "Case Studies" website, http://www.tailings.info/casestudies.htm (accessed September 29, 2008) and Wise Uranium Project, "Chronology of Major Tailings Dam Failure" website, http://www.wise-uranium.org/mdaf.html (accessed September 29, 2008).

[63] Tailings.info, "Tailings Related Accidents" website, http://www.tailings.info/accidents.htm (accessed September 29, 2008).

[64] J. Engels and D. Dixon-Hardy, Tailings. Info, Water Management Considerations for Conventional Storage (2008) http://www.tailings.info/water.htm (accessed September 25, 2008).

[65] N. R. Morgenstern, "Performance in Geotechnical Practice" (Paper presented at the Inaugural Lumb Lecture, May 10 2000).

[66] Ibid.

[67] J. Grant, D.Woynillowicz and S. Dyer, *Fact* or *Fiction* (Drayton Valley, AB: The Pembina Institute, 2008), 39.

[68] Ibid.

[69] Some advances in tailings technology are being applied to reduce tailings volume. This includes consolidated tailings. However, this does not address the majority of tailings waste. For more information see J. Grant, D. Woynillowicz and S. Dyer, *Fact or Fiction* (Drayton Valley, AB: The Pembina Institute, 2008).

[70] F. Westcott and L. Watson, "End Pit Lakes Technical Guidance Document," (prepared for the Cumulative Environmental Management Association End Pit Lakes Subgroup Project 2005-61, 2007).

Figure 10 Suncor's Tar Island Dyke (center of the photo) separates an oil sands tailings pond (upper right) from the Athabasca River.

Photo: David Dodge, The Pembina Institute

Tailings Pond Break at Spain's Los Frailes Lead-Zinc Mine

Source: tailings.info, http://www.tailings.info/images/pics/accidents/Spain.jpg

"On 24–25 April 1998, a large tailings pond dam failed at Spain's Los Frailes mine, which was owned by the Canadian mining company Boliden Ltd. A slab of soil beneath the dam, 20 meters wide, slid downhill approximately one meter. The dam cracked and abruptly broke. Between five and seven million cubic meters of acidic, metals -laden water and slurries spilled through the gap. Three rivers were affected, along with 11,000 acres of farmland. Damage was also caused in the Doñana National Park, a UN World Heritage Site…The Spanish Government has spent over $275 million cleaning up after the spill."

—Robert Repetto, *Silence is Golden, Leaden and Copper*, Prepared for the Commission for Environmental Cooperation, (Montreal, Quebec, 2004)

2.2.3 Water Quantity and Aquatic Ecosystem Health

The Athabasca River flows are highly variable from year to year and vary seasonally as well. Seasonal variations in flow are important to maintain the ecological integrity of the ecosystem. However, if minimum flows are not maintained the aquatic environment could be compromised. Fish populations are considered the most vulnerable part of the aquatic ecosystem, particularly during the winter when the river flows are seasonably low. If the water level is too low, it could significantly reduce the availability of critical habitat needed for overwintering.[71]

Most of the water used for oil sands development cannot be returned to the environment because it is contaminated. It is therefore removed from the water cycle. There is currently no enforceable requirement for oil sands companies to halt water withdrawals when the flow is not adequate to maintain aquatic health. Statistical analysis has shown that the summer flows of the Athabasca River at Fort McMurray have been steadily decreasing since 1970.[72] Members of the downstream community of Fort Chipewyan have also noticed a significant drop in water levels, with various effects. For example, trappers are now unable to reach trap lines that they have historically been able to reach only by boat.

Lesions and other abnormalities in fish populations have been documented through traditional knowledge and scientific studies.[73] Local residents have noted that fish populations appear to be declining and that the fish taste and smell differently than they used to.[74]

2.2.4 Human Health

Any changes to water quality can significantly impact the health of residents in the region. In 2006, a physician and medical examiner in Fort Chipewyan, Dr. John O'Connor, drew attention to the high rate of rare cancers in the community.[75] Dr. O'Connor also witnessed an unusually high rate of thyroid problems and other immune-related diseases.[76] Alberta Health and the

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[71] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 68–69.

[72] Summer (May–August) flows in the Athabasca River at Fort McMurray declined by 29% between 1970 and 2005; D. Schindler, W. Donahue and J. P. Thompson, *Running Out of Steam* (The Munk Centre for International Studies and Environmental Research and Studies Centre, University of Alberta, 2007), http://www.powi.ca/pdfs/running_out_of_steam_final.pdf (accessed September 24, 2008).

[73] Government of Alberta, *Northern River Basins Study Final Report*, (Government of Alberta, 2002); Editorial, "Study Contradicts Earlier Findings on N. Alberta Water Quality," CBC News, November 8, 2007, http://www.cbc.ca/health/story/2007/11/08/water-study.html (accessed September 25, 2008); K. Timoney, *A Study of Water and Sediment Quality as related to Public Health Issues*, Fort Chipewyan, Alberta, prepared on behalf of the Nunee Health Board Society (Sherwood Park, AB: Treeline Ecological Research, 2007).

[74]Government of Alberta, *Northern River Basins Study Final Report*, (Government of Alberta, 2002); Editorial, "Study Contradicts Earlier Findings on N. Alberta Water Quality" CBC News, November 8, 2007, http://www.cbc.ca/health/story/2007/11/08/water-study.html (accessed September 25, 2008).

[75] Editorial, "Cancer rate in Fort Chipewyan cause for alarm: medical examiner," CBC News, March 10, 2006, http://www.cbc.ca/canada/edmonton/story/2006/03/10/ed-fortchip20060310.html; CBC News, "Local doctor doubts report on Fort Chipewyan cancer rates," July 25, 2006, http://www.cbc.ca/canada/calgary/story/2006/07/25/doctor-fortchip.html (accessed September 25, 2008).

[76] CBC News, "Cancer rate in Fort Chipewyan cause for alarm: medical examiner," March 10, 2006, http://www.cbc.ca/canada/edmonton/story/2006/03/10/ed-fortchip20060310.html.

Alberta Cancer Board launched a study of the cancer rates in the community and found no significant increase in cancer rates.[77] Dr. O'Connor deemed the study inadequate because of its short timeline and lack of community involvement. As a result of speaking out on the issue, Dr. O'Connor was investigated by Alberta's College of Physicians and Surgeons for professional misconduct and Health Canada filed a number of complaints against him.[78] In December 2007, Dr. O'Connor was cleared of all but one charge of causing "undue alarm," which is still pending.[79]

In 2007, the local health board in Fort Chipewyan, the Nunee Health Board Society, commissioned a report by Dr. Kevin Timoney of Treeline Ecological Research on the potential impact of water on public health. The report used water and sediment sampling and considered traditional knowledge.[80] The report summarizes water quality monitoring of the Peace River, Athabasca River and Peace–Athabasca Delta, and links water quality to the health problems in the area. Dr. Timoney found that arsenic levels in Lake Athabasca were relatively high in comparison to other regional values. In the conclusions, Timoney wrote:

> "The people and biota of the Athabasca River Delta and western Lake Athabasca are exposed to higher levels of metals than those upstream. Higher arsenic levels than elsewhere, coupled with the clear link between arsenic exposure and various diseases, call for in-depth study of the issue. Arsenic exposure is associated with bile duct, liver, urinary tract, and skin cancers, vascular diseases, and Type II diabetes."[81]

Mercury, arsenic and polycyclic aromatic hydrocarbons (PAHs) concentrations in rivers and streams in the region were shown to be on the rise.[82] Timoney's study results were contrary to previous government reports that did not find cause for concern about water quality in the region.[83] A review of the Timoney report was completed by the Government of Alberta but never made public. Given the long history of uranium mining at the east end of Lake Athabasca and the recent growth in oil sands development, more research is needed on the effect of changing water quality on residents' health, including a review of water quality sampling methodologies.

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[77] Editorial, "Local doctor doubts report on Fort Chipewyan cancer rates" CBC News, July 25, 2006, http://www.cbc.ca/canada/calgary/story/2006/07/25/doctor-fortchip.html (accessed September 25, 2008).

[78] P. Woodford, "Health Canada muzzles oilsands whistleblower: AB physician sounded cancer alarm, slapped with College complaint," *National Review of Medicine* 4, no. 6 (2007), http://www.nationalreviewofmedicine.com/issue/2007/03_30/4_policy_politics1_6.html (accessed September 25, 2008).

[79] G. Lanktree, "Oilsands whistleblower MD cleared; Government charge of "undue alarm" from cancer warning remains," *National Review of Medicine* 5, no. 1 (2008).

[80] K. Timoney, *A Study of Water and Sediment Quality as related to Public Health Issues* (Sherwood Park, AB: Treeline Ecological Research, 2007), http://www.borealbirds.org/resources/timoney-fortchipwater-111107.pdf (accessed September 25, 2008).

[81] Ibid, 69.

[82] Ibid.

[83] Editorial, "Study Contradicts Earlier Findings on N. Alberta Water Quality" CBC News, November 8, 2007, http://www.cbc.ca/health/story/2007/11/08/water-study.html (accessed September 25, 2008).

2.3 Impacts of In Situ Extraction on Water

In situ extraction takes place when steam or solvents are injected into deep wells, making the bitumen less viscous so that it can be brought back up to the surface for processing, as shown in Figure 11. Most in situ operations in the Athabasca River Basin use groundwater. Some operations recycle up to 90% of their water. When recycled or saline water is used, it must be desalinated before it is used to produce steam. The wastes from desalinization and other treatment processes may be injected into disposal wells in deep formations or land filled.[84]

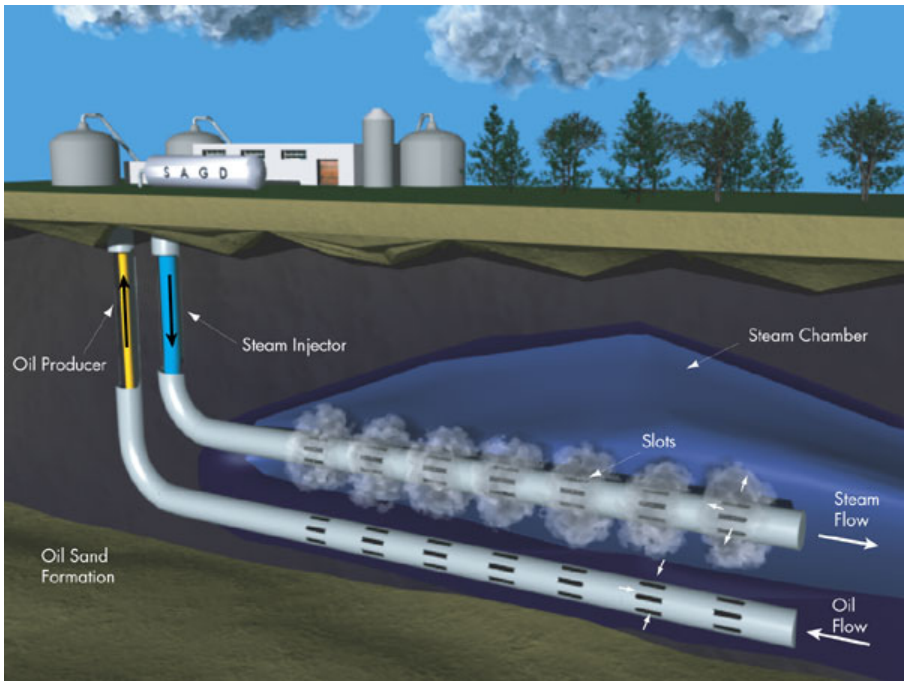

Figure 11 In situ extraction process.

While mining is a much more intensive process that requires more water to produce one barrel of oil, in situ development is being done on a much larger scale. The majority of the established oil sands reserves (81%) must be extracted by in situ techniques.[85] While in situ extraction does not require clearing the forest to the same extent as open pit mining, the network of well pads, roads and pipelines can cause fragmentation of wildlife habitat and damage to aquatic ecosystems, and the disposal of waste water and accidental spills can contaminate land and water.

In situ extraction affects water by

- extracting water from underground aquifers;
- leaving water in deep wells after the oil is extracted;
- crossing rivers, streams and wetlands with pipelines and roads, accelerating the rate and amount of sediment and nutrients that flow into the water;

[84] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 106.

[85] R. Schneider and S. Dyer, *Death by a Thousand Cuts*: *The Impacts of In Situ Oil Sands Development on Alberta's Boreal Forest* (Drayton Valley, AB: The Pembina Institute, 2006).

- releasing emissions such as nitrogen oxide and sulphur dioxide that deposit and raise the acidity of soil and water in the region;
- disposing of waste water in deep wells and landfills, posing a risk to the environment as salts may leach into the surrounding aquifers.[86]
- In order to produce a single barrel of oil from the oil sands by in situ processes, at least one barrel of water is required (including upgrading).[87]

Figure 12 An aerial view of in situ oil sands development in northern Alberta.
Photo: David Dodge, The Pembina Institute

2.3.1 Wetlands

As mentioned above, wetlands filter and store water, which helps maintain the health of surrounding ecosystems. In situ development can deplete freshwater reserves by drawing water directly from freshwater aquifers, which may impact adjacent aquifers and surrounding ecosystems.[88] In addition, when wells are drilled to extract groundwater for the in situ process, it

[86] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 105.

[87] On average 0.5 cubic metres of water is required per cubic metre of oil from oil sands by in situ processes. At least another 0.5 cubic metres of water is required in the upgrading stage; M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 105.

[88] R. Schneider and S. Dyer, *Death by a Thousand Cuts*: *The Impacts of In Situ Oil Sands Development on Alberta's Boreal Forest* (Drayton Valley, AB: The Pembina Institute, 2006), 17.

can reduce the pressure and water levels in the aquifer around the well. This can allow the surface water to flow downwards into the groundwater, reducing the water available in nearby wetlands, streams and lakes.

Much of the groundwater (90 to 95%) that is recovered after being used in the in situ process to extract the bitumen, called produced water, can be recycled by de-oiling and treating it. Additional water must then be withdrawn from the groundwater well to top up the water required in the bitumen extraction process. The non-recycled produced water is disposed of in deep wells or landfilled with salts and other wastes from the water recycling and treatment process. The wells and landfills must be monitored for years afterward to make sure that the salts do not leach into freshwater aquifers.

Some operations use saline groundwater (from deeper formations) to minimize the use of freshwater. However, the processing of saline water for use in steam generators produces large amounts of solid waste.

2.3.2 Groundwater Aquifers

Little is known about groundwater sources in northeastern Alberta. No one knows how much water is available underground, and whether or not oil sands activities contaminate fresh groundwater sources. Drawing from one underground aquifer may reduce the groundwater available in another area.[89] In June 2008, the Metis Nation in northeastern Alberta raised alarms about the number of blowouts — high pressure steam releases — from in situ projects, and about the risk of a blowout contaminating underground freshwater aquifers. These freshwater aquifers may be connected directly to the Athabasca River.[90]

The use of water and management of contaminated water in oil sands development poses a number of risks to water resources in Alberta and downstream. No proof exists today that the oil sands are having an impact on water in the Northwest Territories, but the health problems and changes in the environment experienced by the residents of Fort Chipewyan create more than enough cause for alarm. The current management of tailings, including reclamation plans that call for the use of end pit lakes, also raises concerns about the risks posed by oil sands development long after the projects have ceased operation.

[89] M. Griffiths, A. Taylor and D. Woynillowicz, *Troubled Waters, Troubling Trends* (Drayton Valley, AB: The Pembina Institute, 2006), 102.

[90] Métis Nation of Alberta and Alberta Wilderness Association, “Tar Sands Industry Poised to Pollute Canada’s Largest Freshwater Aquifer,” news release, July 24, 2008.

3. Water Management

Under the Canadian Constitution, control over water management is divided between the federal government and the provinces and territories. The federal government has control over water on federal land, in the territories, national parks and on Indian reserves. It also has jurisdiction over inland and ocean fisheries, inter-provincial/territorial waterways and commercial navigation. However, since both surface water and groundwater move across human-made boundaries and borders, interagency collaboration is critical.

The objective of the Federal Water Policy of 1987 "is to encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic and environmental needs of present and future generations."[91] The federal government did not presume to be able to accomplish this alone. The policy emphasizes the importance of all sectors of society and all Canadians taking responsibility and embracing the "value of water."[92] The policy also emphasizes integrated water use by taking into account all water uses and through joint federal, provincial and territorial planning.

The federal government, in conjunction with provincial and territorial governments under the Canadian Council of Ministers of the Environment, also developed the Canadian Water Quality Guidelines for use in the development of water quality objectives in certain locations. The guidelines are just that — guidelines — and are not mandatory or prescriptive.

The federal government has pointed out that, "Water is of special value in the North as the breeding ground for the majority of North America's migratory birds, as a means of transportation, and as a sustaining force for the essentials of life for the native population: fish and wildlife for food, trapping and cash income; and recreation. It is also one of the main economic resources for the North's future, particularly hydroelectric development and resource industries."[93]

3.1 Water Management in Alberta

The Government of Alberta has control over its natural resources, including water within its borders. The Alberta Water Act governs the allocation of all surface water and groundwater. Alberta Environment requires individuals and municipalities to apply for a licence to divert or use water.[94] Each licence specifies a maximum amount of water that can be diverted and used within a certain period of time. Before a licence is issued for a large scale oil sands project, the potential environmental impact of water diversion must be assessed. Water licenses are allocated based on a "first in time, first in right" principle, meaning that priority access to water is given to those who are first to obtain a licence. Recent water licences have typically been granted for ten years and are subject to periodic reviews. Environmental assessments are a relatively recent

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[91] Environment Canada, *Federal Water Policy*, (Government of Canada, 1987), http://www.ec.gc.ca/Water/en/info/pubs/fedpol/e_fedpol.htm#8 (accessed September 25, 2008).

[92] Ibid.

[93] Ibid.

[94] The exceptions to this are for household and traditional agricultural use.

concept, however, and numerous allocations were granted in perpetuity without an assessment of the potential environmental impacts or appropriate size of the allocation.

In addition to the Water Act, which applies to licences and approvals for water diversion and use, approval under the Alberta Environmental Protection and Enhancement Act (EPEA) may be required for projects that use water to enhance bitumen recovery and that store water which has been used in extracting or processing oil sands.[95]

The Government of Alberta's Water for Life Strategy is intended to guide sustainable water use and address water quality issues in the province. Established in 2003, the strategy's goals are to ensure

- a safe, secure drinking water supply;
- healthy aquatic ecosystems; and
- reliable, quality water supplies for a sustainable economy.[96]

The strategy sets a target of improving the efficiency and productivity of water use 30% by 2015.[97] It sets out three types of multi-stakeholder partnerships to implement the Water for Life Strategy: The Provincial Water Council; Watershed Planning and Advisory Councils (WPACs); and Watershed Stewardship Groups (WSGs). WPACs are responsible for developing watershed management plans and reporting on the state of the watershed. The WPACS for the Athabasca and Peace Rivers are currently being developed.[98]

The Government of Alberta has also completed a land use framework to guide the development of regional planning in Alberta. Through multi-stakeholder advisory councils, the regional plans will use a cumulative effects approach to set environmental, social and economic outcomes, to assess tradeoffs associated with land use decisions, and monitor changes over time.[99] The connection between the Land Use Framework and Water for Life Strategy has not yet been defined.

3.1.1 Shared Responsibility for Water Management

Some developmental activities in Alberta trigger federal laws such as the Navigable Waters Protection Act, Fisheries Act, Canada Waters Act, and the Canadian Environmental Protection Act (CEPA). In addition, federal legislation and policy that relates to migratory birds, endangered species, fish habitat, wetlands, and drinking water are relevant.[100] The federal

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[95] Environmental Protection and Enhancement Act, Schedule 1, Division 2, Part 8 and Division 3(b).

[96] Government of Alberta, *Water for Life (*Edmonton, Alberta: Alberta Environment, 2003).

[97] Ibid.

[98] Government of Alberta, "Citizens, industry and government gather to understand issues in Athabasca watershed" Information Bulletin, April 11, 2008, http://www.gov.ab.ca/home/NewsFrame.cfm?ReleaseID=/acn/200804/232943E1CB965-95E5-FD32-46611937E3B419F1.html.

[99] Government of Alberta, *Land Use Framework* (Edmonton, AB, Government of Alberta, 2007), http://www.landuse.alberta.ca/.

[100] Major federal statutes and policies that are relevant include the Fisheries Act (R.S.C. 1985, c. F-14), the Navigable Waters Protection Act (.S.C. 1985, c. N-22), Federal Policy on Wetland Conservation (1991), Migratory Birds Convention Act, and the Species at Risk Act. The Federal Government is also guided by the Convention on Wetlands of International Importance, Federal Water Policy.

government is responsible for inter-provincial/territorial and international waterways. The Slave River flows north of Lake Athabasca, which is fed by the Athabasca River, so the federal government is responsible for both of these rivers.

The Government of Alberta and the federal departments of Environment Canada and Fisheries and Oceans Canada work together on oil sands issues through the environmental assessment processes,[101] joint policy (like the Lower Athabasca River Water Management Framework), and multi-stakeholder bodies such as the Cumulative Environmental Management Association and the Regional Aquatics Monitoring Program.

Since the Northern Rivers Ecosystem Initiative concluded in 2003, a considerable amount of information has been gathered about water resources in the region through the Cumulative Environmental Management Association and the Regional Aquatics Monitoring Program (explained below).

Cumulative Environmental Management Association

The Cumulative Environmental Management Association (CEMA), created in 2000, is a multi-stakeholder non-profit organization tasked with managing the cumulative impact of oil sands development in the Wood Buffalo region. CEMA's Surface Water Working Group is responsible for establishing instream flow needs for the Athabasca River; setting indicators and thresholds to manage land use activities; creating a system for water quality management; and communicating surface water quality to the public.

The Athabasca Chipewyan First Nations, Mikisew Cree First Nations, and the Oil Sands Environmental Coalition[102] have ceased participating in CEMA because a number of factors have rendered it inefficient and ineffective.[103] CEMA's work has not kept pace with new oil sands approvals and as such is not fulfilling its role in protecting the environment. The Government of Alberta continues to grant project approvals even though CEMA's work setting critical environmental limits has not been completed. At the same time, CEMA was used as a "green shield" in project environmental impact assessments and regulatory hearings to deflect questions about cumulative environmental management in the region. After eight years of CEMA's existence, the following gaps remain in the environmental management of the oil sands region:

- no land use plan that protects wildlife and regional ecosystems
- no lower limit on flows of the Lower Athabasca River below which oil sands water withdrawals would be prohibited
- no environmental management plan to maintain the integrity of watersheds

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[101] The federal government's responsibilities pursuant to CEAA has led it to participate with the Government of Alberta's Energy Resources Conservation Board in joint federal/provincial panel reviews of individual oil sands project applications. Government of Canada, *Canada-Alberta Agreement on Environmental Assessment Cooperation* (2005); Joint Reviews are referred to in sections 40, 41 and 42 of the Canadian Environmental Assessment Act.

[102] The Oil Sands Environmental Coalition includes the Fort McMurray Environmental Association, Toxics Watch Alberta and the Pembina Institute.

[103] L. Dolha, "Mikisew Cree pulls out of oil sands watchdog," News from Canada's Native Communities (first Nations Drum, April 2007), http://www.firstnationsdrum.com/Spring%202007/April/index.html (accessed December 8, 1008).

- no reclamation guidelines for restoring ecologically important peatlands
- no specific certification standards for oil sands reclamation.[104]

Instream Flow Needs

When CEMA failed to reach consensus on and meet its deadline to set instream flow needs (IFN), the Government of Alberta introduced the "Interim Framework: Instream Flow Needs and Water Management Systems for Specific Reaches of the Lower Athabasca River" in January 2006. A final version was released in February, 2007, by Alberta Environment and Fisheries and Oceans Canada.[105] The river's instream flow needs is a threshold that represents the amount and timing of water flow needed to maintain the health of the river ecosystem.[106] The Government of Alberta's approach is graduated based on flows in the river. When water is at its lowest and fish habitat is being damaged, which is called the "red zone," the framework requires that industry reduce its use of water. This approach has been criticized by some groups because even when water flows are in the red zone, industry can still collectively withdraw a large volume of fresh water — between 8 and 15 cubic metres of water per second, or enough to fill between 25 and 50 bathtubs each second.[107] Schindler, Donahue and Thompson (2007) noted that during low flow years, if current and approved water license amount were withdrawn, it would put the river in the red zone for several months in the winter.[108]

Regional Aquatics Monitoring Program

The Regional Aquatics Monitoring Program (RAMP) was initiated in 1997 to monitor the effects of oil sands activity on aquatic environments. RAMP focuses on the Athabasca River, Peace–Athabasca Delta, tributaries to the Athabasca River, wetlands and some lakes. RAMP is jointly funded by industry and government. Members of RAMP include companies, federal and provincial government departments, First Nations organizations and environmental organizations.[109] The information collected through RAMP is used to monitor the cumulative effects of oil sands activity on aquatic environments; understand baseline data and regional variation; and to compare data in individual project environmental impact assessments. RAMP has a specific mandate to collect traditional environmental knowledge.

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[104] C. Severson-Baker, J. Grant and S. Dyer, *Taking the Wheel: Correcting the Course of Cumulative Environmental Management in the Athabasca Oil Sands* (Drayton Valley, AB: The Pembina Institute, 2008).

[105] Alberta Environment and Fisheries and Oceans Canada, *Water Management Framework: Instream Flow Needs and Water Management System for the Lower Athabasca River* (Alberta Environment and Fisheries and Oceans Canada, 2007) http://www.dfo-mpo.gc.ca/regions/central/pub/water-eau/pdf/water-eau_e.pdf (accessed September 25, 2008).

[106] The instream flow needs should represent the natural flow required to sustain, rehabilitate or restore the ecological functions of a river taking into consideration the timing, frequency and amount of flows.

[107] Pembina Institute, "Government Protects Oil Sands Industry, Fails to Protect Athabasca River," news release, March 2, 2007, http://www.tarsandswatch.org/pembina-institute-press-release-0 (accessed September 25, 2008)

[108] D.Schindler, W. Donahue and J. P. Thompson, *Running Out of Steam* (Edmonton, AB: The Munk Centre for International Studies and Environmental Research and Studies Centre, University of Alberta, 2007), http://www.powi.ca/pdfs/running_out_of_steam_final.pdf (accessed September 24, 2008).

[109] Regional Aquatic Monitoring Program (RAMP), (2007) http://www.ramp-alberta.org (accessed September 25, 2008).

RAMP monitoring in 2007 found local variations of aquatic health but no detectable changes in regional aquatic resources as a result of oil sands development.[110]

RAMP has been criticized by Aboriginal organizations and a number of independent studies for weak analysis, inconsistent monitoring and overly conservative findings.[111] Some believe RAMP is biased because it is funded by government and industry with an interest in the oil sands industry. Various groups have called for independent environmental monitoring of cumulative environmental impacts.

Other Monitoring

Alberta Environment and Environment Canada have water monitoring sites on the Slave River at Fitzgerald, the Peace River at Peace Point, and the Athabasca River at Old Fort. A joint monitoring effort in the Peace–Athabasca Delta by federal, territorial, provincial and Aboriginal governments was initiated by Parks Canada in 2008.

3.2 Water Management in the Northwest Territories

The federal government, through Indian and Northern Affairs Canada (INAC), is responsible for water resource management in the Northwest Territories. The Water Resources Division of INAC administers the Northwest Territories Waters Act and Regulations and the Arctic Waters Pollution Prevention Act. INAC is responsible for conducting research on water issues, developing guidelines for water resource management, and monitoring.

Two federal government departments, Environment Canada and Fisheries and Oceans Canada, also have roles in relation to migratory birds, endangered species, fish habitat, wetlands, and drinking water as set out in the Navigable Waters Protection Act, Fisheries Act, Canada Waters Act, and the Canadian Environmental Protection Act.[112]

A Slave River monitoring program was initiated in the late 1980s to establish baseline conditions in response to concerns about industrial activity upstream.[113] A baseline report was published in

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[110] RAMP, WBEA, CEMA, *Joint Community Update 2008: Reporting our Environmental Activities to the Community* (Regional Aquatic Monitoring Program, Wood Buffalo Environmental Association and Cumulative Environmental Management Association, 2008) http://www.ramp-alberta.org/archive/CommunityUpdate2008.pdf.

[111] K. Timoney, *A Study of Water and Sediment Quality as related to Public Health Issues* (Sherwood Park, Ab: Treeline Ecological Research, 2007), http://www.borealbirds.org/resources/timoney-fortchipwater-111107.pdf (accessed September 25, 2008); P. Cyprien, **"**Petition: Water and sediment contamination downstream of industrial Tar Sands development on the Athabasca River, Peace–Athabasca Delta and Lake Athabasca and serious adverse affects of this contamination on the health of the people of Fort Chipewyan, Alberta," Petition to the Office of the Auditor General of Canada (January, 4, 2008), http://www.oag-bvg.gc.ca/internet/English/pet_238_e_30190.html (accessed October 20, 2008).

[112] Major federal statutes and policies that are relevant include the Fisheries Act (R.S.C. 1985, c. F-14), the Navigable Waters Protection Act (.S.C. 1985, c. N-22), Federal Policy on Wetland Conservation (1991), Migratory Birds Convention Act, and the Species at Risk Act. The Federal Government is also guided by the Convention on Wetlands of International Importance, Federal Water Policy.

[113] J. Sanderson, C. Lafontaine, and K. Robertson, *Slave River Environmental Quality Monitoring Program: Summary Report* (Yellowknife, NT: Water Resource Division Indian and Northern Affairs Canada, 1998) http://nwt-tno.inac-ainc.gc.ca/pdf/wr/Slave_River_Environmental_Quality_Monitoring_Program.pdf (accessed September 25, 2008).

1998 documenting water conditions from 1990 to 1995.[114] The next report from the monitoring program is expected in early 2009.[115]

Under the 1998 Mackenzie Valley Resource Management Act (MVRMA), co-management land and water boards were created to regulate the use of land and water. Three regional boards — the Gwich'in, Sahtu and Wek'eezhii (Tlicho) — are responsible for issuing land use permits and water licenses in their settlement areas. The Mackenzie Valley Land and Water Board is responsible for the rest of the unsettled lands in the Mackenzie Valley, addressing transboundary applications and ensuring consistency across the boards. Under the MVRMA, the Mackenzie Valley Environmental Impact Review Board can participate in a review of the environmental effects of development in regions adjacent to the Northwest Territories when the development "might have a significant adverse impact on the environment in the Mackenzie Valley."[116] The review has not yet been done in relation to oil sands development in northeastern Alberta.

The Northwest Territories Water Board is responsible for managing water resources in portions of the Mackenzie Delta and Arctic Islands in the Northwest Territories. It was established under Section 7 of the Northern Inland Waters Act that was proclaimed on February 28, 1972. In 1992 the Northern Inland Waters Act and Regulations were replaced with the Northwest Territories Waters Act and Regulations.

Minister Miltenberger speaking on the Motion 20-15 (5) Right to Water:

"Mr. Speaker, water is what sustains us and gives us life. Every one of our communities is situated on a body of water. People are drawn to water and there is a deep spiritual and mystical significance to water for most people, especially the aboriginal people.

"Mr. Speaker, this is not just a feel good motion; this is a very fundamental statement of one of our core values. There is a debate going around the world about whether water is just a need or a fundamental right. We are asserting in this motion that it is a fundamental right for all people. If it is just a need it becomes a commodity, it becomes subject to export, privatization, it becomes subject to all these trade agreements we have and that, Mr. Speaker, is not what I think we want in the Northwest Territories. We want to state very clearly, on record, in this House where laws are made and public policy is decided, that one of our values is that water is a fundamental right.

"Mr. Speaker, it has been said the federal government has jurisdiction but I would submit that we have, as legislators, a political and moral obligation to act on this. We know we cannot count entirely on the federal government. They have legislation but they choose not to act on it in many, many cases."

Residents of the Northwest Territories have raised concerns about their water at a number of forums including the Water is Life Conference in 2006, Water Wise Conference in 2007, Sahtu Water Conference and Dene National Environment and Water Summit in 2008, and the Keepers of the Water Conferences (I, II and III).[117] The Keepers of the Water Conferences were attended by First Nations, non-governmental organizations and citizens, and produced declarations on the

[114] Ibid.

[115] Bob Reid, personal communication, December 2008.

[116] Mackenzie Valley Resource Management Act (1998), 142.

[117] Sahtu Water Conference, *Radili Ko resolution*, (Fort Good Hope, NT: September 4, 2008).

need to protect water resources in the face of increasing industrial development in the Arctic Ocean Drainage Basin (which includes the Mackenzie Basin).[118]

Figure 13 The Keepers of the Water Conference III, held in Fort Chipewyan, Alberta, in 2008.

Water protection has been an explicit priority of the Legislative Assembly of the Northwest Territories since a motion was passed unanimously in the assembly on March 17, 2007, recognizing water as a fundamental human right. The assembly's interest in water management and protection is due to increasing concern about the effects of industrial development and climate change.

3.2.1 The Role of the Government of the Northwest Territories and the Northwest Territories Water Strategy

The Government of the Northwest Territories (GNWT) is responsible for domestic drinking water quality and environment protection. Although water management is not legislatively under its mandate, the GNWT has taken the initiative to produce a discussion paper (in collaboration with the federal department of Indian and Northern Affairs) on how to manage water in the Northwest Territories. The discussion paper, "Northern Voices, Northern Water: Towards a Water Resources Management Strategy for the Northwest Territories" presents a proposed approach for a water management strategy to be completed in Spring 2009. The Northwest Territories plans to use the water strategy to guide its bilateral negotiations with Alberta through the Mackenzie Basin Transboundary Waters Master Agreement (explained more in the following section).

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[118] Keepers of the Water Conferences I, II and III, http://www.keepersofthewater.ca; Natural Resources Canada, "Map of Ocean Drainage Basins in Canada," *Atlas of Canada*, http://atlas.gc.ca/sitefrancais/english/learningresources/facts/map_drainage.gif/image_view (accessed December 8, 2008).

Fourteen principles are proposed to guide the strategy's development:

1. Watersheds – The Essential Unit.
2. Surface and Groundwater Connections.
3. Sustainability.
4. Renewability.
5. Multiple Uses/Values.
6. Joint Production of Benefits.
7. Values and Valuation.
8. Treaty and Aboriginal Rights, Land Claims, Water Rights and Ownership.
9. Maximization of Social Well-being.
10. Fairness and Equity.
11. Integrated Management.
12. Natural Capital Accounting for Water.
13. Risk and Uncertainty.
14. Adaptive Management.

The principles emphasize the cooperation and collaboration necessary to make integrated water management decisions. Integrated water management considers the interplay of land uses and values, across jurisdictions and regions, and between different levels of decision making.

The principle Values and Valuation alludes to how competing interests for water can be resolved. The value of water to different users will be estimated and used to make trade-off decisions. This is further explained in the Natural Capital Accounting Principle. The natural capital of watersheds is the economic value of the ecological goods and services provided by water. This accounting system allows for comparison between the costs and benefits of water use for economic production, recreation, subsistence and other uses.

A natural capital approach is on the cutting-edge of water management practices in the world. In this approach, an economic price is put on the services water provides to humans such as drinking water, industrial production, power generation, and recreation. It includes ecosystem services provided by water such as cycling nutrients, providing habitat and sustaining plants and animals. If water and its services are not valued economically, then the value of water cannot be compared to that of development. Yet we cannot fully calculate the value of water because most of the ecosystem services it provides are irreplaceable. In addition, the value placed on water resources will likely be conservative because we do not yet understand all of the benefits water provides. However, natural capital accounting can provide an estimate of current benefits and the potential costs to humans if water is depleted or contaminated. Numerous studies have been conducted to better understand how the natural capital approach can improve land, water and resource use management, [119] and a number of jurisdictions are starting to take this approach.

[119] Sara J. Wilson, *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services* (Vancouver, B.C.: David Suzuki Foundation, 2008); Millennium Ecosystem Assessment, *Ecosystems and Human*

Fairness and Equity stand alone as a principle, and also run as a theme through several of the other principles. Fairness and equity will be achieved by respecting and understanding land claims, self-government agreements and existing rights. Fairness and equity also depend on the transparency of decision making, how fairly the benefits and costs are distributed, and on the ability of users to work together.

The Risk and Uncertainty Principle refers to the precautionary principle. According to the precautionary principle, where there are threats of irreversible harm, lack of scientific certainty should not be used as a reason to postpone action to prevent environmental degradation. Instead, decisions should be made within an adaptive management approach, which involves using the best available information, monitoring and evaluating changes to water resources, and altering approaches in the future based on new information.

3.3 Transboundary Water Management: Mackenzie River Basin Board

After 25 years of discussion, study and negotiation, the Mackenzie River Basin Board was created in 1997 by the signing of the Transboundary Waters Master Agreement between the Governments of Canada, Saskatchewan, Alberta, British Columbia, Yukon and Northwest Territories. Under the agreement, each jurisdiction is committed to using water in a sustainable manner; protecting the ecological integrity of aquatic ecosystems in the whole basin; and consulting with other jurisdictions on any developments that would affect the integrity of aquatic ecosystems in another jurisdiction.[120]

The thirteen member Mackenzie River Basin Board "is a cooperative forum for sharing information and advice which promotes the ecological health of the entire Mackenzie River Basin." The board is made up of government and Aboriginal representatives from each jurisdiction. The board has no regulatory authority or any legal or policy basis to manage resource use in any of the jurisdictions.[121] It currently has a very small budget and no internal research or monitoring capacity. It seeks to influence member jurisdictions by sharing information, providing a forum for discussion, participating in regulatory processes and facilitating the development of Bilateral Water Management Agreements.

The master agreement makes provision for the negotiation of seven Bilateral Water Management Agreements between neighbouring jurisdictions. However, after being in force for more than a decade, only the Yukon–Northwest Territories bilateral agreement has been signed and implemented. In the master agreement and in the Yukon–Northwest Territories bilateral agreement, the Mackenzie Basin Board is tasked with resolving any disputes or questions.[122]

Well-Being: Wetlands and Water Synthesis (Washington, DC: World Resources Institute, 2005), http://www.millenniumassessment.org/documents/document.358.aspx.pdf; Millennium Ecosystem Assessment, *Ecosystems and Human Well Being: A Framework for Assessment* (Washington, DC: World Resources Institute and Island Press. 2005); Mark Anielski and Sara Wilson**,** *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems* (Calgary, AB: Pembina Institute and Canadian Boreal Initiative, 2005).

[121] Mackenzie River Basin Board, "About Us" (Mackenzie River Basin Board, 2008) http://www.mrbb.ca/about.asp (accessed September 25, 2008).

[122] Part E of the Master Agreement; Section 8.2 of the Yukon–NWT Transboundary Water Management Agreement J. P. Bruce, H. Martin and P. Colucci, *Climate Change on Boundary and Transboundary Water Management*

This dispute resolution mechanism has never been used. In 2004, the board released the Mackenzie River Basin State of the Aquatic Ecosystem Report 2003 which used existing information to evaluate ecosystem health, find gaps in knowledge and management practices and demonstrate the value of integrating traditional knowledge into ecological assessment.[123] The next State of the Aquatic Ecosystem Report is due in 2009.

Excerpt from the Mackenzie River Basin Transboundary Waters Master Agreement

The Parties are committed to:

1. Managing the Water Resources in a manner consistent with the maintenance of the Ecological Integrity of the Aquatic Ecosystem;

2. Managing the use of the Water Resources in a sustainable manner for present and future generations;

3. The right of each to use or manage the use of the Water Resources within its jurisdiction provided such use does not unreasonably harm the Ecological Integrity of the Aquatic Ecosystem in any other jurisdiction;

4. Providing for early and effective consultation, notification and sharing of information on developments and activities that might affect the Ecological Integrity of the Aquatic Ecosystem in another jurisdiction; and

5. Resolving issues in a cooperative and harmonious manner.

Figure 14 The Mackenzie Delta.
Photo: Ron Seale

(London, ON: University of Western Ontario, 2003), section 8.2 http://www.saskriverbasin.ca/Resources/Climatechangestudy/Final%20Report%20A458-402%20CCAF.pdf (accessed September 25, 2008).

[123] Mackenzie River Basin Board, *Mackenzie River Basin State of the Aquatic Ecosystem Report 2003 (2004)*, http://www.env.gov.bc.ca/wsd/plan_protect_sustain/interprov/mackenzie_river_basin.html (accessed Oct. 22, 2008).

3.3.1 Northwest Territories–Alberta Bilateral Agreement on Transboundary Water Management

Alberta and the Northwest Territories began discussions to produce a bilateral agreement on transboundary water management in 1982.[124] The development of the plan was announced again in March 2007 by ministers from Alberta Environment and the GNWT Environment and Natural Resources. As part of the announcement, then Northwest Territories Environment and Natural Resources Minister Michael McLeod said, "Wetlands and water flows throughout northern Alberta and the southern Northwest Territories are changing and affecting the fish, moose and other life in aquatic ecosystems."[125] The agreement will ensure water management takes an adaptive management approach and address the condition of water quality and quantity of water flowing through northern Alberta into the Northwest Territories.[126] The negotiations are scheduled to be completed in 2010.[127] Although we will not know the outcome of the negotiations and the details of the agreement for some time, we can learn from the transboundary water agreement signed between the Yukon and the Northwest Territories in 2002 and from other international transboundary water agreements.

The bilateral agreement signed between the Yukon Government, the Northwest Territories Government and the Government of Canada in 2002[128] provides for the protection of aquatic resources through specific water quality and quantity objectives that must be monitored over time. The CCME's Canadian Environmental Quality Guidelines for Freshwater Aquatic Life (1999) were used as the water quality objectives. The interim objective for water quantity is that "there will be no significant change in the flow regime resulting from new human activity that could affect the aquatic ecosystem." The terms "significant" and "new human activity" are not defined. The water quality and quantity objectives may need to be updated as climatic changes impact the basin ecosystems.[129]

The Yukon–Northwest Territories bilateral agreement was simpler to negotiate because of the lack of pressure for industrial development and the relatively pristine environmental condition of the Peel River watershed. The Alberta–Northwest Territories bilateral negotiations will likely be more difficult because of the multiple land and water users. Alberta has less incentive to sign a

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[124] Jack Van Camp, personal communication, October 2008.

[125] Editorial, "Natural Resources: NWT and Alberta Announce Plan to Protect Transboundary Water Resources" Nation Talk, arch 21, 2007, http://www.nationtalk.ca/modules/news/article.php?storyid=806 (accessed September 25, 2008).

[126] Ibid.

[127] Government of the Northwest Territories, *Northern Voices, Northern Waters: Towards a Water Resources Management Strategy* (Yellowknife, NT: Environment and Natural Resources, 2008), http://www.enr.gov.nt.ca/library/pdf/Northern_Voices_Northern_Waters-Summary.pdf (accessed September 25, 2008).

[128] Government of Canada, Government of the Yukon, Government of the Northwest Territories, "Yukon and Northwest Territories Transboundary Water Management Agreement," news release, January 24, 2002, http://www.ainc-inac.gc.ca/nr/prs/j-a2002/wate_e.html (accessed September 25, 2008).

[129] J. P. Bruce, H. Martin and P. Colucci, *Climate Change Impacts on Boundary and Transboundary Water Management* (London, ON: University of Western Ontario, 2003), section 8.2 http://www.saskriverbasin.ca/Resources/Climatechangestudy/Final%20Report%20A458-402%20CCAF.pdf (accessed September 25, 2008).

bilateral agreement with downstream jurisdictions without having an agreement with their upstream jurisdiction, British Columbia.[130] Historically there has been no compelling incentive for British Columbia to sign agreements with downstream jurisdictions. Federal jurisdictions have not provided leadership in the development of these agreements.

The master agreement and bilateral agreements do not supercede the authority over water resources mandated to the provinces, territories and federal government. They are merely mechanisms for communication and information sharing between the signatories. The implementation of these agreements relies totally on the honour of the jurisdictions.[131] There is no way for a jurisdiction to hold another jurisdiction legally to the terms of the agreement. Although a dispute resolution process is outlined within the master agreement, any party may release itself from these agreements by giving notice at any time.

3.3.2 Principles for Transboundary Water Management

Bilateral transboundary agreements should contain rules about the quality and quantity of water that is shared across borders. The principles listed below were adopted from the United Nations Convention on the Law of the Non-navigational Uses of International Watercourses[132] and other publications on transboundary water management.[133] The following principles could be included within the Alberta–Northwest Territories transboundary waters agreement.

Equitable Utilization and Participation

Water should be shared fairly, with apportionment, or distribution of the water, based on the calculation of natural flows. Natural flow is the volume of water flow that would occur in a river if it was not affected by human activity. Allocation of water should be based on the instream flow needs on either side of the border and informed by geography, hydrology, ecology and climate; by the social and economic needs of the jurisdictions; by population needs; and by the effects of water use by one jurisdiction on another. The criteria for water quantity must be based on ecological needs consistent with seasonal variability.

Protection and Preservation of Ecosystems

Clear and flexible criteria for water allocation, quality and aquatic health should be set. The criteria should be based on an understanding of basin dynamics and societal values.

Prevention, Reduction and Control of Pollution

Pollution prevention policies should be harmonized across borders and include mutually agreeable measures and methods to prevent, reduce and control pollution. This can include

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[130] Jack Van Camp, personal communication, October 2008.

[131] J. P. Bruce, H. Martin and P. Colucci, *Climate Change Impacts on Boundary and Transboundary Water Management* (London, ON: University of Western Ontario, 2003), section 8.2 http://www.saskriverbasin.ca/Resources/Climatechangestudy/Final%20Report%20A458-402%20CCAF.pdf (accessed September 25, 2008).

[132] United Nations, Convention on the Law of the Non-navigational Uses of International Watercourses (1997), http://untreaty.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf

[133] The Committee on the Uses of the Waters of International Rivers, Helsinki Rules on the Uses of the Waters of International Rivers and Comments (International Law Association, 1966).

setting joint water quality objectives and criteria; establishing techniques and practices to address pollution from point and non-point sources; establishing lists of substances the introduction of which into water is prohibited, limited, investigated or monitored; and developing an emergency plan in case pollution is accidentally released into the watercourse.

Obligation to Not Cause Significant Harm

Neither jurisdiction may disrupt or use water in a way that causes harm in another jurisdiction. All measures should be taken to prevent harm to a watercourse. Significant harm could be defined as that which has an irreversible environmental impact. The jurisdiction causing harm must eliminate or mitigate the harm, or pay compensation. The precautionary principle should also be applied so that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason to postpone measures to prevent environmental degradation.

Emergency Situations

An emergency in relation to a watercourse is a situation that poses an imminent threat to cause serious harm. For example, emergency plans should be developed for a tailings dam failure, to make clear what each jurisdiction can do to minimize the damage.

Integrated Monitoring

Monitoring across jurisdictions should be integrated so that the same physical and chemical parameters of the water are measured at the same times of year. A water quantity and quality baseline will establish the range of natural variation in the watercourse. With this information, unusual changes as a result of human activities or development can be detected. Monitoring should be complemented by reporting and the regular exchange of data and information between jurisdictions.

Relationship Between Different Kinds of Uses

The agreement may include a priority for certain uses, such as human use or environmental use. Otherwise, no use should take priority over another unless agreed upon.

Notification and Consultation Concerning Planned Measures and Potential Adverse Effects

Notification and consultation should be accompanied by the results of any environmental impact assessment so that each jurisdiction may consider the effects of the planned project. As in the Yukon–Northwest Territories agreement, a provision should be included for “early consultation and notification of development activities that might affect another jurisdiction” and for sharing “environmental assessment information in a timely and consistent manner.” Early notification could also include a requirement to address cumulative impacts of development, which are the result of multiple projects, not just one project. The cumulative impact of development could be managed over time by setting environmental objectives prior to issuing leases for exploration or development.

4. Conclusions and Recommendations

Oil sands development has a variety of impacts on water resources in the region in which projects operate, and poses a risk to water resources downstream. There are various management efforts, from monitoring at the local scale to cumulative effects assessment and management at the federal, provincial and territorial levels. Yet these efforts are not enough to ensure that water remains clean and plentiful north of the oil sands region. This chapter suggests six ways to improve water management and minimize risks to water resources.

1. The Government of Alberta should suspend new oil sands lease sales and oil sands project approvals until environmental rules protecting water are in place.

The list of organizations and individuals calling for a suspension of new lease and project approvals in the oil sands is growing.[134] Aboriginal organizations and other northern organizations could join the list of concerned groups. A variety of approaches are possible:

- Intervene in the review of individual oil sands projects and raise concerns about the potential impact on water resources. Ask for clear expectations of tailings management and reclamation to reduce potential long-term risks due to seepage and tailings pond dyke breaks.
- Pursue a legal case against the federal government for lack of consultation and/or infringement on Aboriginal rights.
- Start a public education campaign territorially, provincially or even nationally to raise awareness about the potential impact of oil sands development, and ask for political support for a suspension of lease sales and project approvals.

2. The Government of the Northwest Territories and the Government of Canada should request that the Government of Alberta halt granting new water licenses until a transboundary agreement is complete.

At present, water licences are being issued in the absence of a clear definition of what is required to maintain ecological conditions in Alberta or in the Northwest Territories. Water licenses should not be issued until the Alberta–Northwest Territories transboundary agreement has been signed, and criteria for water quality and quantity and aquatic ecosystems have been defined.

3. Complete a transboundary agreement between Alberta and the Northwest Territories.

Summarized from section 3.3.1 above, the following elements should be included in a Northwest Territories–Alberta transboundary agreement:

- clear criteria for water quantity and quality and aquatic ecosystems based on achieving environmental objectives

[134] No New Approvals for Tar Sands Development, 2008, http://www.nonewapprovals.ca

- emergency plan in the case of a tailing pond dyke break
- commitment to notify the Northwest Territories about oil sands projects and associated risks to water resources downstream
- integrated monitoring across the jurisdictions that establishes a baseline for water quality and quantity and aquatic ecosystems
- agreement terms that are enforceable by law

4. Implement a water management framework for the Athabasca River and Slave River that sets a protective Ecological Base Flow (EBF) below which water withdrawals are prohibited.

The Government of Alberta's framework for instream flow needs for the Lower Athabasca River should be revised to guarantee protection of the river.[135] Similar protection should be guaranteed for the Slave River. This protection should include the base flow required to maintain the ecological health of the river. It should be based on precautionary water withdrawal limits that trigger mandatory (enforceable by law) requirements for changes in water use and management. The EBF should consider Aboriginal rights, which are inseparable from the health of the environment, and meet the requirements of the Canadian Fisheries Act to maintain fish populations and habitat.

5. Prohibit the production of liquid tailings for new oil sands projects.

The pollution prevention principle was recommended at the completion of the Northern Rivers Basin Study in 1996. It is "the elimination or virtual elimination of the generation, use and discharge of persistent toxic substances that tend to bioaccumulate in the environment."[136] The NRBS recommended that all agencies responsible for water management implement pollution prevention and zero discharge as an objective through law, policy and practice. This recommendation was made when the overall impacts of development were much smaller than those associated with oil sands operations today. There is more reason for concern now due to the risk of liquid tailings contaminating lakes, rivers and streams.

Companies are not allowed to discharge tailings directly into the ecosystem. Instead, they are permitted to create tailings ponds and landfills, which pose a risk to the environment due to the potential for leaching and dyke breaks. At the end of a project's life, companies plan to build end pit lakes to house the leftover tailings. End pit lakes have not been tested or proven to work as a long-term reclamation practice for oil sands tailings. There is no proof that these lakes will be capable of supporting aquatic life as proposed.

The government should prohibit the creation of liquid tailings, thereby eliminating the need to dispose of waste water in tailings ponds or lakes. The industry should be required to use other technologies that do not produce tailings to extract the bitumen from the sands. Some of these

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[135] D. Woynillowicz and C. Severson-Baker, *Down to the Last Drop: The Athabasca River and Oilsands* (Calgary, AB: Pembina Institute, 2005).

[136] Northern River Basins Study Board, *Northern River Basins Study Final Report*, (Northern River Basins Study Board, 1996), http://www3.gov.ab.ca/env/water/nrbs/sect1/sect15.html (accessed September 24, 2008), recommendation 1.1.

technologies exist today and new ones would likely be developed if end pit lakes and liquid tailings were not allowed.[137]

6. Establish a consistent, transparent and integrated monitoring system, at arms length from industry, on water quality and quantity and aquatic ecosystems in the Athabasca River, the Peace-Athabasca Delta, Lake Athabasca and the Slave River.

Improve baseline water testing on each side of the border to ensure that the same monitoring approaches are used and that the same physical and chemical conditions of the water are measured. Water testing results must be communicated on a regular basis to the public to build trust and knowledge about the conditions of the water and any changes.

The impact of oil sands development on water resources is no longer acceptable to many people in Alberta and beyond. There is mounting evidence that oil sands development is affecting water resources in Alberta in a way that has exceeded, or will soon exceed, environmental limits. In addition, there is a lack of trust in the management processes in place to protect water resources. As the water flows north into the Northwest Territories, residents are becoming increasingly concerned about the impact of oil sands development, and in particular about the long-term risks from the storage of toxic tailings. Northern Aboriginal groups are joining with their southern neighbours in calling for a moratorium on new leases and oil sands project approvals. In advance of further oil sands development, transboundary environmental rules protecting water and integrated monitoring are needed, recognizing the life-supporting human and ecological uses of the water.

[137] Examples of new technologies: Vapour Extraction (VAPEX), Gradek Energy Inc., http://www.gradekenergy.com; Bitman Resources Inc. Bitmen Process, http://www.bitmenresources.com