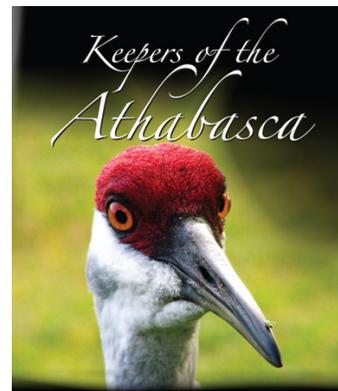
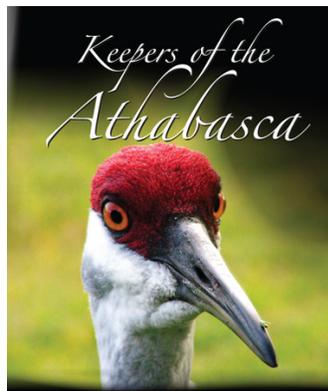
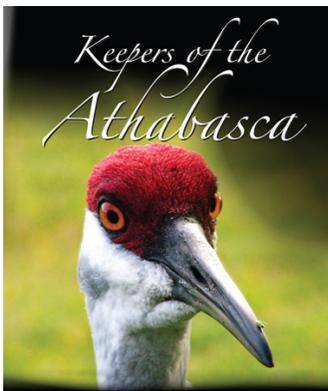


*Alberta's Oil Sands
Development is
Not Responsible-
Moratorium Needed*



Keepers of the Athabasca

June 2012

Keepers of the Athabasca are First Nations, Metis, Inuit, environmental groups, and watershed citizens working together for the protection of water, land and air, and thus for all living things today and tomorrow in the Athabasca River Watershed of Alberta.

About the Author

This report was written by Helene Walsh for Keepers of the Athabasca. Helene has worked for the Canadian Parks and Wilderness Society Northern Alberta Chapter (CPAWS NAB) for about ten years. Helene is currently on the CEMA board representing CPAWS NAB, however, this report does not represent the views of CPAWS NAB. No funding was provided for the writing of this report by any organization. Helene was born in Fort McMurray, has a Masters in Zoology from the University of Alberta, has always been a resident of Alberta, is a grandmother and a volunteer for Keepers of the Athabasca.

Executive Summary

This report for Keepers of the Athabasca provides:

1. A compilation of evidence documenting the lack of information on cumulative effects on the environment in the oil sands region of Alberta, which is a requirement for regulatory approval of new projects under both provincial and federal requirements, and
2. Evidence that significant harmful environmental effects have occurred already.

This report's evidence supports a Keepers of the Athabasca recommendation to the Alberta and Federal Governments for a moratorium on new oil sands projects until existing cumulative effects are fully documented and properly assessed. The current plan to allow new development while a new monitoring program is being established, and implemented, is contrary to regulation and is not responsible development.

Approval of oil sands projects is the responsibility of both provincial and federal agencies. The Canadian Environmental Assessment Agency requires cumulative effects be determined before new projects can be approved. The provincial Energy Resources Conservation Board requires that approved projects are in the public interest, and claims that it is a requirement of the approval process to consider cumulative effects.

To support the conclusion that the full cumulative effects in the oil sands area are not known, the key findings of the five recent reviews of current monitoring efforts are provided: the Federal Oil sands Advisory Panel (2010), the provincial Regional Aquatics Monitoring Program (RAMP) Review Panel, a panel commissioned by the Royal Society of Canada, the provincial Alberta Environmental Monitoring Panel and the Auditor General of Canada. To support the conclusion that significant harmful environmental effects have already been found, evidence is provided from available traditional knowledge, peer reviewed scientific literature, and independent studies.

Information on reported increases in cancer rates, or contribution of the oil sands industry to greenhouse gas emissions were considered beyond the scope of this report.

All five oil sands reviews concluded that environmental monitoring in the region has not been adequate to measure the current harmful cumulative effects. In addition, evidence documented in this report from the five reviews, aboriginal groups and independent study is sufficient to show that environmental effects caused by the oil sands industry in the region already pose a threat to air, water, land and biodiversity. This is after over 30 years of building huge projects, the accumulation of 170 km² of toxic tailings ponds, acid rain, destruction and fragmentation of boreal forest, toxins in surface and groundwater and serious problems with reclamation.

Therefore, until a monitoring program capable of detecting regional trends and cumulative effects has been established, implemented and has results upon which decisions can be made, approvals (since at least 2004 when the first review of the water monitoring in the oil sands area was very critical, indicating then that cumulative effects were not being determined) are contrary to the Canadian Environmental Assessment Act, and to Alberta's Environmental Protection and Enhancement Act. Therefore, at least since 2004 both agencies (Energy Resources Conservation Board and the Canadian Environmental Assessment Agency) that approve new oil sands projects did not have the basis in their own regulations to approve more projects.

Hence, the Keepers of the Athabasca call on the Governments of Alberta and Canada to stop permitting the building of new projects including expansions, new water licenses or land sales in the oil sands region until enough research is done to bring those projects already built back into compliance with the governments' own regulations. This is what is required:

- An independent monitoring program capable of detecting regional trends and cumulative effects and this program is implemented and has adequate results,
- Independent limits established for environmental damage to the air, water, land and biodiversity such that there will not be lasting harm to the environment, and
- Existing projects have been brought within those limits and therefore new projects can be safely accommodated.

These are some of the main findings indicating existing and increasing future environmental damage:

- Aboriginal people in the region have indicated water and wildlife quality and quantity problems already exist and are affecting their treaty rights.
- The main water monitoring program (Regional Aquatic Monitoring Program (RAMP)) has not been doing an adequate job of monitoring for over ten years, including not collecting baseline data or trends in toxic substances, so that at this point in time we do not know the cumulative effects of pollution from petroleum development on water and sediment quality in rivers and lakes.
- Recent independent science and reviews of existing information have concluded that industrial activities are the source of observed contamination of water with toxic heavy metals and petroleum compounds from Ft. McMurray all the way down to the Peace Athabasca Delta, and on land within about forty km of the mining projects.
- Increases over time of some of some extremely toxic substances such as arsenic, mercury, naphthenic acids, polycyclic aromatic hydrocarbons (PAH, PAC) have been found in water and sediments.
- Canada's or Alberta's guidelines for the protection of aquatic life were exceeded for seven Priority Pollutants —cadmium, copper, lead, mercury, nickel, silver, and zinc—in melted snow and/or water collected near or downstream of development.

- Tailings ponds are not lined and contain toxic substances that are leaking into the surrounding environment and groundwater.
- Groundwater is being contaminated to unknown degrees and repair may take an extremely long time, is very expensive, and may be impossible.
- Water quantity in the area is expected to decline due to global warming, while industrial water needs continue to increase. This will increase the clash between environmental and economic needs.
- Quantities of groundwater used in the oil-sands are not sustainable. Some areas have already seen lowering of water levels harmful to ecosystems due to petroleum activity.
- Populations of some wildlife species are already declining. The woodland caribou, for example, is threatened with local extinction and indicators of native fish integrity, fisher, moose and black bear are below healthy levels.
- In situ operations will occupy about eighty per cent of the region and increase habitat fragmentation to an extent that sensitive wildlife populations will decrease even further.
- Aboriginal people report increasing frequency of deformed fish caught in the Athabasca River and Lake.
- Alberta's air quality standards allow significantly more pollution than the European Union, U.S. Environmental Protection Agency and World Health Organization. The tar sands industry is allowed to largely self-monitor air pollution.
- Acid rain from the oil sands extraction process is already falling in amounts that will lead to conditions that are harmful to fish and other species in lakes.
- It is well known that restoration will not be able to return the landscape of the mined area to its previous condition. Wetlands of various types currently occupy about half of the oil sands area now, but will be much reduced in the future. The salty nature of the tailings sand needed to reconstruct the landscape after mining will limit the success of restoration.
- Unlined end pit lakes are to be permanent features on the landscape where toxic liquid tailings will be stored. It is hoped that capping them with fresh water will result in the eventual creation of a functional lake ecosystem. This is unproven.

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Notes:

- This report is not intended to be an exhaustive list of all existing information available on harmful impacts in the oil sands area caused by industrial development, but rather sufficient information to demonstrate the need for a moratorium on the development of new projects in order to limit the damage.
- All bold is added by the author unless otherwise indicated.

1. Purpose

This report for Keepers of the Athabasca is intended to provide:

1. A compilation of evidence documenting the lack of information on cumulative effects on the environment in the oil sands region of Alberta, which is a requirement for responsible development, and
2. Evidence that significant harmful environmental effects have occurred already.

This report's evidence supports a Keepers of the Athabasca recommendation to the Alberta and Federal Governments for a moratorium on new oil sands projects until existing cumulative effects can be fully documented and properly assessed.

Approval of additional oil sands projects is the responsibility of both provincial and federal agencies. The Canadian Environmental Assessment Agency (CEAA) requires that cumulative effects be determined before projects can be approved. The provincial Energy Resources Conservation Board (ERCB) requires that approved projects are in the public interest, which cannot be determined without knowledge of cumulative effects. (For example, each individual project has limited harmful environmental effects, but each additional project adds more harmful effects and it is this total harm of all projects, including that of other existing industry, which is what is needed to determine whether a new project can be safely added.)

To support the conclusion that the full cumulative effects in the oil sands area are not known, the key findings of the six recent reviews of current monitoring efforts are provided: the Federal Oil sands Advisory Panel (2010), the provincial Regional Aquatics Monitoring Program (RAMP) Review Panel, a panel commissioned by the Royal Society of Canada, the provincial Alberta Environmental Monitoring Panel and the Auditor General of Canada, are provided. To support the conclusion that significant harmful environmental effects have already been found, evidence is provided from available traditional knowledge, peer reviewed scientific literature, and independent studies.

Detailed information on reported increases in cancer rates, or contribution of the oil sands industry to greenhouse gas emissions were considered beyond the scope of this report.

Information on groups associated with oil sands development and project approvals is provided to indicate that project approvals have not been appropriate at least since 2004 due to lack of information on cumulative effects, which means the approvals have not been meeting government requirements.

2. Introduction to the Alberta oil sands¹

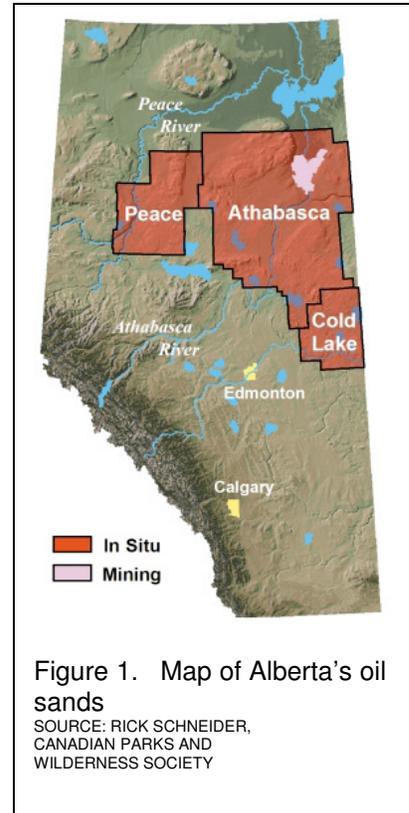
2.1 Description of the resource

The Alberta oil sands are located in three major areas of north eastern Alberta as indicated in Figure 1.

Oil sand is a naturally occurring mixture of sand, clay or other minerals, water and bitumen. It is thick oil that must be treated before it can be used by refineries to produce usable fuels such as gasoline and diesel. The bitumen needs to be separated from the water and sand prior to being upgraded into a lighter crude oil and numerous other petroleum products. Oil sands within 75 meters of the surface can be mined. Surface mining requires a cleaning facility where the material is mixed with hot water to separate the bitumen oil from the sand. Water used in the process is stored in tailings ponds. At present there are about 170 km² of tailings ponds. To date, about 602 square kilometres of land has been disturbed by oil sands mining activity.

For deeper oil sands reservoirs an in situ recovery method is used to produce bitumen through wells. Eighty per cent of recoverable bitumen can only be produced using in situ methods. The majority of in situ operations use steam-assisted gravity drainage (SAGD). This involves pumping steam underground through a horizontal well to liquefy the bitumen, which is then pumped to the surface through a second well.

As of September 2010, there are 91 active oil sands projects in Alberta. Of these, five are mining projects; the remaining projects use various in situ (in place) recovery methods, the most common one being SAGD.



¹ Government of Alberta. Facts about Alberta's Oilsands. <http://www.oil.sands.alberta.ca/FactSheets/FS-Resource.pdf> Accessed April 2012.

2.2 Oil sands monitoring and advisory organizations

2.2.1 Cumulative Environmental Management Association (CEMA)

CEMA is a multi-stakeholder society that is a key advisor to the provincial and federal Government.

This was CEMA's Vision in 2004.

- *“The environment of the region, including the land, forest, air, water, wildlife and biodiversity, will be protected, sustained, and restored over the long term and that the collective activity of industrial activity in the region will not cause any lasting harm to the environment or adverse effects to the health of humans. Should these impacts be evident, the Association and its Members will recommend, promote and implement mitigation action to manage their effects.”*² (As of 2010 CEMA no longer has a vision statement and although the new mission statement below was intended to duplicate the old vision, it fails to do so.)

This is CEMA's mission as of 2010.

*“The Cumulative Environmental Management Association (CEMA) is a multi-stakeholder society that is a key advisor to the provincial and federal Government's committed to respectful, inclusive dialogue to make recommendations to manage the cumulative environmental effects of regional development on air, land, water and biodiversity.”*³

Most of the information in this report was provided to the CEMA Board in June 2011, with a request from the Canadian Parks and Wilderness Society Northern Alberta (CPAWS NAB), a five year member of CEMA, to recommend to government that no new projects be allowed to proceed until the existing cumulative effects have been determined. CEMA declined:

Achievement: CEMA made a clear recommendation on resource tenures in 2008: The association advised the Alberta Government to suspend granting new resource tenures on an interim basis until January 2011 to maintain the conservation authority in areas identified by CEMA as having high conservation value to Wood Buffalo and its people. <http://www.ramp-alberta.org/UserFiles/File/CEMA-RAMP%202009%20Community%20Report.pdf>

The government did not implement this recommendation.

² CEMA. Mission and Goals. <http://cemaonline.ca/index.php/about-us/cema-mission-and-goals> Accessed April 2012.

³ CEMA. About CEMA. CEMA's Vision <http://clonelibrary.cemaonline.ca/> Accessed April 2012.

most members indicated they felt this kind of recommendation was not within the mandate of CEMA.

2.2.2 Regional Aquatics Monitoring Program (RAMP)⁴ Claims to integrate aquatic monitoring activities so that long-term trends, regional issues and potential cumulative effects related to oil sands and other development can be identified and addressed. It is an industry-funded, multi-stakeholder environmental monitoring program initiated in 1997.

2.2.3 Wood Buffalo Environmental Association (WBEA)⁵ monitors the air in the Regional Municipality of Wood Buffalo, It is a multi-stakeholder collaboration of communities, environmental groups, industry, government and Aboriginal groups.

2.2.4 Alberta Biodiversity Monitoring Institute (ABMI)⁶ conducts monitoring of more than 2000 species and habitats to support decision making about provincial biodiversity. It is funded by contributions from Alberta's major natural resource managers and users including: the Government of Alberta, the Government of Canada, the energy sector, the forest sector and others.

2.3 Oil Sands Regulatory Bodies

Federal and provincial bodies share roles and responsibilities for the environmental assessments of major oil sands projects and in determining if projects should be approved to proceed.

2.3.1 The Alberta Energy Resources Conservation Board (ERCB)⁷

The Energy Resources Conservation Board (ERCB) makes the decisions on approving oil sands projects. It is an independent, quasi-judicial agency of the Government of Alberta. They claim to regulate the safe, responsible, and efficient development of Alberta's energy resources: oil, natural gas, oil sands, coal, and pipelines.

The ERCB's mission is to ensure that the discovery, development and delivery of Alberta's energy resources take place in a manner that is fair, responsible, and in the public interest. In assessing the public interest, the ERCB has regard for social, economic, and environmental impacts.

⁴Regional Aquatics Monitoring Program (RAMP) website. <http://www.ramp-alberta.org/RAMP.aspx>

⁵ Wood Buffalo Environmental Association (WBEA) website. <http://www.wbea.org/>

⁶ Alberta Biodiversity Monitoring Institute (ABMI) website. <http://www.abmi.ca/abmi/home/home.jsp>

⁷Energy Resources Conservation Board (ERCB) website. <http://www.ercb.ca/portal/server.pt?open=512&objID=260&PageID=0&cached=true&mode=2>

The Environmental Protection and Enhancement Act⁸ states:

49 d. a description of potential positive and negative environmental, social, economic and cultural impacts of the proposed activity, including **cumulative**, regional, temporal and spatial considerations;

These are some of the stated requirements of the ERCB for the oil sands⁹:

- The regulatory system and approvals process takes into account environmental, social and economic impacts **including cumulative effects** for all major projects as well as promoting resource conservation and technical excellence at every stage.
- **No oil sands project in Alberta may proceed without an assessment of cumulative effects;**
- Alberta relies on the best information and science available to predict the impacts and cumulative effects of a proposed industrial activity on the surrounding environment. This provides the foundation to decide whether the activity should proceed, and under what conditions. Follow-up monitoring is used to validate those predictions and provides the basis for future action and policy that will ensure that Alberta's high standards continue to be met.

2.3.2 Canadian Environmental Assessment Agency (CEAAgency)

Canadian Environmental Assessment Act (CEAAAct) includes a requirement for a cumulative effects assessment.

The Act¹⁰ states:

16. (1) Every screening or comprehensive study of a project and every mediation or assessment by a review panel shall include a consideration of the following factors:

(a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any **cumulative environmental effects** that are likely to result from the project in combination with other projects or activities that have been or will be carried out;

⁸ Alberta Government. 2010. Environmental Protection and Enhancement Act. Queen's Printer.
<http://www.qp.alberta.ca/documents/Acts/E12.pdf>

⁹ ERCB. 2011. Big Reserves, Big Responsibility Developing Alberta's Oil Sands.
http://www.ercb.ca/docs/Documents/reports/OilSandsRegulatoryCaseStudy_201104.pdf

¹⁰ Government of Canada. 1992. Canadian Environmental Assessment Act.
<http://laws-lois.justice.gc.ca/eng/acts/C-15.2/>

Canadian Environmental Assessment Act (CEAA) requires that the environmental assessment of each project under review consider cumulative environmental effects. The Minister of the Environment is responsible for the preservation and enhancement of the quality of the natural environment, including water, air, and soil quality. The minister is also responsible for coordinating the policies and programs of the Government of Canada for preserving and enhancing the quality of the natural environment. Further, Section 44 of the *Canadian Environmental Protection Act, 1999* requires the Minister of the Environment to establish, operate, and maintain “a system for monitoring environmental quality.” According to the Act, “environment” means the components of the Earth, and environmental quality includes the health of ecosystems.¹¹

3. Lack of cumulative effects assessments for the oil sands region

What are cumulative effects? The Auditor General’s report¹² provides a good description: *“The cumulative environmental effects of a project are environmental effects arising from a single project under review, combined with the effects of other projects or activities located in the same geographic region. The assessment of multiple-project environmental effects combines the environmental effects of projects that have been in operation for years or decades, the projected environmental effects of the specific project under review, and the potential environmental effects of projects that have not yet begun operation but will do so in the future. While the environmental effects of a single project may not be significant when assessed in isolation, the combined effects of multiple projects on water, air, land, and wildlife may have significant adverse environmental effects.”*

While the Canadian Environmental Assessment Act (CEAA) requires that the environmental assessment of each project under review consider cumulative environmental effects, that has not been done in the oil sands region as documented below:

From the Audit by the Auditor General of Canada 2011¹³

Canadian Environmental Assessment Act requires that the environmental assessment of each project under review consider cumulative environmental effects. The objective of the audit was to determine whether the federal government has considered the cumulative environmental effects of major oil sands projects in northern Alberta according to the Canadian Environmental Assessment Act. It focused on the work of Fisheries and Oceans Canada (as a responsible authority), Environment Canada (as a key expert federal authority), and the Canadian Environmental Assessment Agency (as the federal administrator of environmental assessment activities). Five large oil sands projects were examined: Project Millennium (1999), the Horizon

¹¹ Auditor General of Canada. 2011. October Report of the Commissioner of the Environment and Sustainable Development. Chapter 2. Assessing Cumulative Environmental Effects of Oil Sands Projects. http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201110_02_e_35761.html#ex3

¹² Ibid.

¹³ Ibid.

Oil Sands Project (2004), the Jackpine Mine Project (2004), the Muskeg River Mine Expansion (2006), and the Kearl Oil Sands Project (2007). This is what the audit concluded with respect to cumulative effects:

- **Fisheries and Oceans Canada and Environment Canada have not been able to consider in a thorough and systematic manner the cumulative environmental effects of oil sands projects in that region due to lack of information.**
- **We have concluded that incomplete environmental baselines and environmental data monitoring systems needed to understand changing environmental conditions in northern Alberta have hindered the ability of Fisheries and Oceans Canada and Environment Canada to consider in a thorough and systematic manner the cumulative environmental effects of oil sands projects in that region.**
- The federal government did not take the opportunity to modify terms of reference in later projects to deal with key concerns previously raised by federal authorities, in areas such as water quantity and quality, fish and fish habitat, land and wildlife, and air. In our opinion, federal authorities should have used the sound management practice of adapting terms of reference over time in order to address identified gaps in information being provided to them.
- In September 2010, the government established the Oil Sands Advisory Panel, with a mandate to document, review, and assess the current body of scientific research and monitoring in the northern Alberta oil sands region and, in December 2010, the Panel issued its report. In response, the federal government committed to establish, with its key partners, a world-class environmental monitoring system for the lower Athabasca River basin.

From the Royal Society of Canada Expert Panel:¹⁴

- *“Cumulative environmental impact assessment has been acknowledged as a priority need for regulatory reform by the Government of Alberta. Cumulative environmental assessment requires determination of the ecological capacity in the region to identify limits that need to apply to individual project approvals.”*
- ***“Based on the specific deficiencies that we have identified and the important lack of cumulative analysis on many environmental and social issues, the Energy Resources Conservation Board (ERCB—the body that decides project approvals) faces difficult public interest determinations on future projects unless these information deficiencies, especially on cumulative impacts, are corrected. Accordingly, the necessary studies need to be completed with highest priority to assure a***

The Royal Society of Canada commissions expert panels to provide expert assessment on critical issues of public policy. The panel on the Environmental and Health Impacts of Canada’s Oil Sands Industry was commissioned in the fall of 2009 and completed in December 2010.

¹⁴ Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada’s Oil Sands Industry. http://www.rsc.ca/documents/expert/RSC_report_complete_secured_9Mb.pdf

sound evidence base for the public interest decisions that the ERCB's enabling legislation obliges it to make for the people of Alberta on project applications.”

- *“Environmental Regulatory Performance: The environmental regulatory capacity of the Alberta and Canadian Governments does not appear to have kept pace with the rapid expansion of the oil sands industry over the past decade. The EIA (Environmental Impact Assessment) process relied upon by decision-makers to determine whether proposed projects are in the public interest has serious deficiencies in relation to international best practice. Environmental data access for cumulative impact assessment needs to improve.”*
- *“Despite long-standing commitments to cumulative impacts assessment there is little tangible progress evident in recent EIAs or current regulatory policy.”*
- *“The purpose statements of the Environmental Protection and Enhancement Act and the Water Act provide clear guidance to the Government of Alberta about what needs to be achieved in managing environmental impacts from oil sands development; the government simply needs to respect the letter of its own legislation in this regard.”*

From the Oil Sands Advisory Panel¹⁵

- *“Many of the [oil sands] **monitoring programs were unable to definitively distinguish... oil sands industrial impacts.**”*
- *“Although a significant level of monitoring and research activity is occurring within the oil sands region, it is **dwarfed by the level of activity** that was expended on other major environmental issues of the past few decades, such as the acid deposition problem in eastern Canada.”*
- *“**The current fragmented collection of monitoring and research activities will not adequately support the goals of environmentally sustainable development in the oil sands region**”.*

The Oil Sands Advisory Panel was appointed in September 2010 by then Federal Environmental Minister Jim Prentice in response to concerns about industrial pollution in the Athabasca watershed. It was to review the design and management of related environmental systems. This report was submitted to the Federal Minister of Environment.

¹⁵ Oil sands Advisory Panel. 2010. A Foundation for the Future: Building an Environmental Monitoring System for the Oil Sands. A report submitted to the Minister of Environment.

<http://www.ec.gc.ca/pollution/default.asp?lang=En&n=E9ABC93B-1>

¹⁶RAMP Review Panel. 2010. Regional Aquatics Monitoring Program (RAMP) Scientific Review.

<http://www.ramp-alberta.org/UserFiles/File/RAMP%202010%20Scientific%20Peer%20Review%20Report.pdf>

From the RAMP Review Panel¹⁶

- The study design is not building upon well established state-of-the science in Canada and elsewhere. (2004)
- ***“...the existing Regional Aquatics Monitoring Program is not sufficient to detect regional trends and cumulative effects brought about by the industry and that the program is not asking the right questions or monitoring the right things.”***
- **RAMP does not monitor aquatic environments in the oil sands region to detect and assess cumulative effects** and regional trends.
- RAMP does not compare data against which predictions contained in environmental impact assessments can be assessed.
- RAMP does not collect baseline data to characterize natural variability in the aquatic environment in the Athabasca oil sands region and
- **RAMP does not collect data that satisfies the monitoring required by regulatory approvals of oil sands developments.**

RAMP initiated a provincial panel which undertook a review of RAMP in 2004 and again in 2010. The panel was composed of nine individuals selected for their scientific expertise in climate and hydrology, water quality, benthic invertebrate communities and sediment quality, fish populations and acid---sensitive lakes.

Since 2004 many new projects have been approved and that continues today despite the continued failures of RAMP and the fact that both traditional environmental knowledge and independent western science have provided evidence of harmful effects from industry.

From the Report of the Alberta Environmental Monitoring Panel¹⁷

- *“Environmental monitoring in Alberta currently consists of a collection of individual monitoring networks around the province that have differing objectives, governance and operational structures. **These networks do not form an integrated system and are not optimally configured to support cumulative effects management or the environmental management frameworks associated with regional plans.**”*

The **Alberta Environmental Monitoring Panel** was established in January 2011 by the Provincial Environment Minister. Mr. Renner directed this independent expert panel to provide recommendations on the development of a provincial scale world class environmental monitoring evaluation and reporting system with initial focus on the Lower Athabasca region (the oil sands region) of northeastern Alberta.

¹⁶RAMP Review Panel. 2010. Regional Aquatics Monitoring Program (RAMP) Scientific Review.

<http://www.ramp-alberta.org/UserFiles/File/RAMP%202010%20Scientific%20Peer%20Review%20Report.pdf>

¹⁷Alberta Environmental Monitoring Panel. 2011. A World Class Environmental Monitoring, Evaluation and Reporting System for Alberta. <http://environment.gov.ab.ca/info/library/8381.pdf>

- “The achievement of cumulative effects management outcomes will need to be validated by data and information produced by an integrated environmental monitoring, evaluation and reporting system.”
- “A consistent message was that Alberta needs a comprehensive, integrated, state-of-the-art monitoring system that can assess cumulative effects.”

4. Evidence that harm to environment has already occurred

4.1 Surface water

4.1.1 Surface water quality

Aboriginal people have raised significant concerns regarding water pollution to the Athabasca watershed and the possible linkage to health concerns from oil sands development.¹⁸

*Observations of traditional elders about ecological and other changes from Ft. Chipewyan are consistent. They say the river water tastes differently now: oily, sour, or salty. When river water is boiled, a brown residue remains in the pot.*¹⁹

Some Fort McKay Elders have said that water quality is very important to the traditional life ways of aboriginal communities; cumulative effects to water quality are already felt to be significant. Traditional knowledge views increased water contamination as seriously affecting the health of humans, animals and vegetation in the area.²⁰

Athabasca Chipewyan and Mikisew Cree First Nations Chiefs said²¹: As Leaders, we are relatively young. But yet, in our lifetimes, we have seen drastic changes in the quality of water in the Athabasca River. When we were children we still drank the water from the river channel flowing out from the Delta, past our on-reserve communities and Fort Chipewyan. Today, we will not allow our loved ones to drink the water from the river. We have experienced oil spills whereby our Elders were exposed to toxic chemicals during the clean-up, and our reserves became dumping grounds for the toxic waste.

¹⁸ Droitsch, D. and T. Simieritsch. 2010. Canadian Aboriginal Concerns With Oil Sands A compilation of key issues, resolutions and legal activities. Briefing Note. <http://pubs.pembina.org/reports/briefingnoteofntoursep10.pdf>

¹⁹ Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

²⁰ Fort McKay First Nation Traditional Knowledge Report Total E & P Canada Ltd. Joslyn North Mine Project Update Prepared By FMA Heritage Resources Consultants Inc . http://www.total-ep-canada.com/upstream/documents/Additional_Information/AIR_July2010/Appendix_B.pdf

²¹ Craig Candler, Rachel Olson, Steven DeRoy and the Firelight Group Research Cooperative with the Athabasca Chipewyan First Nation (ACFN) and the Mikisew Cree First Nation (MCFN) 2010 As Long as the Rivers Flow Athabasca River Knowledge, Use and Change.

http://parklandinstitute.ca/research/summary/as_long_as_the_rivers_flow/

²² Ibid

A survey of river users and knowledge holders in the community of Fort Chipewyan indicated that over 80% have seen negative changes in water quality.²²

Dr. Kevin Timoney was asked to do a study on behalf of the Nunee Health Board in Fort Chipewyan, Alberta.²³ His 2007 study examined water and sediment quality indicators in the area. Data were analyzed and discussed in the contexts of water and sediment quality guidelines, wildlife contaminants, and ecosystem and public health. Some of the findings of his study were:

- The people and biota of the Athabasca River Delta and western Lake Athabasca are exposed to higher levels of some contaminants than are those upstream of the oil sands development.
- Overall, the primary contaminants of concern may be arsenic, mercury, and polycyclic aromatic hydrocarbons (PAHs). Concentrations of these contaminants, which are already high, appear to be rising.
- People most at risk of adverse health effects are those...who consume untreated surface water.
- In water, chemical constituents of concern include: arsenic, aluminum, chromium, cobalt, copper, iron, lead, phosphorus, selenium, titanium, and total phenols; the herbicides dicamba, mcpa, bromacil, and triallate; and the pesticide lindane. Other possible constituents of concern include: ammonia, antimony, manganese, molybdenum, and nickel.
- In sediment, constituents of concern include: arsenic, cadmium, PAHs, and resin acids.

Oil sands industry or natural sources?

One of the issues, raised largely by industry and government, was whether or not the contaminants were natural as a result of river water flowing through oil sands deposits, or they were of industrial origin. Research showed that by far the contaminants were of industrial origin:

- In 2003 Tetreault et al.²⁴ compared responses of slimy sculpin at a site with exposed natural bitumen, an industrially-affected site, and a site with no bitumen. They observed that slimy sculpin exposed to mining elevated levels of bitumen showed up to a ten-fold increase in a kind of liver activity relative to the bitumen-free site; fishes exposed to natural levels of bitumen showed only a two-fold elevation of this activity.

²³ Timoney, K.P. 2007. A Study of Water and Sediment Quality as Related to Public Health Issues, Fort Chipewyan, Alberta. On behalf of the Nunee Health Board Society Fort Chipewyan, Alberta.
http://www.tothetarsands.ca/wp-content/uploads/2007/11/fc_final_report1-1.pdf

²⁴ Tetreault GR, McMaster ME, Dixon DG, Parrott JL. 2003. Using reproductive endpoints in small forage fish species to evaluate the effects of Athabasca oil sands activities. *Environm Toxicol and Chem* 11:2775-2782. <http://www.ncbi.nlm.nih.gov/pubmed/14587921>

- In 2007 a study by Environment Canada²⁵ was conducted between 1998 and 2000 to determine whether the quality of water and sediments in tributaries of the Athabasca River are affected by flowing through natural oil sand deposits. The study found no indication that metal concentrations changed in three tributaries of the Athabasca River as they flow through natural oil sand exposures.

Timoney and Lee undertook a comprehensive study²⁶ of all the available data regarding industry pollution in the oil sands area. They found the following:

- Arsenic levels in water near Ft. Chipewyan and in the lower Athabasca River exceeded those for western Lake Athabasca.
- In 2007, dissolved arsenic levels near Ft. Chipewyan at the town water intake; in the Rochers River near Mission Creek and in the Fletcher Channel exceeded their historical medians.²⁷
- Sediment arsenic concentrations in Lake Athabasca increased over the period 1970-1990, from 2 mg/kg to 10 mg/kg.²⁸
- Levels of arsenic in 2000 in Athabasca River sediments at Big Point Channel, Flour Bay, in the Rochers River near Mission Creek, and at the Ft. Chipewyan water intake were about 44%, 35%, 112%, and 114%, respectively, above the historical median levels (1976-99).²⁹

Still in 2009 some industry and government still insisted that the toxins in the river were due to natural causes, due to the exposed bitumen deposits in the river valley. In order to prove that some of the harmful substances found in the river were contributed by industry, scientists working with Dr. David Schindler did two studies. They first investigated polycyclic aromatic

²⁵Conly FM, Crosley RW, Headley JV, Quagraine EK. 2007. Assessment of metals in bed and suspended sediments in tributaries of the Lower Athabasca River. Environment Canada, National Hydrology Research Centre, Saskatoon, Canada. J Environ Sci Health A Tox Hazard Subst Environ Eng. 2007 Jul;42(8):1021-8.

Abstract <http://www.ncbi.nlm.nih.gov/pubmed/17616873>

²⁶Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

²⁷RAMP (Regional Aquatics Monitoring Program). Oil Sands Regional Aquatics Monitoring Program 2000, Volume I: Chemical and Biological Monitoring. Ft McMurray: RAMP 2001 in Timoney and Lee, Ibid.

²⁸Bourbonniere RA, Telford SL, Kemper JB. Depositional history of sediments in Lake Athabasca: geochronology, bulk parameters, contaminants and biogeochemical markers. Project Report No. 72. Edmonton: Northern River Basins Study 1996 in Timoney and Lee, 2009.

²⁹RAMP (Regional Aquatics Monitoring Program). Oil Sands Regional Aquatics Monitoring Program 2000, Volume I: Chemical and Biological Monitoring. Ft McMurray: RAMP 2001.

compounds (PAC)³⁰ and second, toxic elements.³¹ By studying toxins above and below oil sands projects, and in the snow they found industry was responsible:

- Dissolved PAC concentrations increased in tributaries and the Athabasca River downstream of development in winter and summer. In the Athabasca and its tributaries, development within the past 2 years was related to elevated dissolved PAC concentrations that were likely toxic to fish embryos.
- The oil sands industry releases 13 elements considered priority pollutants (PPE) under the US Environmental Protection Agency's Clean Water Act, via air and water, to the Athabasca River and its watershed. **In the 2008 snowpack, all PPE except selenium were greater near oil sands developments than at more remote sites. Canada's or Alberta's guidelines for the protection of aquatic life were exceeded for seven PPE—cadmium, copper, lead, mercury, nickel, silver, and zinc—in melted snow and/or water collected near or downstream of development.**

Giesy³² investigated some of the findings of RAMP with respect to arsenic, aluminum and mercury and reported:

- Over the past decade RAMP reported no detectable trend for arsenic concentrations in Athabasca delta sediments. In contrast, an independent 1996 study found between 1970 and 1990, arsenic concentrations increased 5-fold in the sediments of Lake Athabasca.
- Report (RAMP IT 2010a) provides some insight to the question of change in the Athabasca watershed. There was "*a general increase in frequency of measurable concentrations of mercury among all baseline and test stations monitored by RAMP.*" This information was not made public at the time.

³⁰ Kelly, Erin, Jeffrey W. Short, David W. Schindler, Peter V. Hodson, Mingsheng Ma, Alvin K. Kwan and Barbra L. Fortin. 2009. Oil sands development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries. Proceedings of the National Academy of Sciences. <http://www.pnas.org/content/107/37/16178.full>

³¹Kelly, Erin N., David W. Schindler, Peter V. Hodson, Jeffrey W. Short, Roseanna Radmanovich, and Charlene C. Nielsen. 2010. Oil sands development contributes elements toxic at low concentrations to the Athabasca River and its tributaries. Proceedings of the National Academy of Sciences. <http://www.pnas.org/content/107/37/16178.full?sid=6e9cedf2-6a9f-47a0-80c3-c9cd1702f985>

³²Giesy, John P., Julie C. Anderson, and Steve B. Wiseman. 2010. Alberta oil sands development. Proc Natl. Acad. Sci. U S A. 2010 January 19; 107(3): 951–952. Published online 2010 January 11. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2824323/>

Pollution from tailings ponds through leakage

Water used for extraction at oil sands mines ends up in tailings– a mixture of bitumen, water, sand, silt and fine clay particles – that is pumped to tailings ponds. These bodies of water and their containing dykes are some of the largest human-made structures in the world.³³ As of 2010 there are 840 million cubic metres of oil sands tailings covering 170 square kilometres.³⁴ Tailings ponds may be the source of many of the contaminants found in the region.

Environment Canada reported³⁵ that there is ample evidence that oil sands tailings, and their toxins are released into the environment beyond the tailings ponds. The containment areas for tailings ponds in the oil sands are built from materials the companies excavate from the surrounding area - earthen materials - **and are not lined. In their project proposals, companies assume that tailings ponds will systematically leak into the surrounding area.** Industry claims they have gathering systems to collect what is leaked.) However, a 2009 study³⁶ examined existing reports with information on leakage of tailings ponds and found the following with respect to surface water:

- On the Suncor lease, the pond known as “Natural Wetland” contains elevated levels of hydrocarbons, naphthenic acids, and salinity due to **seepage of tailings water through the adjacent containment dyke.**
- Seepage from the Syncrude Mildred Lake site is implied in the high concentration of naphthenic acids found in the adjacent Beaver Creek and in high and increasing levels of naphthenic acids downstream of the “lower seepage dam”.

Polycyclic aromatic hydrocarbons (PAH)³⁷ are a concern in the oil sands area. The US Agency for Toxic Substances and Disease Registry has ranked polycyclic aromatic hydrocarbons eighth on their list of hazardous substances. Although PAHs exist as natural components of oil sands sediments, the results presented by Kelly et al. suggest that fishes inhabiting the Athabasca River and its tributaries may be exposed to additional PAHs either liberated from oil sands sediments as a result of mining practices or from emissions from upgrading facilities. Of particular concern is increased loading of PAHs into ecosystems, especially during the spring snowmelt, which occurs during fish spawning periods.

³³Woynillowicz, D., C. Severson-Baker, M. Reynolds. 2005. Oil Sands Fever, The Environmental Implications of Canada's Oil Sands Rush. <http://www.pembina.org/pub/203>

³⁴ Environment Canada. 2010. Proposal by Environmental Defence to Add Naphthenic Acids to the NPRI. Rationale. <http://www.ec.gc.ca/inrp-npri/default.asp?lang=en&n=AC708134-1>

³⁵Ibid.

³⁶Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

³⁷Giesy, John P., Julie C. Anderson, and Steve B. Wiseman. 2010. Alberta oil sands development. Proc Natl. Acad. Sci. U S A. 2010 January 19; 107(3): 951–952. Published online 2010 January 11. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2824323/>

In the presence of sunlight, some PAHs can be as much as 50,000-fold more toxic than they are under laboratory conditions. Therefore, an assessment of the risk of even small concentrations of PAHs deposited into the environment must consider this aspect of chemical and physical interactions in the environment.

Timoney and Lee³⁸ examined existing data on PAHs in the oil sands region and found an increase over time. The Alberta Government insisted this information was faulty and engaged a group of independent scientists (Water Monitoring Data Review Committee³⁹) to examine it. The committee concluded that the Timoney and Lee finding were accurate:

- Based on an extensive review of the literature and some analysis of data from other sources, including RAMP, Timoney and Lee (2009) found increased levels of PAH when sites downstream of industry were compared with sites upstream of industry.
- We fault some aspects of the statistical procedures used by Timoney and Lee, but their correction is unlikely to require any change in their conclusions.
- There is moderately strong evidence in Alberta Environment's own data set that PAC levels in delta sediments are gradually increasing over time.

Naphthenic Acids are a toxic by-product of oil sands production and are primarily found in oil sands tailings. Environment Canada has identified them as the primary source of toxicity in tar sands tailings, as has Alberta Environment.⁴⁰

Of growing concern is the presence of naphthenic acids in tailings ponds and local water bodies, and their potential impacts on water quality and fish tainting. This concern is a result of their persistence in the environment and their aquatic toxicity at the levels found in tailings ponds. Naphthenic acids are a naturally occurring constituent of bitumen that are soluble and become concentrated in tailings as a result of the bitumen extraction process. Despite concern about the persistence and aquatic toxicity of naphthenic acids, Alberta Environment does not have any regulations for this toxin.⁴¹

³⁸Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

³⁹ Water Monitoring Data Review Committee. 2011. Evaluation of Four Reports on Contamination of the Athabasca River System by Oil Sands Operations. Prepared for Government of Alberta. http://environment.alberta.ca/documents/WMDRC_-_Final_Report_March_7_2011.pdf

⁴⁰ Environment Canada. 2010. Proposal by Environmental Defence to Add Naphthenic Acids to the NPRI. Rationale. <http://www.ec.gc.ca/inrp-npri/default.asp?lang=en&n=AC708134-1>

⁴¹ Griffiths, Mary, A. Taylor, D. Woynillowicz. 2006. Troubled Waters, troubling trends. Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. Pembina Institute. <http://www.pembina.org/pub/612>

4.1.2 Surface water quantity

Surface water quantity is of considerable concern in the region with a focus on the mining industry water needs from the Athabasca River and the effects of climate change. There is also a link between amount of ground water, and how that affects the amount of surface water in rivers, lakes, ponds and peat lands. That aspect will be discussed in the groundwater quantity section.

The in 2006 the National Energy Board⁴² stated that: *“Stakeholders agree that the Athabasca River does not have sufficient flows to support the needs of all planned oil sands mining operations. Adequate river flows are necessary to ensure the ecological sustainability of the Athabasca River. In winter, river flows are naturally lower with low rates of precipitation, and therefore, water withdrawal during this period is of particular concern.”* Stakeholders listed included producers, refiners, marketers, pipeline companies, electricity and petrochemical officials, industry associations, consultants, government departments and agencies, and environmental groups.

Aboriginal groups have raised concerns that water withdrawals from the Athabasca River system reduces river flows, threatening fish populations during low flow periods, and the health of the Peace-Athabasca Delta.⁴³

Several Aboriginal communities have recommended a reduction in water use in oil sands development and that an ecological base flow be set for the Athabasca River.⁴⁴

*“The escalating use of water for SAGD heavy oil operations and for enhanced recovery of conventional oil within the Peace-Athabasca watersheds has the potential to degrade the extensive Boreal wetland ecosystems which T8FN Peoples rely on to support their way of life.”*⁴⁵

One of the key issues raised by Fort Chipewyan participants was the difficulty of accessing traditional lands at low river levels because of challenges in navigating the main stream of the

Athabasca River between Fort Chipewyan and Fort McMurray, or because of an inability to access smaller creeks and rivers running into the Athabasca due to shallow water.⁴⁶

⁴² National Energy Board. 2006. Canada's Oil Sands Opportunities and Challenges to 2015: An Update. <http://www.neb-one.gc.ca/clf-nsi/rnrgynfntn/nrgyrprt/lsnd/pprtnsndchllngs20152006/pprtnsndchllngs20152006-eng.pdf>

⁴³ Droitsch, D. and T. Simieritsch. 2010. Canadian Aboriginal Concerns With Oil Sands A compilation of key issues, resolutions and legal activities. Briefing Note. <http://pubs.pembina.org/reports/briefingnoteofntoursep10.pdf>

⁴⁴ Alberta Department of Energy. 2006. Oil Sands Consultations Aboriginal Consultation Final Report. <http://www.assembly.ab.ca/lao/library/egovdocs/2007/aleo/161130.pdf>

⁴⁵ T8FNs of Alberta. 2006. Legitimate Expectations and Concerns About Heavy Oil Development. http://www.sfmn.ales.ualberta.ca/en/Events/NetworkWorkshops/~media/sfmn/Events/NetworkWorkshops/Documents/T8FN_CLASS_EIA.ashx

⁴⁶ Griffiths, Mary, A. Taylor, D. Woynillowicz. 2006. Troubled Waters, troubling trends. Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. Pembina Institute. <http://www.pembina.org/pub/612>

Some Fort McKay elders have concern about the amount of water used by regional industry because water quantity is very important to the traditional lifeways of Aboriginal communities and cumulative effects to water quantity are already felt to be significant.⁴⁷

A study of the declining amount of water in the Athabasca River and the impacts of climate change⁴⁸ concluded: Climate warming, drought, human withdrawals and modifications to catchments in the prairie provinces are well known to be causing changes in the annual and seasonal flows of rivers and levels and water quality of lakes and rivers. In the past century, river flows and lake levels declined throughout the prairies. Summer (May-Aug) flows in the Athabasca River at Fort McMurray had declined by 29% between 1970 and 2005.

A new 5200-year record⁴⁹ of Lake Athabasca water level variations, shows that western Canadian society has developed during a rare period of unusually abundant water provided by glacier expansion. Future water availability is likely to become similar to a time when Lake Athabasca dropped 2–4 m below the twentieth century mean. Regions dependent on high elevation runoff must prepare to cope with impending water scarcity of magnitude not yet experienced since European settlement.

4.2 Groundwater

4.2.1 Groundwater quality

The lack of appropriate groundwater monitoring and the rapid pace of development is dangerous with respect to groundwater contamination.

Canada's National Energy Board⁵⁰ has warned that: *“the principal environmental threats from tailings ponds are the migration of pollutants through the groundwater system and the risk of leaks to the surrounding soil and surface water.... the scale of the problem is daunting and current production trends indicate that the volume of fine tailings ponds produced by Suncor and Syncrude alone, will exceed one billion cubic metres by the year 2020.”*

⁴⁷ Fort McKay First Nation Traditional Knowledge Report Total E & P Canada Ltd. Joslyn North Mine Project Update Prepared By FMA Heritage Resources Consultants Inc www.total-ep-canada.com/upstream/documents/.../AIR.../Appendix_B.pdf

⁴⁸ Schindler, D., W.F. Donahue, John P. Thompson and Vic Adamowicz. 2007. Running out of Steam? Oil Sands Development and Water Use in the Athabasca River-Watershed. http://www.powi.ca/pdfs/watersecurity/running_out_of_steam_27_4_2007.pdf

⁴⁹ Wolfe, B. B., T. W. D. Edwards, R. I. Hall, and J.W. Johnston. 2011. A 5200 year record of freshwater availability for regions in western North America fed by high-elevation runoff, Geophys. Res. Lett., 38, L11404, doi:10.1029/2011GL047599. <http://www.science.uwaterloo.ca/news/5200-year-record-warns-of-impending-water-shortages>

⁵⁰ National Energy Board. 2006. Canada's Oil Sands Opportunities and Challenges to 2015: An Update. <http://www.neb-one.gc.ca/clf-nsi/rnrgynfmitn/nrgyrprt/lsnd/pprtntsndchllngs20152006/pprtntsndchllngs20152006-eng.pdf>

Currently there is far too little evidence being collected about pollution in groundwater from the petroleum projects given the potential permanent damage to water quality. The Pembina Institute described some of the concerns:⁵¹

- The current practice of storing fluid, fine tailings in ponds risks the migration of pollutants through the groundwater system and leaks to the surrounding soil and surface water.
- Surveys to locate oil may pose a risk to groundwater if the exploration holes are not properly filled.
- Well casing failures can occur when the well casing is not strong enough to withstand the build-up in pressure. Failures in the surface casing or at intermediate depths are of greatest concern due to the risk of a leak into a fresh water aquifer.

Steam Assisted Gravity Drainage (SAGD) extraction processes, which use steam heated to more than 250°C, can alter subsurface dynamics such as leaching of arsenic into groundwater. Deep-well injection of wastes can increase the potential for groundwater and surface water contamination.⁵²

Timoney and Lee⁵³ examined existing reports with information on leakage of tailings ponds and found the following with respect to groundwater:

- Alberta government technical staff acknowledged escape of tailings from the Aurora North tailings pond when it advised Syncrude that it hoped construction of a soil bentonite wall would reduce or eliminate further seepage of process water.
- Government correspondence with Syncrude shows that the government suspects seepage off the Syncrude site. Excerpt: Wells ... continue to clearly show increasing chloride concentrations not reflective of background chemistry... This is all indicative of an advancing plume... Wells with elevated chloride ... indicate increasing chloride concentrations.... Explain the increasing naphthenic acid concentration (60 mg/L) in monitor well OW98-09....

The Council of Canadian Academies reported: The large tailings ponds, which hold what is left after the oil is separated from the sand, can leach petrochemicals into the surrounding groundwater.⁵⁴

⁵¹Griffiths, Mary, A. Taylor, D. Woynillowicz. 2006. Troubled Waters, troubling trends. Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. Pembina Institute. <http://www.pembina.org/pub/612>

⁵²Weinhold B. 2011. Alberta's Oil Sands: Hard Evidence, Missing Data, New Promises. Environ Health Perspect 119:a126-a131. doi:10.1289/ehp. <http://ehp03.niehs.nih.gov/article/fechArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.119-a126>

⁵³Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

⁵⁴Council of Canadian Academies. 2009. The Sustainable Management of Groundwater in Canada Case Study: Athabasca Oil-Sands, Alberta <http://www.scienceadvice.ca/en/assessments/completed/groundwater.aspx>

4.2.2 Groundwater quantity

The lack of groundwater monitoring is a serious deficiency of the monitoring program. There are development related groundwater withdrawals occurring in the study area that can be expected to have an impact on the surface and subsurface water levels in the area.⁵⁵

In 2009 the Council of Canadian Academies looked into the management of groundwater across Canada, including the oil sands, with these findings:⁵⁶

- In situ methods of bitumen extraction consume large volumes of groundwater for steam production. Alberta's regulatory regime has been challenged by the scale and rate of the oil-sands developments. While environmental impact assessments are used in development planning, they are generally limited to the lease area, fail to address basin-scale impacts, and often neglect the cumulative impacts of other operations. **Groundwater use in the oil-sands development areas is not sustainable as defined in this report.**
- The long-term impact on groundwater is still insufficiently understood, but is likely to be greatest for in situ operations; **impacts on groundwater from land-use practices or over-exploitation may take many years or even decades to appear. Likewise, repair may take an extremely long time, is generally very expensive, and may even be impossible.**

Because ground water and surface water are connected, when groundwater is taken by industry, surface water such as from peatlands, ponds, streams, lakes and rivers can be drained. As seen in the information below these effects are already showing up in the area.

Oil sands mining operations have direct impacts on groundwater levels. Once the mine pit is excavated, it is essential to reduce groundwater levels in the area to prevent flooding of the pit. Withdrawal of groundwater from large areas of the landscape can lower the groundwater level in nearby areas, which can result in reduced groundwater flows to peatlands, wetlands and other surface waterbodies.⁵⁷ The area impacted by the drawdown effect of removing this water can be up to 100 square kilometres. Because prevention of pit flooding is considered essential, even if significant impacts are detected (e.g., wetlands drying out), there is no possible mitigation.⁵⁸

⁵⁵ RAMP Review Panel. 2010. Regional Aquatics Monitoring Program (RAMP) Scientific Review.

<http://www.ramp-alberta.org/UserFiles/File/RAMP%202010%20Scientific%20Peer%20Review%20Report.pdf>

⁵⁶ Council of Canadian Academies. 2009. The Sustainable Management of Groundwater in Canada Case Study: Athabasca Oil-Sands, Alberta <http://www.scienceadvice.ca/en/assessments/completed/groundwater.aspx>

⁵⁷ National Energy Board. 2006. Canada's Oil Sands Opportunities and Challenges to 2015: An Update.

<http://www.neb-one.gc.ca/clf-nsi/rnrgynfntn/nrgyrprt/lnd/pprntnsndchllngs20152006/pprntnsndchllngs20152006-eng.pdf>

⁵⁸ Griffiths, Mary, A. Taylor, D. Woynillowicz. 2006. Troubled Waters, troubling trends. Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. Pembina Institute.

<http://www.pembina.org/pub/612>

About 80 percent of Alberta's remaining established oil sands reserves can only be accessed using in situ extraction technologies, and there is a growing demand for freshwater for these projects. In SAGD operations, 90 to 95 percent of the water used for steam to recover bitumen is reused, but for every cubic metre (6.3 barrels) of bitumen produced, about 0.2 cubic metres (1.3 barrels) of additional groundwater must be used. SAGD projects minimize the use of freshwater aquifers by using some freshwater mixed with saline groundwater. However, treating saline groundwater for the steam generators produces large volumes of solid waste. The disposal of this waste to landfills is another long-term concern because it could impact nearby soil and groundwater. This waste has a high concentration of acids, hydrocarbon residues, trace metals and other contaminants.⁵⁹

The in situ industry currently uses approximately 17 million m³ per year of fresh surface or groundwater, and that amount is expected to increase to 22 million m³ per year by 2015. The industry is continuing to replace fresh water with saline water. In 2008, slightly less saline water was used for in situ oil sands production than fresh water.⁶⁰

Given the projected growth of in situ recovery developments, the cumulative impacts on surface and groundwater resources remain of great concern. There are projected increases in use of both deep saline groundwater and surface water to meet production requirement. **Key environmental concerns related to water availability and use include: the impact of water withdrawals from local rivers and aquifers on the aquatic environment and some First Nations communities; effects on river ecological flow needs; and uncertainties regarding the sustainability of current water licensing practices, particularly in light of predicted changes in surface flow due to climate change.**⁶¹

The in situ bitumen extraction process offers the benefit over mining of removing the bitumen from the ground while leaving the sand in place. However, as water is used to fill the space left when oil is removed, the in situ process also has the detrimental effect of removing water permanently from the water cycle. The net permanent loss for in situ operations is estimated at one barrel of water for every barrel of oil recovered. Even though in the SAGD process an average of 90 percent of the water is recycled, the process still requires large volumes of water.⁶²

⁵⁹ National Energy Board. 2006. Canada's Oil Sands Opportunities and Challenges to 2015: An Update. <http://www.neb-one.gc.ca/clf-nsi/rnrgynfntn/nrgyrprt/lsnd/pprntnsndchllngs20152006/pprntnsndchllngs20152006-eng.pdf>

⁶⁰ Canadian Association of Petroleum Producers. 2009. Overview: Water Use in Canada's Oil Sands. <http://www.capp.ca/getdoc.aspx?DocId=154986&DT=NTV>

⁶¹ Oil sands Advisory Panel. 2010. A Foundation for the Future: Building an Environmental Monitoring System for the Oil Sands. A report submitted to the Minister of Environment. <http://www.ec.gc.ca/pollution/default.asp?lang=En&n=E9ABC93B-1>

⁶² National Energy Board. 2004. Canada's Oil Sands: Opportunities and Challenges to 2015 An Energy Market Assessment. <http://www.neb-one.gc.ca/clf-nsi/rnrgynfntn/nrgyrprt/lsnd/pprntnsndchllngs20152004/pprntnsndchllngs20152004-eng.pdf>

Other related industry has also impacted the groundwater system which is of importance for evaluating cumulative effects. **For example natural gas development has already had a profound impact on the groundwater levels in the southern Athabasca (oil sands) region, with water drops in the 10s of meters in some areas (Gordon Lake area), and this impact is part of the cumulative impact of the region.** Injection of saline wastewater and potential leakage to surface waters will be another potential impact on surface waters in the future.⁶³

Groundwater withdrawals have lowered the water table at least 40 m in some locations, altering the flows between surface water and groundwater. Overall, the Royal Society panel concludes, the complex interactions between surface and subsurface waters are poorly understood.⁶⁴

4.3 Air quality

Some Fort McKay elders indicated air quality has degraded with the development of industry; Aboriginal peoples perceive this as having a negative effect on their health, as witnessed by the development of cancers and shorter lifespans in the community.⁶⁵

Several communities indicated the need to develop and implement more rigorous air-quality standards and environmental management practices that are protective of human health as well as the health of fish wildlife and plants.⁶⁶

The Royal Society reported⁶⁷: Given the major air emissions associated with oil sands operations, Alberta Environment needs to rigorously maintain a requirement for best available technology economically achievable in all operating approvals issued. This is not a decision that industry can simply veto, it must be the responsibility of a competent environmental regulator. This means there must be the political will demonstrated to support technical decisions made by the regulator's technical personnel. The odour problems encountered in recent years are substantial issues that must be similarly understood and effectively resolved. And current ambient air quality monitoring data for the region show minimal air quality impacts from oil sands development except for noxious odour emission problems over the past two years. Resolution of the odour problems being caused by oil sands development is clearly necessary in Ft. McKay and perhaps other locations.

⁶³ RAMP Review Panel. 2010. Regional Aquatics Monitoring Program (RAMP) Scientific Review.

<http://www.ramp-alberta.org/UserFiles/File/RAMP%202010%20Scientific%20Peer%20Review%20Report.pdf>

⁶⁴ Weinhold, B. 2011. Alberta's Oil Sands: Hard Evidence, Missing Data, New Promises. Environ Health Perspect 119:a126-a131.

<http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.119-a126>

⁶⁵ FMA Heritage Resources Consultants Inc. 2010. Fort McKay First Nation Traditional Knowledge Report. Total E & P Canada Ltd. Joslyn North Mine Project Update http://www.total-ep-canada.com/upstream/documents/Additional_Information/AIR_July2010/Appendix_B.pdf

⁶⁶ Alberta Department of Energy. 2006. Oil Sands Consultations Aboriginal Consultation Final Report http://www.energy.gov.ab.ca/OilSands/pdfs/AboriginalCon2007_MSC_OS.pdf

⁶⁷ Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada's Oil Sands Industry. http://www.rsc.ca/documents/expert/RSC_report_complete_secured_9Mb.pdf

Environmental Defence⁶⁸ studied air quality based on data available from the Wood Buffalo Environmental Association, Clean Air Strategic Alliance and the National Pollutant Release Inventory. These are some of their findings:

- Between 2002 and 2008, industry reported a near doubling of volatile organic compounds and particulate matter. Nitrogen oxides have gone up by 50 per cent and sulphur dioxide has remained roughly the same. Hydrogen sulphide emissions were fourteen times greater in 2008 than 2002.
- According to the World Health Organization (WHO), nitrogen dioxide is a toxic gas with significant health effects when people and animals are exposed to over 200 ug/m³ for a short period of time. Asthma can be triggered when levels are higher, and long-term exposure is linked to reduced lung capacity and asthma in children. **Yet, the Alberta government sets the bar for ‘safe’ levels of nitrogen dioxide two times less protective than the WHO.** The same holds true for fine particulate matter and sulphur dioxide. The WHO limit for exposure to sulphur dioxide is seven times more protective than Alberta’s. Alberta’s air pollution limits are also less protective than the U.S. Environmental Protection Agency and the European Union. As a result, people living and working in the tar sands region are being put at higher risk than people elsewhere.

4.4 Acid rain

Acid rain is the result of interactions between sulphur oxides, nitrogen oxides and water. The pollutants that cause acid rain can travel hundreds or even thousands of kilometres.

Environment Canada estimates that the current rates of acid forming pollution from the oil sands are 158,000 tonnes per year for sulphur oxides and 76,000 tonnes per year for nitrous oxides.⁶⁹

Acid rain causes a cascade of effects that harm or kill individual fish, reduce fish population numbers, completely eliminate fish species from a water body, and decrease biodiversity. Some types of plants and animals are able to tolerate acidic waters. Others, however, are acid-sensitive and will be lost as acidity increases. Generally, the young of most species are more sensitive to environmental conditions than adults. At pH 5, most fish eggs cannot hatch. At lower pH levels, some adult fish die.⁷⁰

At most sites in Alberta, the soil pH is still above 4.5. However, the most recent sampling from the Fort McMurray site showed average pH levels to be just under 4. The pH level at which the

⁶⁸ Environmental Defence. 2010. Dirty Oil Dirty Air Ottawa’s Broken Pollution Promise.

<http://environmentaldefence.ca/reports/dirty-oil-dirty-air-ottawas-broken-pollution-promise>

⁶⁹ Hatch, Chris and Matt Price. 2008. Canada’s Toxic Tar Sands the Most Destructive Project on Earth.

Environmental Defence. http://environmentaldefence.ca/sites/default/files/report_files/TarSands_TheReport.pdf

⁷⁰ Environmental Protection Agency. 2012 How Does Acid Rain Affect Fish and Other Aquatic Organisms?

http://www.epa.gov/acidrain/effects/surface_water.html

intensity is great enough to cause damage is considered to be 3.7. The Fort McMurray region is an area of the province with significant emissions of acidifying compounds.⁷¹

RAMP is presented by the Alberta government as responsible for monitoring the trends for acid sensitive lakes and in their 2009 community report stated: “*Generally there were no changes in overall water quality in sampled lakes in 2008 compared to previous sampling years.*”⁷²

However, RAMP reviewers were very critical of the sampling design and strategy for acid sensitive lakes, including the rationale for the selection of lakes, lack of biological monitoring, insufficient frequency of monitoring, assumptions and calculations of critical load. One reviewer said, “*The sampling design is clearly not a representative survey of the lakes and the data cannot be used to assess the potential impact of acid deposition on a regional basis.*”⁷³

Northern Alberta, Saskatchewan, Manitoba and the NWT are particularly susceptible to acid rain because many of these lakes and soils rest on granite bedrock that lacks the alkalinity that is a natural defence against acid rain.⁷⁴

Up to 70% of the sulphur dioxide and nitrogen oxides emitted by Alberta oil sands operations are deposited in Saskatchewan. **The Government of Saskatchewan is concerned that these acidifying emissions could lead to the acidification of lakes in north central Saskatchewan.** While acid deposition is currently below levels that would harm lakes in northern Saskatchewan, longterm projections indicate that it could pose a risk to some lakes in the area within the next twenty-five to fifty years.⁷⁵

At a Saskatchewan site 200 kilometres downwind of the Tar Sands, the mean level of acid in precipitation increased in the past 12 years, sliding from pH 5.3 to 4.1. Normal rainfall has a pH of 5.6. In 2005, Saskatchewan Environment ran a network of 10 monitoring stations in the northwest of the province – across from the Tar Sands – and found build up of nitrogen from Alberta.⁷⁶

A study of Quebec forests showed a 30% decline in growth rate of hardwood and coniferous stands in areas where acid rain was serious between the 1970s and 1990s. Lakes with higher

⁷¹ Alberta Environment. .2008. Acidification of Sensitive Soils. <http://www.environment.alberta.ca/02857.html>

⁷² CEMA and RAMP. 2009. Community Report. A report to the residents of the Regional Municipality of Wood Buffalo. <http://www.ramp-alberta.org/UserFiles/File/CEMA-RAMP%202009%20Community%20Report.pdf>

⁷³ RAMP Review Panel. 2010. Regional Aquatics Monitoring Program (RAMP) Scientific Review. <http://www.ramp-alberta.org/UserFiles/File/RAMP%202010%20Scientific%20Peer%20Review%20Report.pdf>

⁷⁴ Hatch, Chris and Matt Price. 2008. Canada’s Toxic Tar Sands the Most Destructive Project on Earth. Environmental Defence. http://environmentaldefence.ca/sites/default/files/report_files/TarSands_TheReport.pdf

⁷⁵ Mackenzie River Basin. 2003. State of the Aquatic Ecosystem Report: Athabasca Sub-basin. <http://www.swa.ca/Publications/AquaticEcosystem.asp>

⁷⁶ Hatch, Chris and Matt Price. 2008. Canada’s Toxic Tar Sands the Most Destructive Project on Earth. Environmental Defence. http://environmentaldefence.ca/sites/default/files/report_files/TarSands_TheReport.pdf

acidity lose sensitive species, such as some species of minnows that serve to feed larger fish and water birds.⁷⁷

4.5 Wildlife

The health of wildlife populations in the oil sands can be used as an obvious indicator of how the development of the resource is in balance with the needs of the environment. Sustainable development does not result in the degradation of the environment to the extent that species are in severe decline, or are too toxic to eat. Increased fish deformities are also an indication of environmental contamination. All these are evidence that the oil sands development is not sustainable.

4.5.1 Wildlife declines

Many First Nations consider caribou culturally important. Woodland caribou are declining in Alberta as a result of too much development within their ranges. The east side of the Athabasca River herd, for example, has declined 71% since 1996.⁷⁸

In 2010 three First Nations⁷⁹ in northeastern Alberta initiated court proceedings to force the federal government to uphold its legal duty to protect the habitat of the woodland caribou, which are now a threatened species.

The level of fragmentation within Heavy Oil leases has drastic impacts on lynx, marten and fisher. These fur bearers have high levels of cultural importance in relation to a First Nations way of life.⁸⁰

Participants felt if animals and traditional ways of life were to survive, then 'survival areas' had to be protected from development. It was felt that when oil and gas companies were gone, these areas would allow Aboriginal peoples to survive. These areas are currently considered as being relatively untouched and, if left undisturbed, would be a place where wildlife would go to live and avoid disturbance from the oil sands developments.⁸¹

⁷⁷Hatch, Chris and Matt Price. 2008. Canada's Toxic Tar Sands the Most Destructive Project on Earth. Environmental Defence. http://environmentaldefence.ca/sites/default/files/report_files/TarSands_TheReport.pdf

⁷⁸Boutin, S. 2010. Expert report on woodland caribou [*Rangifer tarandus caribou*] in the Traditional Territory of the Beaver Lake Cree Nation http://www.woodwardandcompany.com/media/pdfs/BLCTT_-_Stan_Boutin_Report_-_5_July_2010_final.pdf

⁷⁹Ron Lameman, Beaver Lake Cree Nation, Chief Allan Adam, Athabasca Chipewyan First Nation. 2010. First Nations launch legal challenge to force government to protect woodland caribou Sep 08, 2010 Media Release <http://www.woodwardandcompany.com/newsarchive.html>

⁸⁰Treaty 8 First Nations of Alberta Legitimate Expectations and Concerns About Heavy Oil Development. http://www.sfmn.ales.ualberta.ca/en/Events/NetworkWorkshops/~/_media/sfmn/Events/NetworkWorkshops/Documents/T8FN_CLASS_EIA.ashx

⁸¹Cumulative Environmental Management Association. . 2005. Wildlife Movement in the Regional Municipality of Wood Buffalo. Traditional Environmental Knowledge Workshops.

Many environmental impact assessment reports completed on Fort McKay First Nations Traditional Land Use conclude that ‘strong,’ ‘substantial’ or ‘significant’ negative effects have already occurred as a result of oil and gas developments. Cumulative effects in the region were described by one participant as “heartbreaking,” and include a decrease in the amount of wildlife and the decreased ability for trappers to make a living trapping.⁸²

The Cumulative Environmental Management Association (CEMA) found indicators of native fish integrity, fisher, moose and black bear are already below their natural population size range and will continue to decline.⁸³

The Athabasca Landscape Team,⁸⁴ a government selected group, determined that there is insufficient functional habitat to maintain and increase current caribou distribution and population growth rates within the Athabasca Landscape Area. Boreal caribou will not persist for more than two to four decades without immediate and aggressive management intervention. **Tough choices need to be made between the management imperative to recover boreal caribou and plans for ongoing bitumen development and industrial land-use.** (Bold not added.)

Industry and government often claim that in situ development will cause less damage to the environment than the mining and about 80% of the resource will be accessed that way. However, a 2004 National Energy Board report⁸⁵ said:

In situ development is often seen as more environmentally friendly, however, wildlife, vegetation and wetlands can be disrupted by the complex nature of seismic lines, roads, power-line corridors, and pipelines associated with in situ development.

CPAWS/Pembina report on in situ⁸⁶ found the following:

- As of July 2005, the total area of land leased for in situ development in Alberta was 3.6 million ha. If all these leases, most of which have yet to be developed, are subjected to the same industrial footprint as the existing Long Lake project, then 296,000 ha of forest will be cleared for in situ infrastructure and over 30,000 km of access roads will be built.

⁸² Fort McKay First Nation Traditional Knowledge Report Total E & P Canada Ltd. Joslyn North Mine Project Update Prepared By FMA Heritage Resources Consultants Inc www.total-ep-canada.com/upstream/documents/.../AIR.../Appendix_B.pdf

⁸³ Cumulative Environmental Management Association. 2008. Terrestrial Ecosystem Management Framework. <http://cemaonline.ca/index.php/cema-recommendations/terrestrial-ecosystem>

⁸⁴ Athabasca Landscape Team. 2009. Athabasca Caribou Landscape Management Options Report. www.albertacariboucommittee.ca/PDF/Athabasca-Caribou.pdf

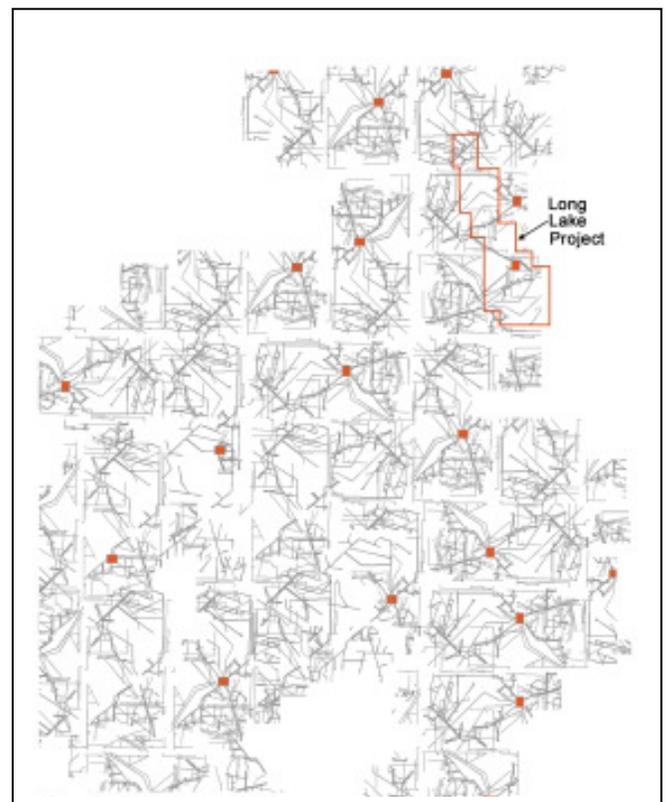
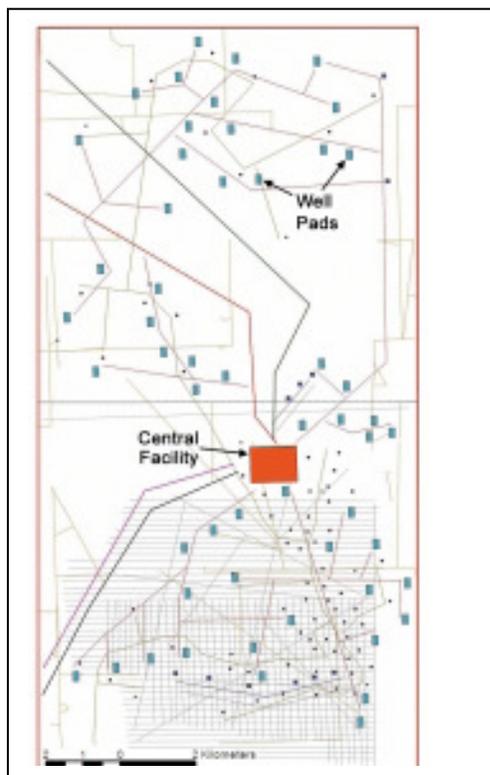
⁸⁵ National Energy Board. 2004. Canada’s Oil Sands. Parliamentary and Research Services. Library of Parliament.

⁸⁶ Schneider, R. and S. Dyer. 2006. Death by a Thousand Cuts: Impacts of In Situ Oil Sands Development on Alberta’s Boreal Forest. Pembina Institute and Canadian Parks and Wilderness Society. http://cpaws.org/uploads/pubs/report_death-thousand-cuts.pdf

This is a conservative estimate and by even the most conservative estimate, there will be more long-term deforestation from in situ development than if the entire mineable oil sands region is completely cleared. The ecological effects will be many times greater still, because the in situ disturbances will be dispersed across a vast region.

- The boreal forest in which the in situ developments are taking place is home to many wildlife species known to be sensitive to industrial disturbances. For these species, useable habitat within a in situ development area is reduced to small scattered islands. Once a threshold is reached where the remnant habitat patches are too small and scattered to maintain a breeding population, the local population is extinguished. Multiply this effect by all projected in situ developments and the result is a serious decline in regional biodiversity.

The figures below show an existing SAGD in situ project (the Long Lake project) and a projection of the build-out of in situ projects which is anticipated for the future to indicate the impact on the land.⁸⁷



⁸⁷Schneider, R. and S. Dyer. 2006. Death by a Thousand Cuts: Impacts of In Situ Oil Sands Development on Alberta's Boreal Forest. Pembina Institute and Canadian Parks and Wilderness Society. http://cpaws.org/uploads/pubs/report_death-thousand-cuts.pdf

4.5.2 Contaminants in wildlife

*Ducks, muskrats, and fishes taste differently now; sometimes they taste 'oily'.*⁸⁸

The report *As Long As the Rivers Flow: Athabasca River Knowledge, Use and Change*,⁸⁹ documents traditional knowledge about the quality of wildlife in the region. One MCFN participant stated that the Athabasca River is:

“... important to me because we do lots of hunting in that river, not only for ducks, for moose and we do lots of fishing also. It's for our livelihood, living out of it. It's not the commercial. You go out there to feed your kids, to feed the family and then Athabasca River is really important for us. I've been doing that for many years and I still do it. And now, the moose is not fit to eat, the fish is not fit to eat, even ducks. What else are we to live on now? There's not anything fit to eat.”

Mercury and arsenic pollution

Mercury concentrations in California gull eggs from Egg Island in Lake Athabasca, increased 40% between 1977 and 2009. In 2009 mercury concentrations in common tern eggs from Mamawi Lake in the delta area had mercury concentrations 61% higher than in common tern eggs from a colony in a more pristine environment. These observations suggest that more attention should be paid to concentrations of contaminants in the biota and sediments of the delta area.⁹⁰

Disturbed wetlands and soils are recognized as important sources of methylmercury, and fish mercury concentrations in boreal lakes have been correlated with areal extent of watershed disturbance. Fillets of lake whitefish, sucker and goldeye were tested for mercury. Under US Environmental Protection Agency (EPA) subsistence fisher guidelines, all of these fishes would be considered unsafe to eat.⁹¹

⁸⁸ Timoney, K.P. 2007. A Study of Water and Sediment Quality as Related to Public Health Issues, Fort Chipewyan, Alberta. on behalf of the Nunee Health Board Society Fort Chipewyan, Alberta http://www.tothetarsands.ca/wp-content/uploads/2007/11/fc_final_report1-1.pdf

⁸⁹ Candler, Craig, Rachel Olson, Steven DeRoy, the Firelight Group Research Cooperative with the Athabasca Chipewyan First Nation (ACFN) and the Mikisew Cree First Nation (MCFN). 2010. *As Long As The Rivers Flow: Athabasca River Knowledge, Use and Change*. http://parklandinstitute.ca/research/summary/as_long_as_the_rivers_flow/

⁹⁰ Giesy, John P., Julie C. Anderson, and Steve B. Wiseman 2010. Alberta oil sands development. *Proc Natl. Acad. Sci. U S A.* 2010 January 19; 107(3): 951–952. Published online 2010 January 11. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2824323/>

⁹¹ Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. *The Open Conservation Biology Journal*, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

Elevated levels of mercury and arsenic in the local fishes are a concern. Health Canada recommended that consumption of large predatory fish should not exceed one meal per week for adults. Pregnant women, women of childbearing age, and children should consume no more than one fish meal per month. Due to the nutritional value of fish, and the traditional-cultural and economic importance of fish to Ft. Chipewyan residents, fish mercury levels pose a serious dilemma.⁹²

One study by a tar sands company⁹³ concluded that arsenic could be as much as 453 times the acceptable levels in moose meat from the region. The Alberta government responded⁹⁴ with a re-assessment, the main finding being: The environmental risk values predicted that lifetime exposure to inorganic arsenic among indigenous people living in the Wood-Buffalo region, *via* the exposure pathways examined, potentially could contribute to 17 to 33 cases of cancer when calculated on a 100,000-person population basis.

4.5.3 Deformed fish

When scientific data and traditional knowledge on fish deformities are considered together, they indicate that rates of fish abnormalities may be higher than expected, may be increasing, and may be related to declines in water quality. PAH and other contamination, changes in water and sediment quality, and changes to the food web may underlie the fish deformities.⁹⁵

*“Traditional users have noted increased rates of fish deformities such as lesions, internal and external tumours, and deformed skulls, skeletons, and fins. “Pushed in faces, bulging eyes, humped back, crooked tails... never used to see that. Great big lumps on them... you poke that, it sprays water...”*⁹⁶

Fish were collected during a University of Alberta fish sampling campaign of the lower Athabasca River and Delta in 2008, and between 2009 and 2010 by local fishers of the Delta and

⁹² Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

⁹³ Suncor. 2005. Voyageur Project. Project Application and Environmental Impact Assessment and Environmental Setting Reports. Volume 3. Air Quality, Noise and Environmental Health. In Timoney and Lee Ibid.

⁹⁴ Cantox Environmental Inc. 2007. Exposure to Inorganic Arsenic among Indigenous People living in the Wood Buffalo Region of Alberta. Prepared for: Alberta Health and Wellness Public Health Surveillance and Environmental Health Public Health Division <http://www.health.alberta.ca/documents/Wood-Buffalo-Arsenic-2007.pdf>

⁹⁵ Candler, Craig, Rachel Olson, Steven DeRoy and the Firelight Group Research Cooperative with the Athabasca Chipewyan First Nation (ACFN) and the Mikisew Cree First Nation (MCFN). 2010. As Long As The Rivers Flow: Athabasca River Knowledge, Use and Change. http://parklandinstitute.ca/research/summary/as_long_as_the_rivers_flow/

⁹⁶ Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

Lake Athabasca. Many were caught together in a gillnet set during May 2010. It was reported that of the 27 whitefish, burbot and northern pike collected, 7 had lesions, hemorrhages and/or crooked spines. Some had bulging eyes.⁹⁷

In 2006 RAMP reported an overall abnormality frequency of 100% in female Athabasca River lake whitefish and walleye and of 74% in males of those species; at least 25% of female and 50% of male walleyes suffered from liver abnormalities.⁹⁸

4.6. Restoration

4.8.1 Landscape change

Some Ft. McKay elders have concern that development is damaging local ecosystems, and that once the damage is done, things will not return to pre-development conditions. They feel that current reclamation practices and strategies that are inadequate or piecemeal, they have profound doubt that land can be 'put back' or restored and feel the "sacredness of the land" has been destroyed.⁹⁹ Several communities indicated the need to keep reclamation on pace with development that will return the land to a functioning boreal ecosystem that will sustain traditional use.¹⁰⁰

Disturbances are widely distributed across the forest Landscape. Disturbances will persist for decades. We cannot restore a wetland ecosystem after disturbances. The net impact of disturbances will be a decline in forest biodiversity. A reduction in forest biodiversity means these forests can no longer support FN cultural survival.¹⁰¹

In 2004 Environment Canada warned that the development of the oil sands presents "staggering challenges for forest conservation and reclamation."¹⁰²

The tailings material (sand left after bitumen is extracted) will be incorporated into the reclaimed landscape and they have high concentrations of salt and the presence of bitumen and naphthenic

⁹⁷ Residents of Fort Chipewyan and Fort MacKay. 2010. Unhealthy Fish - Accusing Finger Points to Oil Sands <http://www.turtleisland.org/discussion/viewtopic.php?f=14&t=7823>

⁹⁸ Timoney, K.P. and P. Lee. 2009. Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence. The Open Conservation Biology Journal, 2009, 3, 65-81 <http://www.scribd.com/doc/21568333/Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence>

⁹⁹ Fort McKay First Nation Traditional Knowledge Report Total E & P Canada Ltd. Joslyn North Mine Project Update Prepared By FMA Heritage Resources Consultants Inc . http://www.total-ep-canada.com/upstream/documents/Additional_Information/AIR_July2010/Appendix_B.pdf

¹⁰⁰ Alberta Department of Energy. 2006. Oil Sands Consultations Aboriginal Consultation Final Report. <http://www.assembly.ab.ca/lao/library/egovdocs/2007/aleo/161130.pdf>

¹⁰¹ Treaty 8 First Nations of Alberta Legitimate Expectations and Concerns About Heavy Oil Development. http://www.sfmn.ales.ualberta.ca/en/Events/NetworkWorkshops/~media/sfmn/Events/NetworkWorkshops/Documents/T8FN_CLASS_EIA.ashx

¹⁰² Woyntonowicz, D., C. Severson-Baker, and M. Reynolds (2005). Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush. The Pembina Institute. <http://www.pembina.org/pub/203>

acids.¹⁰³ Given that widespread reclamation using tailings material has not yet been demonstrated, there is significant uncertainty with regards to the long-term stability of created landforms, the long-term performance and survival of native vegetation species, and the ability to restore landscape biodiversity.¹⁰⁴

Currently, the majority of bitumen is recovered by surface-mining practices that require the clearing of large areas of land, resulting in loss of habitat, including migration corridors and breeding grounds for terrestrial and aquatic species. Methods for mitigating and remediating these effects are under development, **but even when remediated the habitat will be considerably different from its previous state.** These externalities are costs that should be considered when developing this resource.¹⁰⁵

For the lands affected by oil sands development to be returned to the Province of Alberta, a company must demonstrate that it has reclaimed the land to an “equivalent land capability.” It is important to note that this definition does not require that the pre-disturbance ecosystem be re-created. It is likely that the reclaimed landscape will lack the biodiversity of its pre-disturbance state, and it is acknowledged that it will be a major challenge to re-establish self sustaining ecosystems.¹⁰⁶

Wetlands occur throughout the oil sands surface mineable area, with bog and fen peatlands representing the characteristic wetland type in the region. Wetlands play an important ecological service in terms of water regimes and habitat for wildlife. Both peat and non-peat wetlands absorb water from spring snowmelt and summer storms, reducing flooding, erosion and sedimentation and recharging the water table in times of drought. Wetlands are natural filters, cleansing the water that passes through them. All wetland types are habitat for a variety of plants and wildlife, including rare and endangered species. Similarly, peatlands play a vital ecological service, both as a filtration system for water and as a store of carbon. In Western Canada peatlands act as net carbon sinks.¹⁰⁷

¹⁰³ Woynillowicz, D., C. Severson-Baker, and M. Reynolds (2005). Oil Sands Fever: The Environmental Implications of Canada’s Oil Sands Rush. The Pembina Institute. <http://www.pembina.org/pub/203> Ibid.

¹⁰⁴ Ibid.

¹⁰⁵ Giesy, John P., Julie C. Anderson, and Steve B. Wiseman: 2010. Alberta oil sands development. Proc Natl Acad Sci U S A. 2010 January 19; 107(3): 951–952. Published online 2010 January 11.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2824323/> Bracketed items indicate references in the original report.

¹⁰⁶ Griffiths, Mary, A. Taylor, D. Woynillowicz. 2006. Troubled Waters, troubling trends. Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta. Pembina Institute.

<http://www.pembina.org/pub/612>

¹⁰⁷ Ibid.

Peatland destroyed by open-pit mining will not be restored. Current plans dictate its replacement with upland forest and tailings storage lakes, amounting to the destruction of over 29,500 ha of peatland habitat.¹⁰⁸

The in situ process requires no excavation and less surface area for operation but is associated with fragmentation of the forest from the construction of new roads in the area, seismic lines and exploration well sites.¹⁰⁹ The effects of these activities on ecosystems are less known and it was not possible to easily find information on the restoration of in situ operations.

4.6.2 Tailings ponds and end pit lakes

Oil sands process wastewaters stored in tailings ponds contain chemical constituents that are acutely toxic to aquatic organisms. While this toxicity declines with time, there is evidence of persisting negative effects on fish health from these constituents and to establish chronic biological effects of their different forms.¹¹⁰

New technology that produces consolidated or thickened tailings is now being used to reduce the amount of fluid fine tailings and create tailings material that can be incorporated into a reclaimed landscape. But even with these technologies there will be fluid fine tailings that require special management. The industry is currently suggesting that these fluid fine tailings be placed in the mine pit after mining is complete and “capped” with water from the Athabasca River. In theory, these “end pit lakes” will be deep enough (65-100 metres) and of a great enough volume to ensure that the contaminants will be adequately diluted before draining into the Athabasca River watershed. Whether these lakes will support aquatic life and become sustainable aquatic ecosystems is still unknown.¹¹¹

At the end stage of a mining project, tailings ponds will be filled in and the liquid tailings placed in end pit lakes which will then be capped with clean water in hopes they will in the future act as natural lake ecosystems.

Construction of end pit lakes (EPLs) has been approved in principle by Alberta’s Energy Resources Conservation Board (ERCB) since 1993 as a reclamation measure for receiving large

¹⁰⁸ Rooney, Rebecca C., Suzanne E. Bayley, and David W. Schindler. 2012. Oil sands mining and reclamation cause massive loss of peatland and stored carbon. *PNAS* March 27, 2012 vol. 109 no. 13 4933-4937.

<http://www.pnas.org/content/109/13/4933.full>

¹⁰⁹ National Energy Board. 2006. Canada’s Oil Sands Opportunities and Challenges to 2015: An Update.

<http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/lsnd/pprtntsndchllngs20152006/pprtntsndchllngs20152006-eng.pdf>

¹¹⁰ Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada’s Oil Sands Industry. http://www.rsc.ca/documents/expert/RSC_report_complete_secured_9Mb.pdf

¹¹¹ Woynilowicz, D., C. Severson-Baker, M. Reynolds. 2005. Oil Sands Fever, The Environmental Implications of Canada’s Oil Sands Rush. <http://www.pembina.org/pub/203>

quantities of liquid wastes from surface mining and processing operations provided this can prove to be successful. Given their large scale and potential to be a significant water quality hazard for the foreseeable future, high priority should be given to research that improves methods of assessment and possible remediation, including development of a receiving water standard for naphthenic acids.¹¹²

The current industry plan is to wait for the fine clay particles to settle in the tailings and become what is known as fluid fine tailings. This can take anywhere from a few decades to 150 years depending on the technology used. These fluid fine tailings pose a reclamation challenge because they are simply too wet and toxic to incorporate into a reclaimed landscape. The National Energy Board characterizes the problem of managing fluid fine tailings as “daunting” the volume of fluid fine tailings produced by Suncor and Syncrude alone will exceed one billion cubic metres by the year 2020, enough to fill 400,000 Olympic-sized swimming pools.¹¹³

Surface mine operators have committed to discharging water that meets Alberta’s Surface Water Quality Guidelines from these end pit lakes. However, in the absence of any successful demonstration end pit lakes, the feasibility of this commitment or necessary replacement solutions should it prove impossible are unknown. Further, these guidelines do not include water quality limits for some of the toxic chemicals, such as naphthenic acids, found in the fluid fine tailings that will be placed in the end pit lakes.¹¹⁴

At the end of 1993 the tailings ponds of both Syncrude and Suncor collectively contained a total of about 300 million m³ of fine tailings. It is estimated that, if these operations continue at the current rate, over 1 billion m³ of tailings pond water will require reclamation by 2025. Currently, no single reclamation option has been developed that is capable of handling the projected volumes of fine tails in a manner that is technically, environmentally, and economically viable.¹¹⁵

Currently over 27 end pit lakes are planned in the region.

¹¹²Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada’s Oil Sands Industry. http://www.rsc.ca/documents/expert/RSC_report_complete_secured_9Mb.pdf

¹¹³Woynilowicz, D., C. Severson-Baker, M. Raynolds. 2005. Oil Sands Fever, The Environmental Implications of Canada’s Oil Sands Rush. <http://www.pembina.org/pub/203>

¹¹⁴ Ibid

¹¹⁵ Ibid

5. Solutions

There are many oil sands projects already in existence and much evidence of probable irreversible damage to the environment. However, it is possible to take actions to reduce the damage. The graph below indicates how much development is already operating or under construction, and how much is yet to come. If we do not pause to deal with the damage now, we may never catch up.

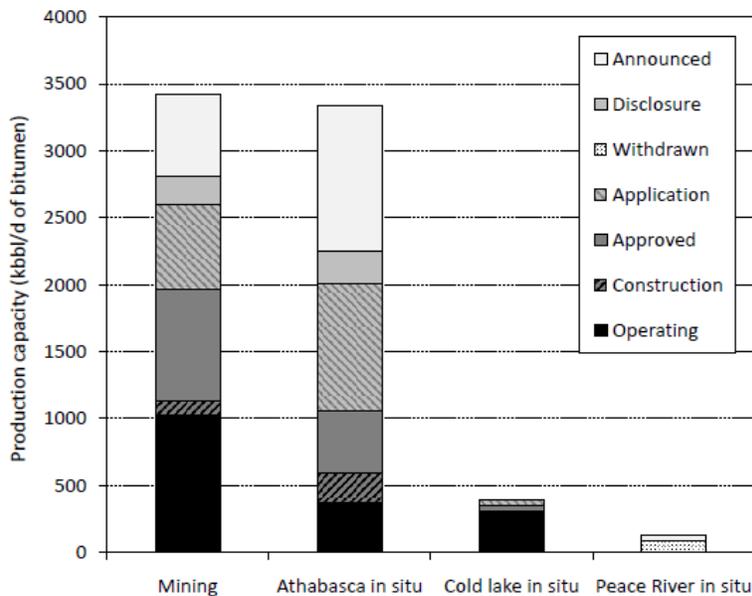


Figure 4 Oils sands production capacity, operational and proposed projects, by stage of completion (current as of January, 2010).¹¹⁶

A pause in new projects would provide time to do the following

- **Develop and implement a regional strategic plan** that includes long-term management objectives and a process for achieving these objectives.
- **Restore the environmental condition of the area and honour the treaty rights of Aboriginal People.**
- **Establish independent monitoring of environmental effects to increase public confidence in the results.**
- **Conduct independent health studies of regional communities and oil sands workers.**
- **Restore caribou habitat and the habitat of other wildlife species.**

¹¹⁶ Brandt, A.R. 2011. Upstream greenhouse gas (GHG) emissions from Canadian oil sands as a feedstock for European refineries. Department of Energy Resources Engineering Stanford University. Green Earth Sciences 065, 367 Panama St. Stanford, CA 94305-2220
http://www.nupge.ca/files/publications/Environment/Brandt_EU_oilsands_Final.pdf

- **Collect baseline data so that existing industrial effects can be compared to the natural condition.** The Oil Sands Advisory Panel¹¹⁷ suggested baseline data could still be obtained by using lake sediment profiles, and chemical tracing that could be used to distinguish between natural and manmade sources.
- **Improve technology to reduce the amount of mercury being released by industry.** It has been shown that reductions in mercury emissions will yield rapid reductions in risk to fish.¹¹⁸
- **Reduce the amount of PAHs pollution to acceptable levels.** Studies have shown it is possible to reduce harmful effects in fish by reducing the amount of PAHs.¹¹⁹
- **Reduce nitrogen and sulphur compounds (NOx and SOx) by installing best technology to reduce acid rain and other harmful effects.**
- **Gain much more knowledge about groundwater quality, quantity, relationships to surface water, the degree to which it has already been contaminated and methods of preventing this.**
- **Develop the technology to eliminate tailings ponds and the harmful effects of tailings wet or dry and eliminate the need for end pit lakes.**
- **Gain a better world reputation for the development of our oil sands in a responsible manner** amid growing environmental and regulatory scrutiny in Canada, the U.S. and Europe.
- **Limit our environmental debt by acting now rather than later.**

6. Conclusions

The key finding is the inability of the regulatory bodies (Alberta's Energy Resources Conservation Board (ERCB) and the Canadian Environmental Assessment Agency (CEAA)) to meet their own regulations in approving projects, due to the lack of information on cumulative environmental effects. Because this lack of cumulative effects knowledge been apparent at least since 2004, when the first critical review of the main monitoring body (RAMP) took place, it is likely that already approved projects, should they be built, will result in exceeding of environmental limits, which are yet to be established.

Based on the lack of cumulative effects knowledge in the oil sands, and the evidence of existing environmental harm, Keepers of the Athabasca call on the Government of Alberta not to permit

¹¹⁷Oil sands Advisory Panel. 2010. A Foundation for the Future: Building an Environmental Monitoring System for the Oil Sands. A report submitted to the Minister of Environment.

<http://www.ec.gc.ca/pollution/default.asp?lang=En&n=E9ABC93B-1>

¹¹⁸Harris, R.C., J.W.M.R., M.A., K.G.B., P.J.B., B.A.B., C.C.G., J.A.G., A.H., H.H., J.P.H., C.A.K., D.P.K., S.E.L., M.J.P., C.L.P., A.R., and V.L.S.L., and M.T.T. 2007. Whole-ecosystem study shows rapid fish-mercury response to changes in mercury deposition. *Proceedings of the National Academy of Sciences of the United States of America* 104 (2007): 16586-16591. <http://www.pnas.org/content/104/42/16586.abstract>

¹¹⁹Nikiforuk, Andrew. 2010. A Smoking Gun on Athabasca River: Deformed Fish. The Tyee. <http://thetyee.ca/News/2010/09/17/AthabascaDeformedFish/>

the building of new projects, new water licences or land sales in the oil sands area until independent scientists have established:

- An independent monitoring program capable of detecting regional trends and cumulative effects and this program is implemented and has adequate results,
- Independent limits established for environmental damage to the air, water, land and biodiversity such that there will not be lasting harm to the environment, and
- Existing projects have been brought within those limits and therefore new projects can be safely accommodated.

We make this recommendation to the Governments of Alberta and Canada directly.