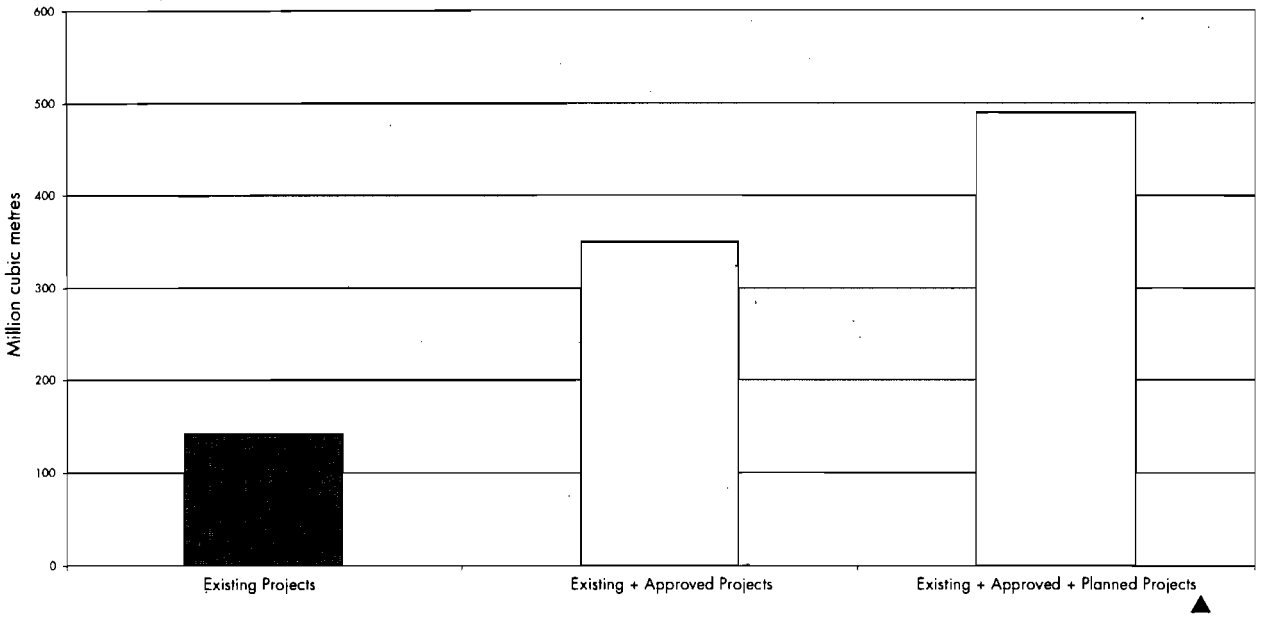


FIGURE 17: Cumulative Athabasca River water allocations for existing, approved and planned oil sands mining operations

aquifers and treat the saline water for use in the steam generators, use of freshwater is projected to continue to grow. The demand for fresh surface and groundwater for in situ oil sands projects in Alberta (Athabasca, Peace River and Cold Lake oil sands deposits) is projected to more than double between 2004 and 2020 (Figure 18).

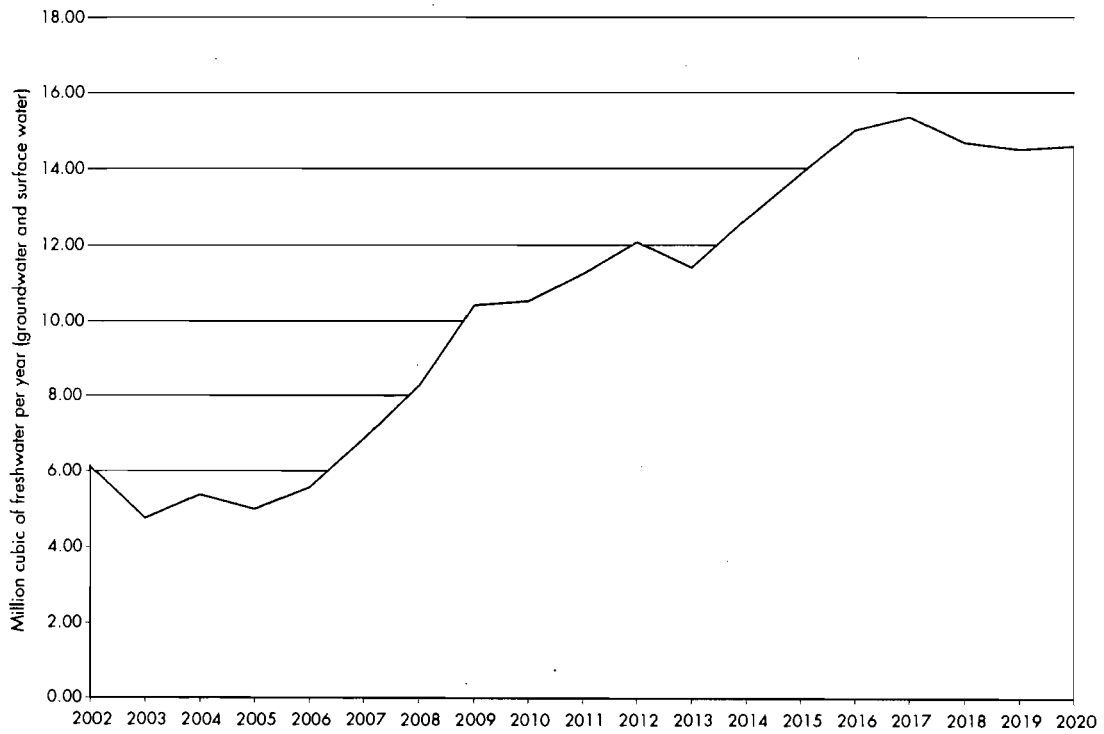


FIGURE 18: Future water demands for in situ oil sands production in Alberta[151]

4.3 Transformed Lands

"Canada's boreal forests represent enormous environmental wealth – for biodiversity, clean air and clean water. Their conservation should be a priority of every Canadian."

Environment Canada, Western Boreal Conservation Initiative [152]

"The world's boreal forest, a resource of which Canada is the major trustee, is under siege."

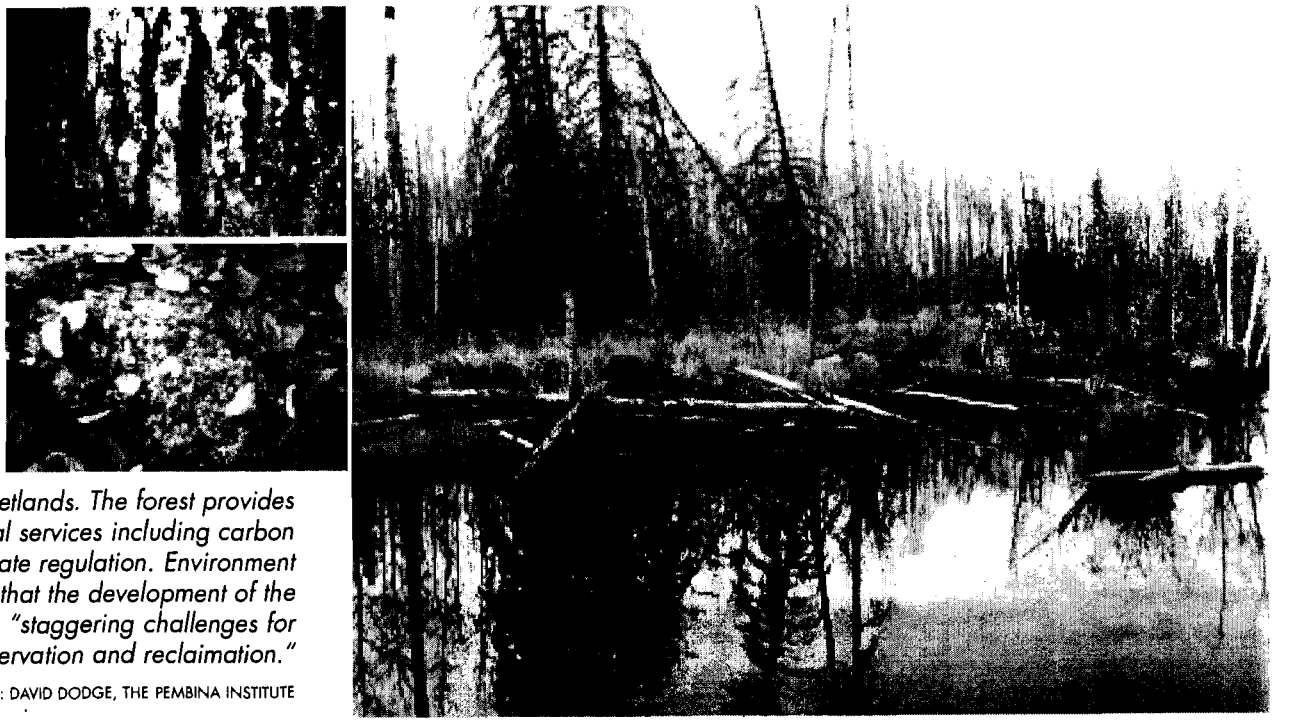
Senate Sub-committee on the Boreal Forest, 1999 [153]

4.3.1 The Boreal Forest

Described as a global endowment, Canada's boreal forest stretches for 310 million hectares across the country, covering about 30% of Canada's landmass.[154] A mosaic of interconnected forest and wetlands, the boreal forest supports a wide range of biodiversity and fulfills critical ecological services such as climate regulation and carbon storage.[155] Canada's boreal forest contains 35% of the world's wetlands and has the largest coverage of peatlands in the world.[156] It provides habitat for many important wildlife species and has the highest diversity of breeding bird species in North America.[157]

The Athabasca oil sands deposit is situated wholly within this boreal forest. The region is not only subject to in situ and surface mining development but also to conventional oil and gas production and logging operations. Within the region, Alberta Pacific Forestry Limited (Al-Pac) holds a Forest Management Agreement (FMA) for 5.8 million hectares of land, the majority of which is within the Athabasca oil sands region.[158]

Environment Canada has warned that the development of the oil sands presents "staggering challenges for forest conservation and reclamation."[159] Surface mining operations drastically alter the landscape and lead to changes in surface and groundwater flows.



The boreal forest is an interconnected mosaic of interconnected forests and wetlands. In fact ecologists say that "wetland" might be a better term to describe the great northern forest since 40% of the boreal forest landscape in Alberta consists of wetlands. The forest provides critical ecological services including carbon storage and climate regulation. Environment Canada has warned that the development of the oil sands presents "staggering challenges for forest conservation and reclaimation."

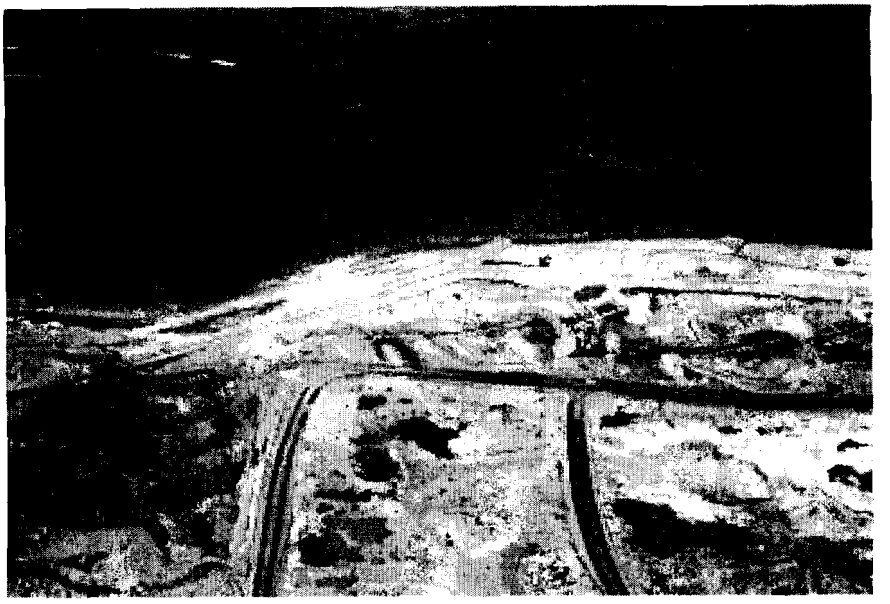
PHOTOS: DAVID DODGE, THE PEMBINA INSTITUTE

In addition to directly removing large areas of wildlife and bird habitat, areas of habitat surrounding surface mines may be less frequented by wildlife because of noise and the presence of humans. To allow wildlife to move between virtual "islands," effective habitat corridors of undisturbed land between projects are essential.

While in situ operations are considered by some to impose less impact on the land than surface mines, the network of seismic lines, roads, power line corridors, pipelines and other infrastructure create a patchwork of fragmented habitat.[160] Fragmentation occurs when extensive, continuous areas of habitat are reduced to isolated and usually smaller patches of habitat. This can reduce the amount of habitat available and the movement patterns of wildlife and birds. While it appears more benign than the expansive open pit mines, habitat fragmentation "may be the most serious threat to biological diversity and is the primary cause of the present extinction crisis."[161]

4.3.2 Surface Mining and Reclamation

During surface mining operations rivers are diverted, wetland complexes are drained and the thin boreal forest soils are stripped away. The future reclaimed landscape that is currently being proposed by the industry will be radically different from the original mosaic of wetlands and forest. Current plans will lead to the creation of dry, forested hills instead of wetlands, a larger percentage of lakes (the end pit lakes), and the absence of peatlands, which take thousands of years to develop and cannot be recreated.[162] In the coming decades, almost 10% of the region's wetlands will be converted, mostly by oil sands operations, and permanently removed from the landscape.[163]



▲ *During surface mining operations, rivers are diverted, wetland complexes are drained and the thin boreal forest soils are stripped away.*

PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

Wetlands account for approximately 40% of the boreal forest landscape in Alberta and fulfill an important ecological role.[164] In addition to being important habitat for rare plants and wildlife, wetlands and peatlands act as a sponge, regulating both surface and groundwater flows by absorbing water from spring snowmelt and summer storms and recharging groundwater aquifers in times of drought. In addition, they act as natural filters, cleansing the water that passes through them.

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." This is defined as "the ability of the land to support various land uses after

"Today the boreal region is undergoing human-induced changes of unprecedented magnitude and rapidity, many of which are potentially irreversible in cultural timeframes."

Global Forest Watch Canada[165]

OIL SANDS RECLAMATION: PAST, PRESENT AND FUTURE

Oil sands mining represents the most intensive and environmentally damaging method of oil extraction in Alberta, involving the drastic alteration of surface and subsurface materials.[166,167]

Very little area directly affected by mining operations has been restored to land with equivalent capability to the pre-mined land, and after 40 years of mining no operations have received a reclamation certificate.

Suncor states that it has reclaimed 858 hectares of land since it started operations in 1967, less than 9% of its total land disturbed to date.[168] *Syncrude's operations have disturbed 18,653 hectares, with 4,055 hectares of land reclaimed.*[169]

In response to growing criticism, the industry has adopted what it refers to as "progressive reclamation," which aims to reclaim land as quickly as is technically possible. However, even with progressive reclamation, virtually no reclamation is undertaken for the first 20-30 years of a project.

conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical."[170,171] 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.[172]

As noted in Section 4.2.2, the tailings produced using consolidated tailings technology will be incorporated into the reclaimed landscape. While they pose fewer challenges than the fluid fine tailings, consolidated tailings have some reclamation challenges of their own because of their high concentrations of salt[173] and the presence of bitumen and naphthenic acids. Because of the toxicity of naphthenic acids it has been noted that reclamation of tailings into terrestrial and aquatic landscapes at the end of a mining operation must "address residual levels of naphthenic acids and their rate, fate, and transport in the environment."[174]

Surface mining will result in irreversible impacts to entire watersheds because

▲ *Reclamation of mines and old tailings ponds present a very significant challenge. Some doubt whether boreal forest can be reclaimed to something resembling the natural ecosystem that once existed. Since mining began in the late 1960s none of the reclaimed lands have been certified as reclaimed.* PHOTO: THE PEMBINA INSTITUTE

▲ *In some oil sands reclamation work, trees are growing on reclaimed lands, but biologists are still questioning whether a self-sustaining boreal forest ecosystem can ever be re-created.*

PHOTO: DAN WOYNILLOWICZ, THE PEMBINA INSTITUTE

it is not possible to re-create the ecological diversity and inter-relationships of the boreal ecosystem. For example, the approved and planned development of several surface mines in the Muskeg River watershed threatens to damage the entire watershed.[175] Environment Canada has stated that this level of impact to the Muskeg River watershed may be irreversible.[176]

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. Despite all the uncertainty, applications for new surface mines take successful reclamation as a given. Canadian Natural Resources Ltd. stated in the environmental assessment for its Horizon Mine: "Mitigation paired with reclamation assumes a post-project success rate of 100%. Residual effects are considered on this basis. Uncertainty with reclamation methods is assumed to be resolved with ongoing reclamation monitoring and research."[177]

This optimism is not shared by all stakeholders. Al-Pac's 2005 Forest Management Plan, which lays out its harvest plans for the next 200 years, states that "in cases such as oil sands developments, the *productive status is removed from the landbase for the length of the timber supply analysis/FMP - 200 years*. These lands *may* be returned to productive ecosystem status *(emphasis added)*."[178] At best, reclamation of the oil sands region will be large-scale experiments that are unlikely to restore a self-sustaining boreal forest ecosystem within the next century.

The woodland caribou is a threatened species and can be very sensitive to disturbance and habitat loss.

PHOTO: CPAWS

THREATS TO WOODLAND CARIBOU

Woodland caribou have been designated as "threatened" under Alberta's Wildlife Act and the federal Species at Risk Act (SARA). They are extremely sensitive to disturbance and stay well back from clearings such as roads, seismic lines and well sites. The combination of forestry, oil and gas, and oil sands development is continually shrinking the areas of effective habitat that can support viable populations. Cleared paths such as seismic lines have made it far easier for hunters as well as wolves and other predators to access areas where the caribou are located.

4.3.3 Fragmented Forests

Fragmentation has a negative effect on species that require extensive tracts of habitat such as interior-nesting birds and large carnivores.[179] In addition, the construction of new roads and corridors increases access for hunting and other recreational uses that can place additional pressures on wildlife populations.

Fragmentation of the forest by in situ operations begins as soon as oil sands companies acquire a mineral lease, which allows them to begin exploration. New roads are constructed to access the area, and a network of intersecting seismic lines and exploration well sites are cleared. Although progress has been made to reduce the width of seismic lines, the region is covered with seismic and well site scars. This is because the oil industry is still not required to replant seismic lines and well sites with trees after the soil has been reclaimed. Environment Canada has noted that clearing in the boreal forest for seismic exploration by the oil and gas industry, including the oil sands industry, equals or exceeds the amount removed by the forestry industry each year.[180]

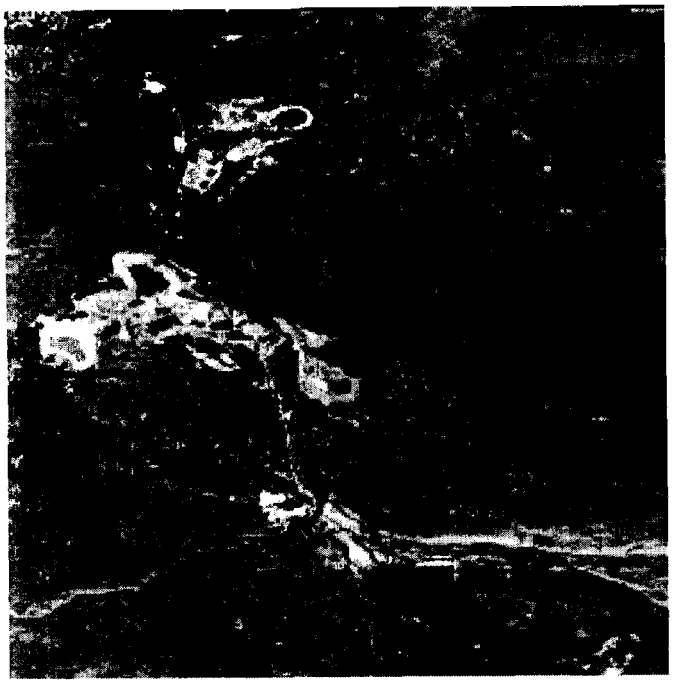
The Al-Pac FMA that overlaps much of the Athabasca oil sands deposit has

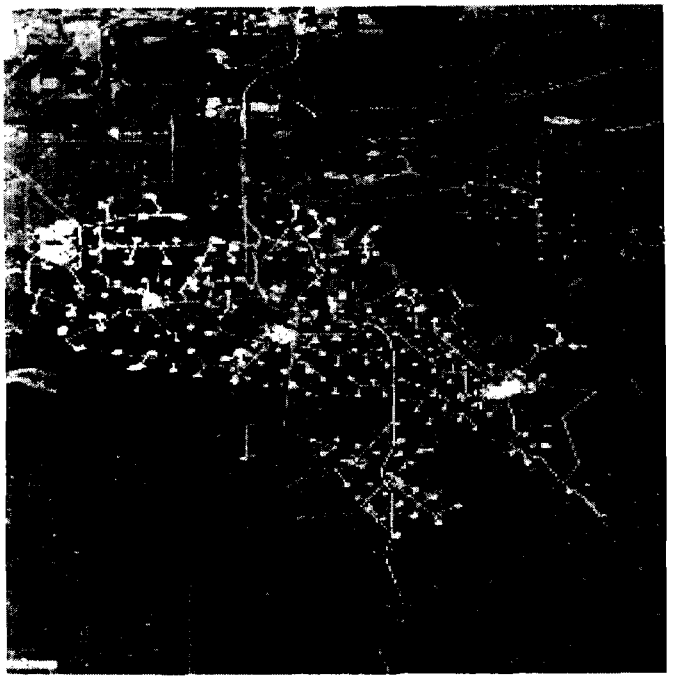
Environment Canada has noted that clearing in the boreal forest for seismic exploration by the oil and gas industry, including the oil sands industry, equals or exceeds the amount removed by the forest industry each year.

PHOTO: DAN WOYNILLOWICZ, THE PEMBINA INSTITUTE

▼

FIGURE 19:
Satellite image of the oil sands from an altitude of 320 kilometres
SOURCE: TERRASERVER.COM





▲

FIGURE 20:
Satellite image of an area of in situ development, Cold Lake Alberta
SOURCE: TERRASERVER.COM

more than 100,000 kilometres of linear developments, with an average density of 1.8 kilometres per square kilometre within its FMA (that is, within one square kilometre of forest there exists 1.8 kilometres of linear cuts).[181] If forestry activity persists at current levels and the energy sector expands as predicted, the average density of linear developments will increase to over five kilometres per square kilometre.[182]

As one of the most sensitive animals in the boreal forest, woodland caribou are used as an indicator of the health of the boreal ecosystem. Woodland caribou habitat quality has declined by 23% over the past several decades in the Al-Pac FMA. Further declines are expected if trends in industrial development continue.[183]

4.3.4 A Growing "Footprint"

The "footprint" of oil sands development in Alberta's boreal forest is growing rapidly. Individual mines range in size from 150 to 200 square kilometers. Mine pits and massive tailings ponds are easily visible to the naked eye from the altitude of an orbiting space shuttle (Figure 19), and an aerial overview of areas with in situ operations reveals a spider web of above-ground pipelines and well pads (Figure 20).

Approximately 1,807 oil sands lease agreements are in place covering an area of 32,000 square kilometres.[184] While this may seem like a substantial number of leases, close to 80% of oil sands areas are still available for exploration, leasing and development.[185] The amount of landscape destruction experienced to date is only a hint of what is still to come (Figures 21 and 22).

▲

Archie Waquan, former Chief of the Mikisew Cree.
PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

"When industry talks about footprint, sometimes I think it's an overused term. A footprint... how I know it, is after two or three rains it's gone. A footprint. The footprints you see up north here are not exactly footprints, okay."

Chief Archie Waquan, Mikisew Cree First Nation[186]

"What's happening to the boreal forest within the 3,450-square-kilometre oil sands Surface Mineable Area of northeast Alberta, can legitimately be described as an ecological holocaust."

Dr. Richard Thomas[187]

4 Environmental Impacts

THE OIL SANDS "FOOTPRINT" IN PERSPECTIVE

Existing, approved and currently planned oil sands mines and in situ projects in the region will directly impact more than 2000 square kilometres of boreal forest. This is

- *Approximately 28,465 NFL football fields.*
- *Approximately 2.5 times larger than Calgary and 3 times larger than Edmonton*
- *More than 5 times the size of Denver.*
- *Almost the size of Tokyo – home to 12 million people.*

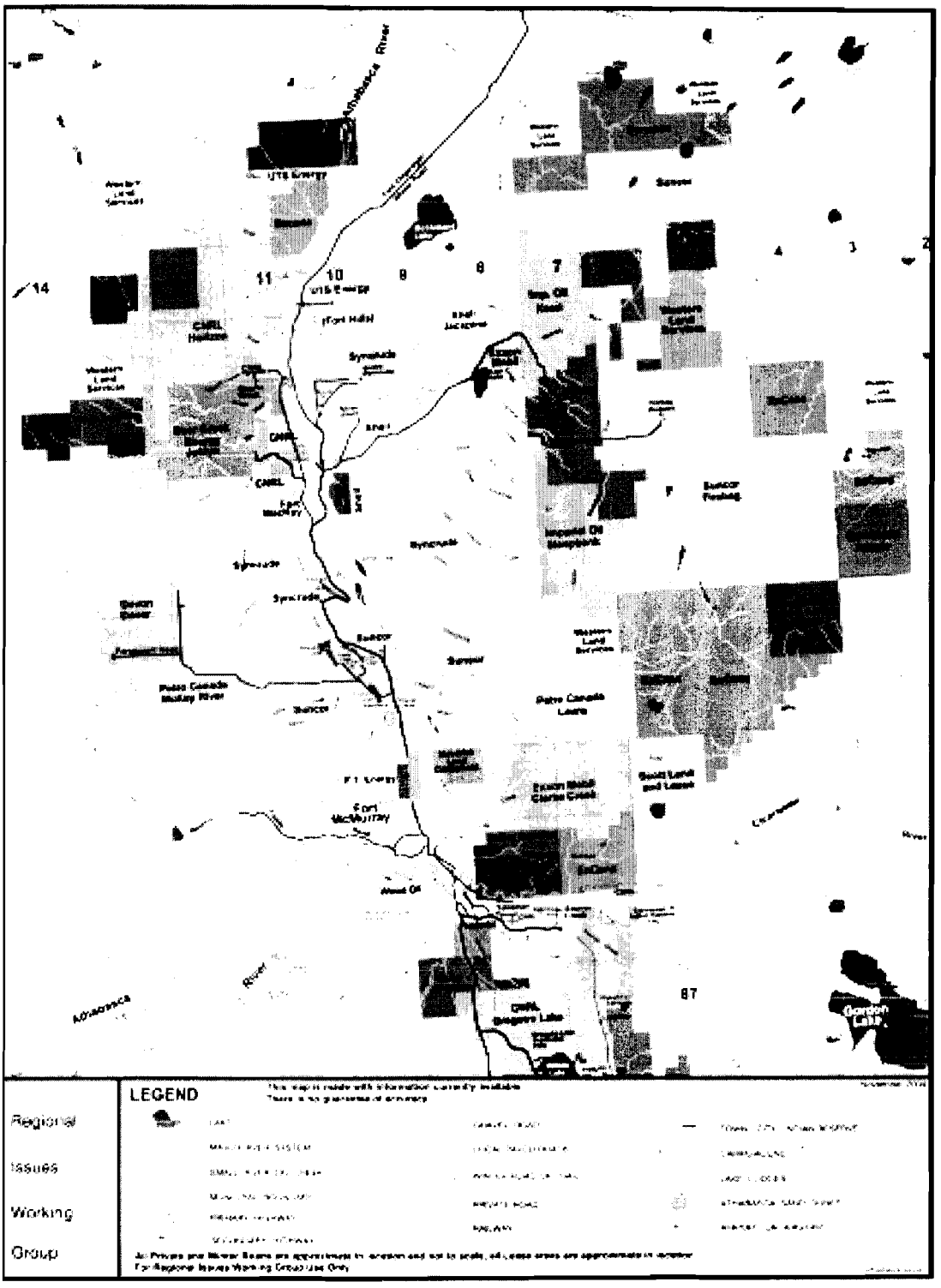


FIGURE 21: Current oil sands leases north of Fort McMurray – Athabasca Oil Sands

In 2003, Alberta Environment reported that the Athabasca oil sands region had approximately 430 square kilometres of land that had been directly impacted, approximately 90% of which was the result of three oil

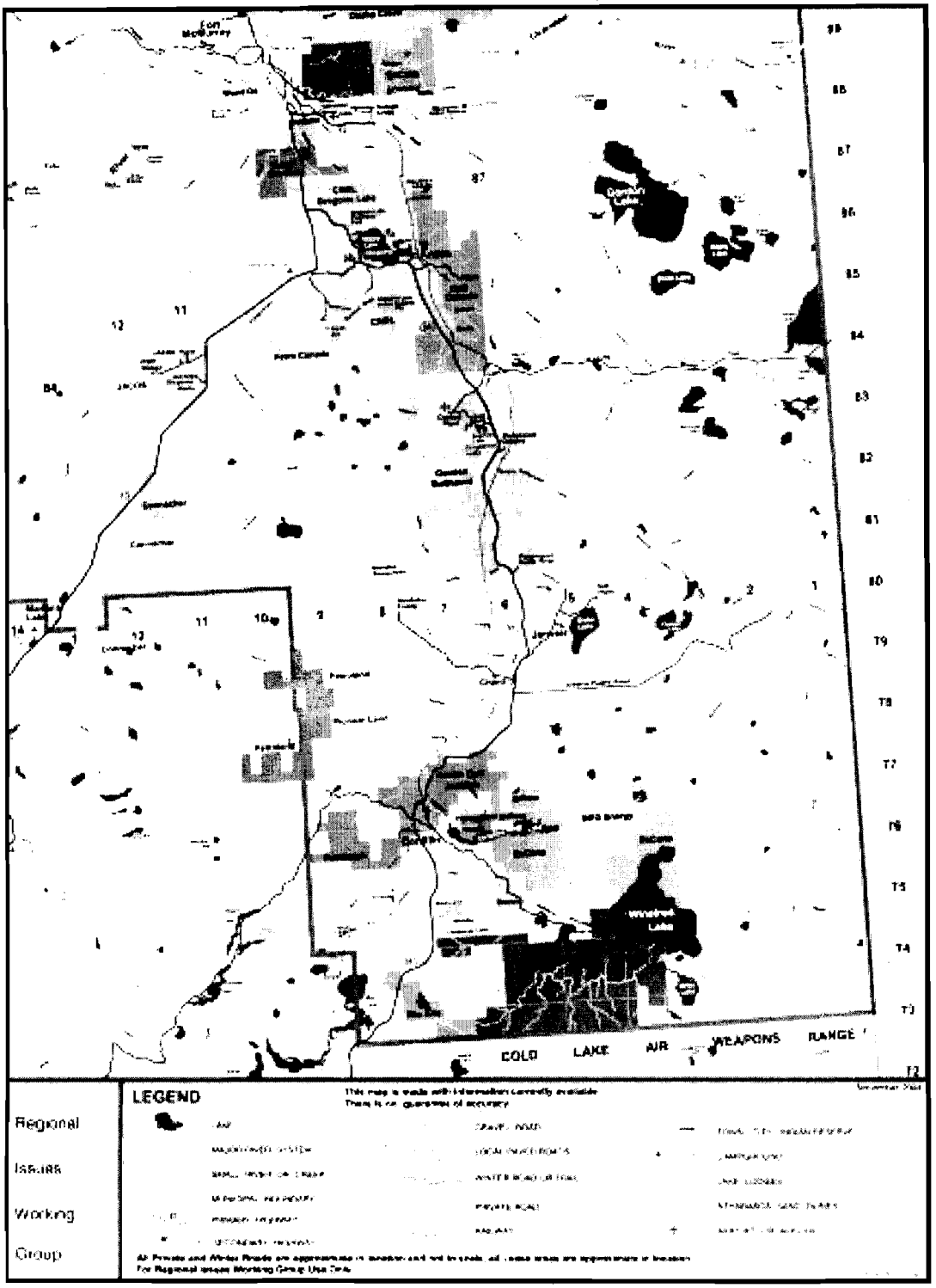


FIGURE 22: Current oil sands leases south of Fort McMurray – Athabasca Oil Sands

sands mines and two SAGD operations.[188] By mid-2004, the total amount of land either already impacted, or approved for future disturbance by oil sands operations, was 950 square kilometres.[189]

The most recently filed environmental impact assessment (EIA) has projected that currently planned oil sands development in the region will lead to a cumulative disturbance of more than 2000 square kilometres.[190] This growing footprint is illustrated in Figure 23.

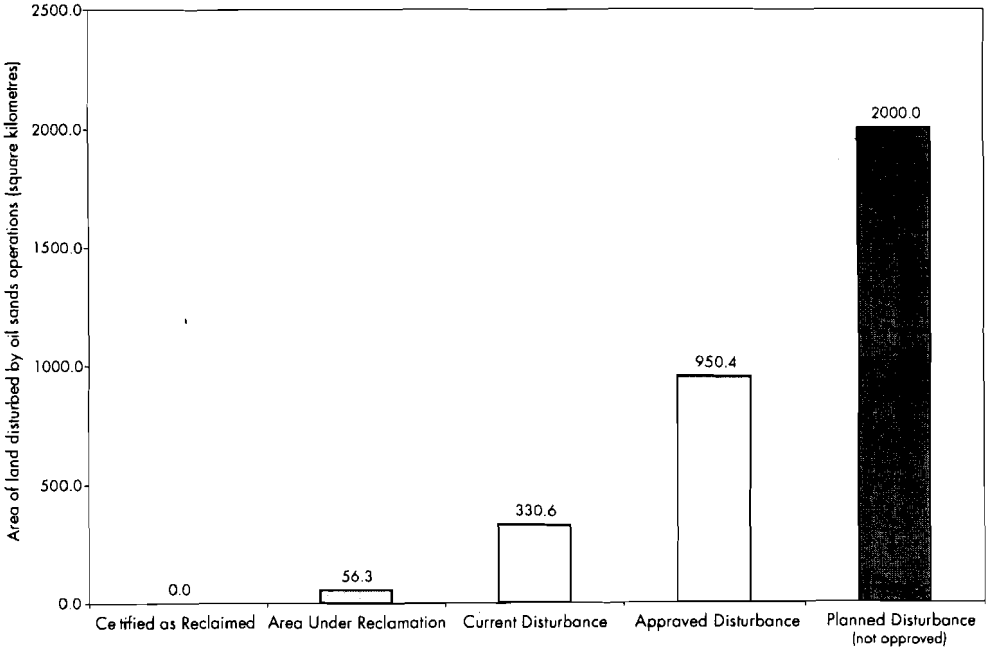


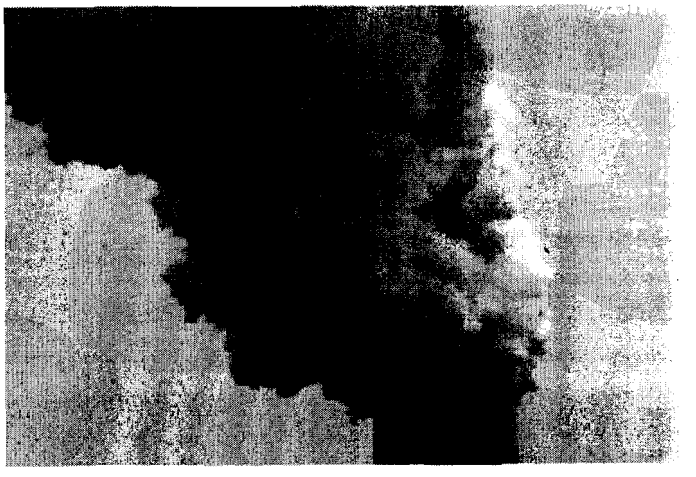
FIGURE 23: Land disturbance and reclamation in the Athabasca oil sands region [191]

4.4 Polluted Air

4.4.1 A Pollution Capital

The rapid expansion of the oil sands is driving up the pollution emitted in Alberta. According to PollutionWatch, companies in Alberta emitted more than one billion kilograms of air pollutants in 2003, which puts Alberta in the #1 spot in the country for air releases from industrial sources.[192]

Criteria Air Contaminants (CACs) are the most common air pollutants released by heavy industry burning fossil fuels. CACs are defined as "air pollutants that affect our health and contribute to air pollution problems" and include such things as nitrogen oxides (NO_x), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and particulate matter (PM) - all of which are emitted in large volumes by oil sands operations.[193] Table 5 provides an overview of the human health effects and environmental impacts associated with these pollutants.



Every day the oil sands industry consumes enough natural gas to heat 3.2 million Canadian homes for a day.

PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

Nitrogen oxides (NO_x)	• Irritates the lungs and increases susceptibility to respiratory infections [194]
	• Combines with VOCs in the presence of sunlight to form ground-level ozone, which can cause damage to human health [195]
		• Is a major component of acid rain, which can [200]
		  • leach essential nutrients from the soil and thereby negatively affect health and rate of growth of trees
		  • reduce capacity of lakes and soil to neutralize acids and potentially change the pH condition of lakes and soil
		  • alter lakes and soil that become acidified
		• Can create a "fertilizer effect," called eutrophication, which can alter the types of plants and animals that can live in the boreal forest [201]
		• Can combine with VOCs in the presence of sunlight to form ground-level ozone [202]
		• Contributes to the formation of smog and haze

Sulphur dioxide (SO_2)	• At high levels can cause premature death, increased respiratory symptoms and disease, decreased lung function, as well as alterations in lung tissue and structure, and in respiratory tract defence mechanisms [196]	• Is a major component of acid rain • Contributes to the formation of smog and haze
Particulate matter ($PM_{2.5}$)	• Can be carried deep into the lungs • Has been linked with heart and lung problems such as asthma, bronchitis and emphysema [197] • Strong links between high levels of airborne sulphate particles and increased hospital admissions for heart and respiratory problems, and higher death rates from these ailments [198]	• Is composed of organic and elemental carbon particles from combustion of fossil fuels as well as sulphur and nitrogen compounds that can contribute to acid deposition • Contributes to the formation of smog and haze
VOCs	• Individual VOCs can be toxic to humans • Benzene is a VOC emitted by oil sands operations. It is carcinogenic to humans and a non-threshold toxicont, which means that there is some probability af harm at any level of exposure [199]	• Can combine with NO_x in the presence of sunlight to form ground-level ozone [203] • Contributes to the formation of smog and haze.

◀

TABLE 5: Effects of criteria air contaminant emissions on human health and the environment

While several other toxic pollutants are also emitted such as heavy metals, polycyclic aromatic hydrocarbons (PAHs)[204] and ammonia, they will not be discussed in detail.

The oil sands industry has reduced the volume of pollutants it emits (referred to as emissions intensity) to produce a barrel of synthetic crude oil. Despite these efforts, the emissions intensity of oil sands production for common pollutants remains higher than that of conventional oil production because there are many more steps involved in producing synthetic crude oil from oil sands (Figures 24 and 25).

FIGURE 24: Nitrogen oxide intensity of producing synthetic crude oil from oil sands versus conventional oil in Alberta[205,206]

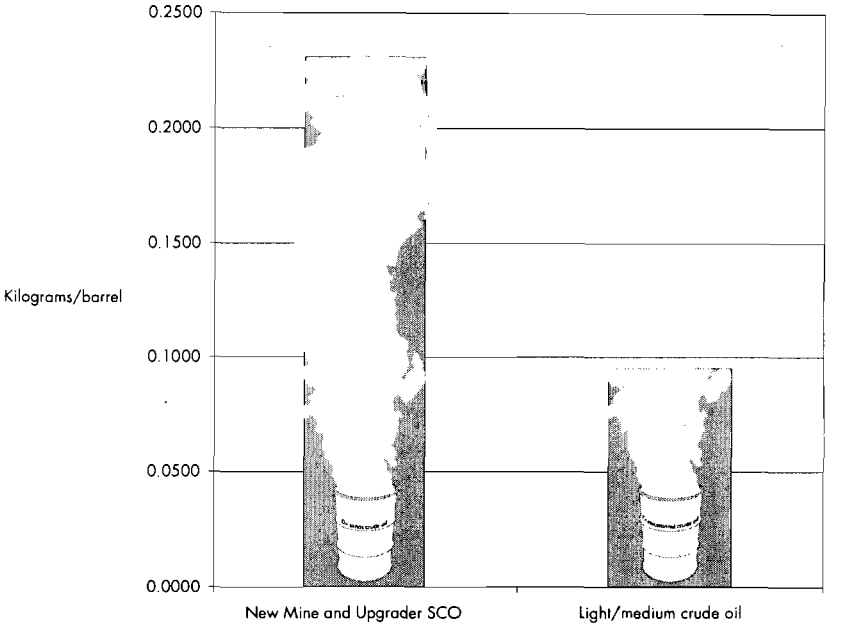
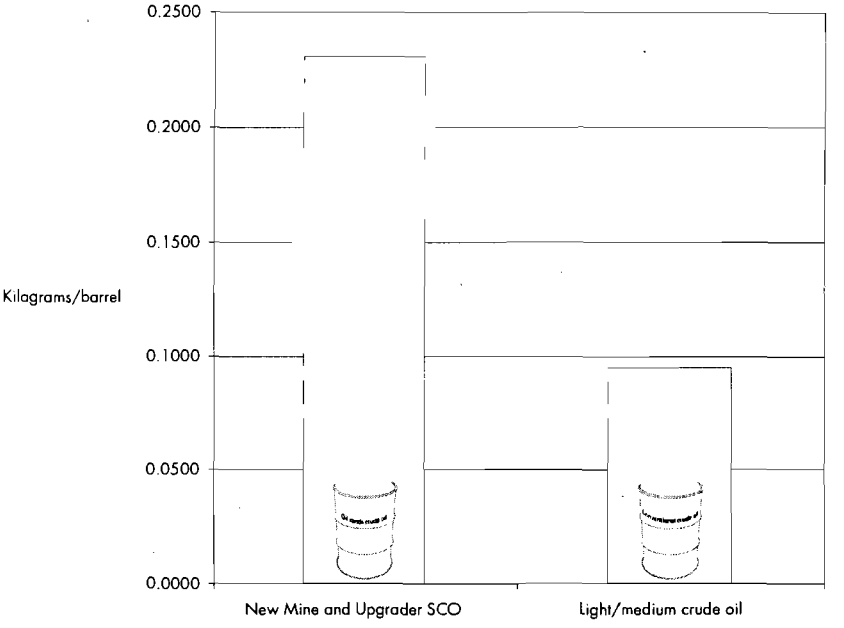


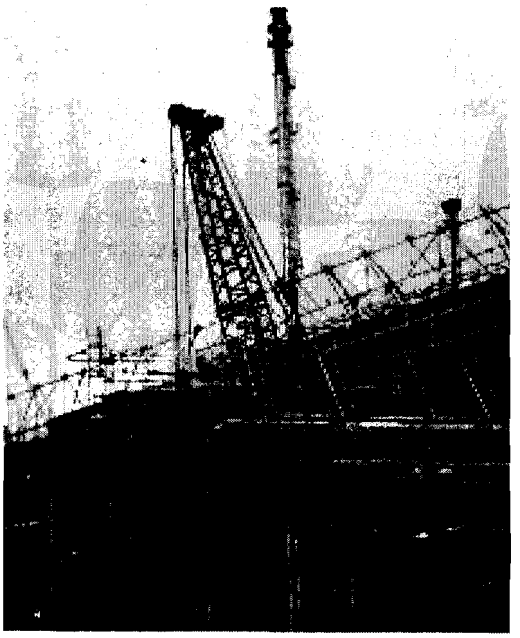
FIGURE 25: Sulphur dioxide intensity of producing synthetic crude oil from oil sands versus conventional oil in Alberta[207]



Pumpjacks to bring oil to the surface Pumps to ship the oil by pipeline to a central facility	Mining and extraction: Mine vehicles to uncover and transport the oil sands deposit Heated water and agitation to extract bitumen from sand and clay Tailings ponds Mine vehicles to fill in pits and reclaim mine	In situ: Steam injection to liberate bitumen from sand and clay Pumpjacks to bring the oil to the surface Pumps to ship the bitumen by pipeline to a central facility Energy to treat and reuse water
Heaters to separate water and other impurities Removal of sulphur compounds if present	Upgrading to break down the bitumen using high heat and pressure Removal of sulphur compounds	

TABLE 6: Steps required before oil can be refined

In 2003, Syncrude and Suncor's facilities were ranked number one and two respectively as Alberta's largest emitters of CACs.[208] Similarly, their facilities ranked fifth and eleventh among the most polluting facilities in Canada.[209] The anticipated growth of air pollution from oil sands development promises to keep Alberta ranked number one in Canada for air pollution for decades, with more oil sands facilities likely to join the national Top 20 list of polluting facilities.



Extracting and upgrading the oil sands into synthetic crude oil requires the burning of large amounts of fossil fuels and therefore emits significant amounts of air pollution.

PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

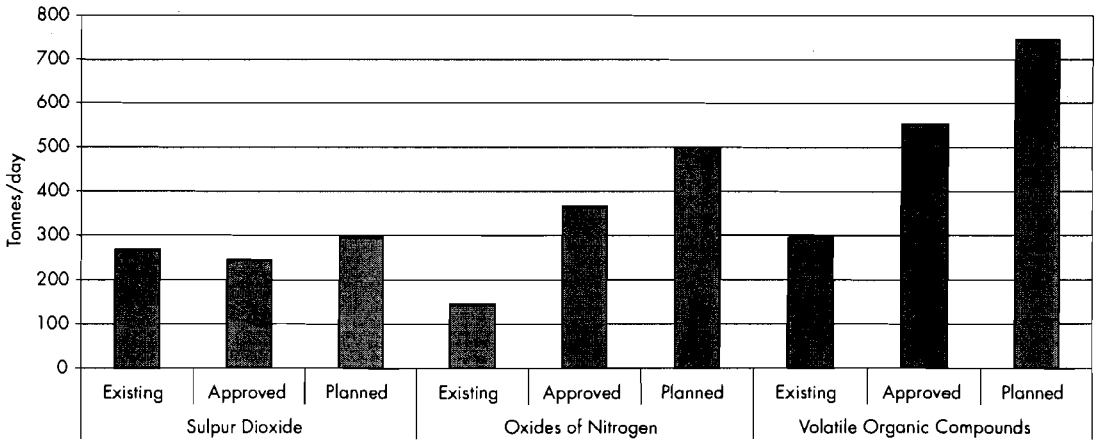
4.4.2 The Impacts of Increasing Air Pollution

Since commercial oil sands production began, the residents of Fort McMurray and other towns in the region have expressed concerns with air toxins and acid-forming pollutants. Extracting and upgrading the oil sands into synthetic crude oil requires the burning of large amounts of fossil fuels and therefore emits significant amounts of air pollution. The air quality in the Fort McMurray area is the same or better than in Calgary or Edmonton.

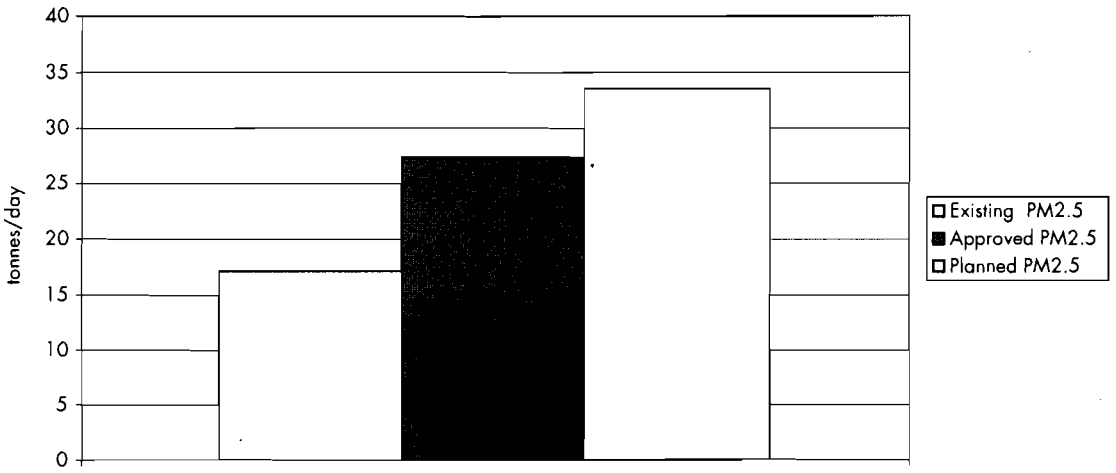
However, the air quality of the region will be further degraded as oil sands production rises to 2.5 million barrels per day, when facilities that have been approved go into production, and then to 3.7 million barrels per day when currently planned facilities also go into production.[210] (Figures 26 and 27).

NB: Companies evaluate three oil sands production scenarios when they assess the impacts from combined air pollution:

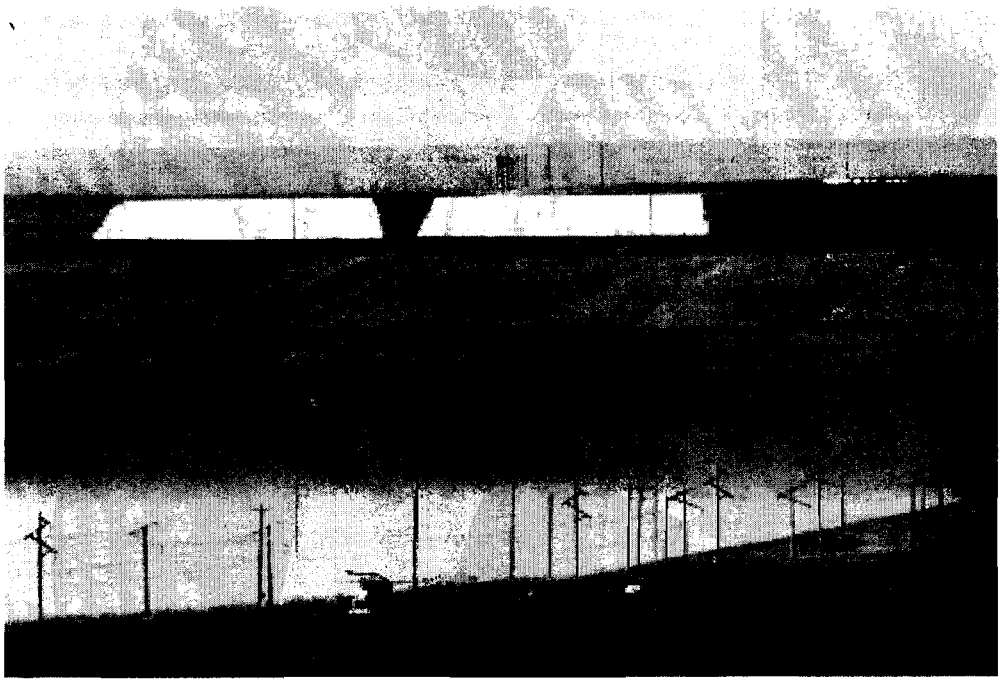
Existing	**Currently polluting sources**
Approved	**Existing + government-approved sources**
Planned	**Existing + approved + projects awaiting approval**



▲ *FIGURE 26: Total air emissions existing, approved and planned for the Athabasca oil sands region*[211]



▲ *FIGURE 27: Total particulate matter ($PM_{2.5}$) emissions existing, approved and planned for the Athabasca oil sands region*[212]



Sulphur that is removed from the bitumen during upgrading is stored in large sulphur blocks.

PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

4.4.3 Future Trends in Air Pollution

When environmental assessments are conducted to evaluate the impacts of increasing air emissions, the impacts from the proposed project are compared to an approved scenario. Computer-generated air dispersion models are used to predict the concentration of air pollutants for both the approved scenario and a planned scenario.

As depicted in Figures 28 and 29, modelling of today's approved scenario, which includes three operating mines and three mining operations at various stages of planning and construction, shows that maximum predicted ambient air concentrations of NO_x and SO_2 already exceed provincial, national and international guidelines.[213] New projects will exacerbate this situation.

Particulate matter ($PM_{2.5}$) refers to microscopic airborne solid and liquid particles less than 2.5 microns in size. $PM_{2.5}$ is emitted directly when fossil fuel is burned. Emissions of SO_2, NO_x and VOC also combine to form particulates in the atmosphere.

In response to human health concerns, the federal and provincial governments have agreed to establish a "Canada Wide Standard" for $PM_{2.5}$ at 30 micrograms per cubic metre (ug/m^3). This standard is to come into effect in 2010.[214]

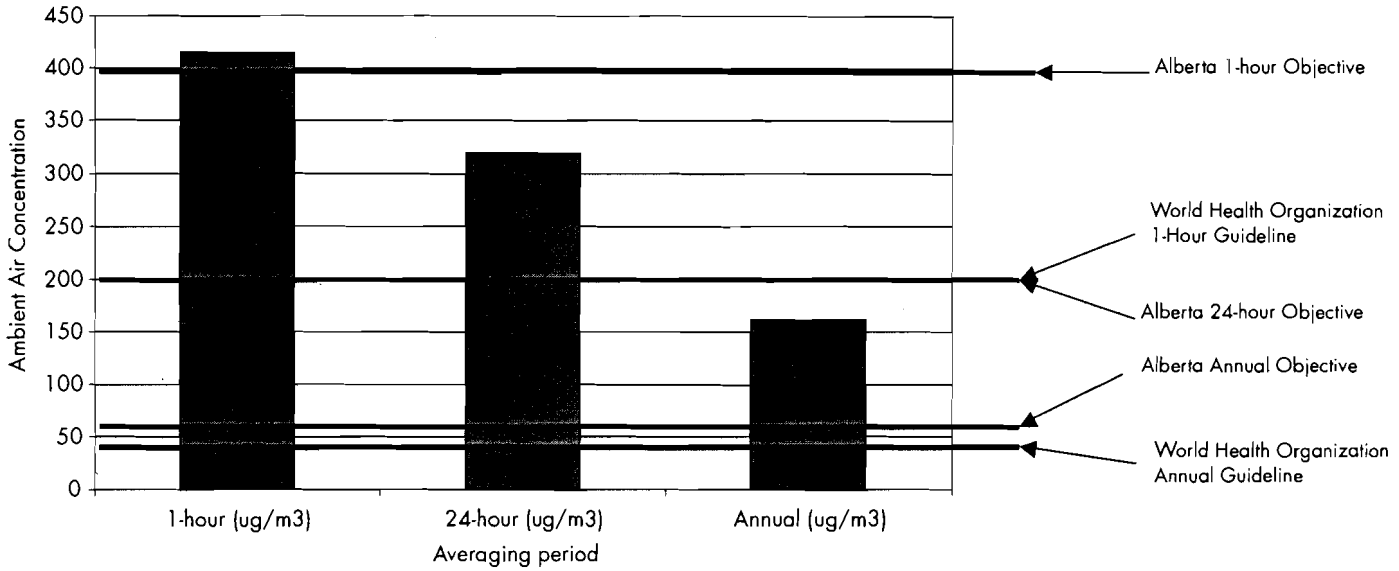
This standard reflects a political tradeoff between economic activity and human health because numerous epidemiological studies on short-term response to $PM_{2.5}$ indicate adverse health effects well below the Canada Wide Standard level (15 ug/m^3 and

BITUMEN

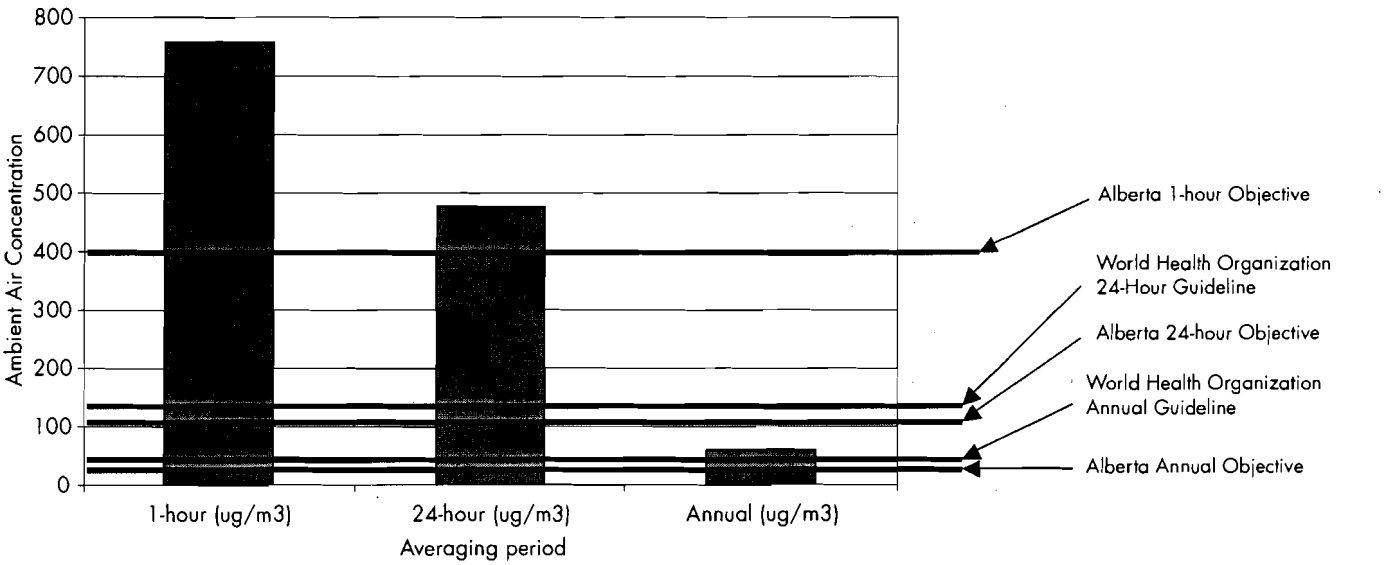
Bitumen contains sulphur that must be removed at the upgrading stage so that the bitumen can be sent to a refinery. Most of it is converted into elemental sulphur, but some is released to the air. The total currently approved level of sulphur dioxide releases from all sources in the Athabasca oil sands region is 245.5 tonnes/day. [215]

KEARL OIL SANDS

Imperial Oil's Kearl Oil Sands Mine fleet of trucks and shovels account for over one-half of the project's emissions of $PM_{2.5}$. Fleet air emissions are dominated by 114 haul trucks that run 24 hours a day, 7 days a week, 365 days a year at peak production.[216] *Each truck has an engine that is roughly equivalent in size to a locomotive engine. Imperial's mine fleet will add approximately 376 tonnes of $PM_{2.5}$ per year to the region's airshed.*[217]



▲ *FIGURE 28: Approved scenario – predicted maximums for nitrogen oxides exceed guidelines* [218]



▲ *FIGURE 29: Approved scenario – predicted maximums for sulphur dioxide exceed guidelines* [219]

potentially lower).[220] Recognizing that the 30 ug/m3 standard was inadequate, the Province has developed the Alberta Particulate Matter and Ozone Management Framework.[221] This framework was designed to prevent degradation of air quality in areas that are below the Canada Wide Standard level.

Modelling of the approved scenario shows that although $PM_{2.5}$ levels are rising, all communities in the region would experience concentrations below the Canada Wide Standard.[222] The planned scenario models predict further increases in $PM_{2.5}$. This means that seven communities will be subjected to levels higher than the Alberta Particulate Matter and Ozone Management Framework Level of 20 ug/m3 – the level that requires Alberta Environment to implement a management plan to prevent further degradation of air quality.[223,224]

Emissions of VOCs are also on the rise because of both emissions from burning fossil fuels (e.g., natural gas, diesel, coke) and the growing number of tailings ponds. (VOCs are a large category of pollutants that share one characteristic – they evaporate or volatilize into the air.) In 2002, Alberta was among the top four states and provinces in North America for emissions of VOC emissions.[225] Currently operating and approved oil sands developments account for more than 500 tonnes per day of VOC emissions.[226] Once planned oil sands development is considered, this total is predicted to grow to more than 750 tonnes per day.[227]

4.4.4 Acid Rain

When acid rain or particles fall onto the land, they are measured as the potential acid input (PAI). Expressed in kiloequivalents per hectare per year (keq/ha/yr)[228] PAI is used to evaluate the environmental impacts of acidifying emissions (NO_x and SO_2). Scientists can estimate how much acid the land can withstand before the chemistry of its soil begins to change, resulting in changes to the types of plants and trees that make up the ecosystem. Land with sensitive soils can absorb less acid than land with non-sensitive soils. This amount of acid is referred to as the ecosystem's critical load.[229]

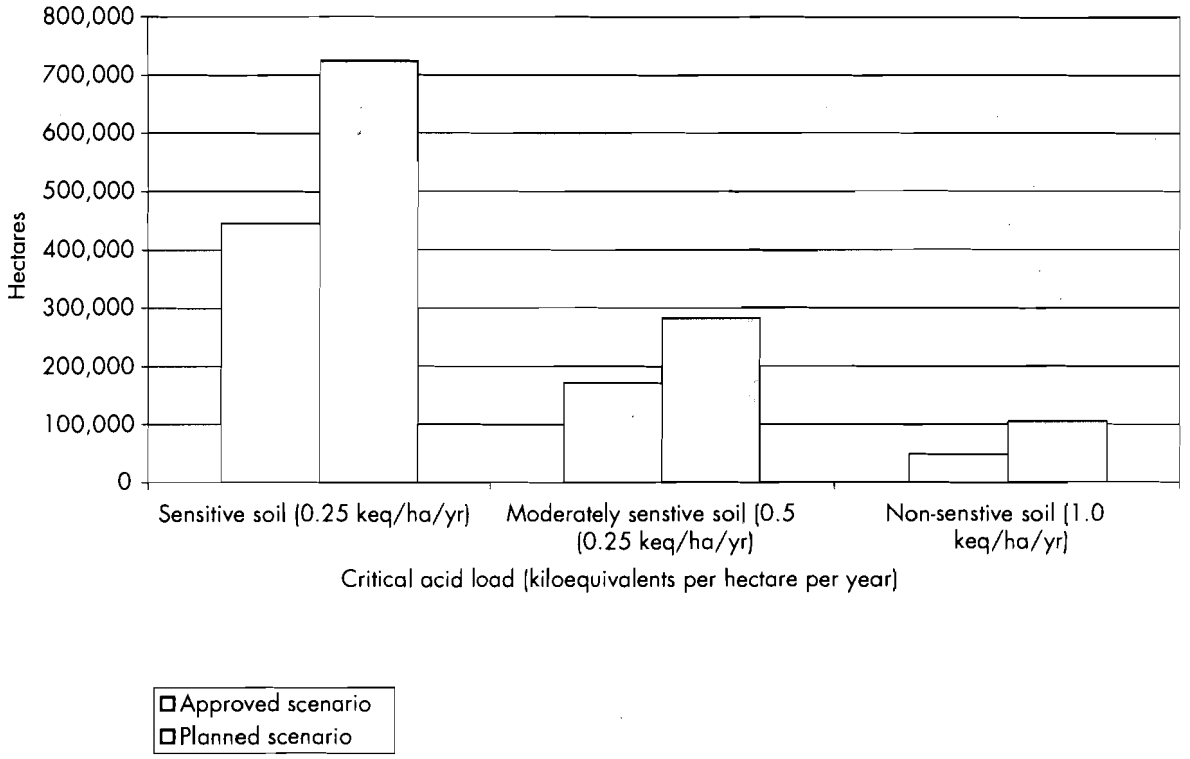
Critical loads have been determined for Alberta soils ranging from sensitive, to moderately sensitive, to not sensitive. If one were to assume that the entire area affected by emissions from oil sands operations has non-sensitive soil, a very conservative assumption, an area equivalent to almost 500 square kilometres is at risk from the acidifying emissions of oil sands projects that are already operating or have been approved to operate (Figure 30). This area will almost double to 1000 square kilometres in the planned scenario.[230]

Water bodies are also at risk of acidification in the Athabasca region. A 2004 study predicted that the acidifying emissions from planned oil sands development would result in the acidification of 25 lakes in the region.[231] This study only analyzed the sensitivity of 6% of the lakes in the region so this tally may be underestimated.

BENZENE

Benzene, one of the VOCs emitted by oil sands operations, has been the target of a successful nation-wide reduction campaign that started in 1995 in response to concerns about the level of human exposure. Actual releases of benzene and concentrations of benzene in the air have been reduced significantly, and the national reduction effort has now entered a second phase.[232] Meanwhile, benzene levels in the air in Fort McMurray and surrounding communities are rising in conjunction with rising VOC emissions in the oil sands.[233]

The massive tailings ponds account for the high VOC emissions in the region. For example Imperial Oil estimates that its tailings pond will account for about three-quarters of its total daily release of 74.01 tonnes of VOCs.[234]



▲ *FIGURE 30: Area of land above the critical load for acid deposition to soil*[235]

LONG RANGE TRANSPORT OF ACIDIFYING EMISSIONS

Acid-forming pollutants can travel hundreds or even thousands of kilometers. Alberta's oil sands development have the potential to contribute to the plume of acid compounds that travels across Canada and undermines efforts to reduce impacts in eastern Canada.

In an effort to proactively prevent environmental damage to the region's ecosystem from acid deposition, the government of Alberta has implemented an initial management framework developed by the Cumulative Environmental Management Association stakeholders. However, successful implementation is subject to the political will of government to implement the recommendations, and to provide adequate funding and human resources to ensure successful completion of key scientific research.

Preliminary national emissions projections from 2000 to 2020 predict that the general trend for $S0_2$ and $N0_x$ will be downwards by 8% and 16% respectively. However, emissions of $S0_2$ and $N0_x$ from oil and gas and oil sands development are predicted to increase during this time period.[236] Whereas $S0_2$ emissions are predicted to decline by 21% in eastern Canada and 38% in the US, they are expected to rise by 15% in western Canada.[237]

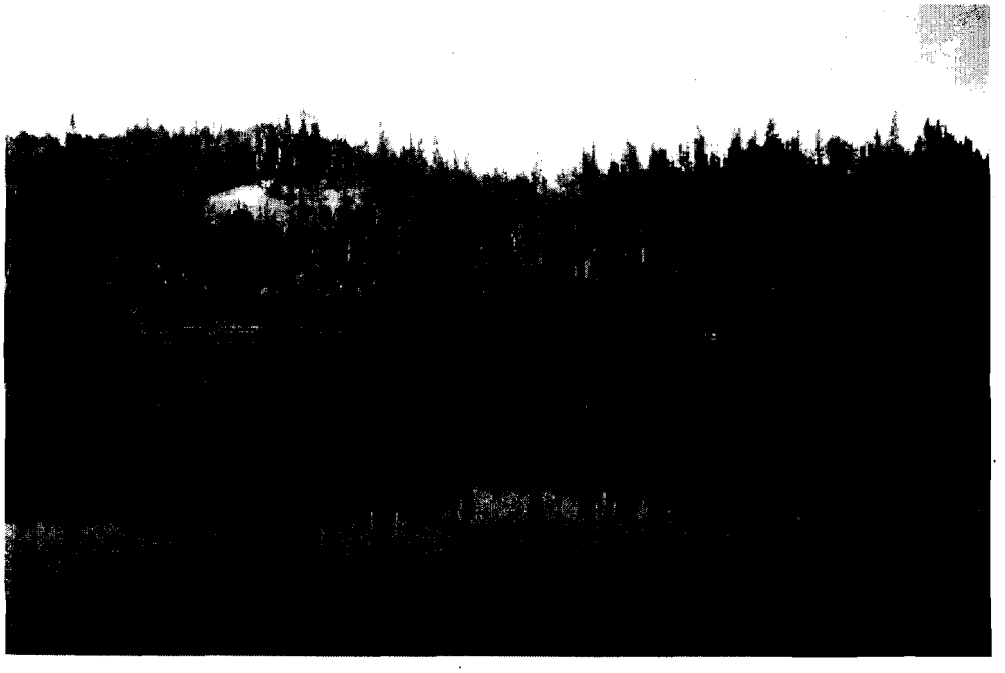
4.5 Managing Cumulative Environmental Impacts

4.5.1 Regulating and Managing the Oil Sands

The oil sands are a provincial resource, and therefore the government of Alberta is the primary regulator of their development. The government-appointed EUB is a regulatory agency tasked with ensuring "that the discovery, development, and delivery of Alberta's energy resources and utilities services take place in a manner that is fair, responsible, and in the public interest."[238,239] The EUB is the primary decision maker regarding proposed projects. Subject to EUB approval, Alberta Environment (AENV) is responsible for granting regulatory approvals and licenses for air emissions, water withdrawals and land disturbance. The regulatory authority of the government of Canada is limited to instances in which a proposed project requires a federal approval or permit, most commonly related to the Department of Fisheries and Oceans' (DFO) jurisdiction over fisheries.[240]

4.5.2 Creating a Plan

The regulatory agencies evaluate the environmental impacts of oil sands development on a project-by-project basis. However, as the second wave of development began in the mid-1990s, regional Aboriginal and Métis, community members and environmental groups noted that the project-by-project review of proposed oil sands development ignored the cumulative environmental impacts.



"Most of the world's forests are islands of wilderness in a sea of development. We'd like to flip that around in the boreal and have islands of economic development in a sea of wilderness."

Stewart Elgie, Canadian Boreal Trust[241]

◀ *The Athabasca River at sunrise near Wood Buffalo National Park.*

PHOTO: DAVID DODGE, THE PEMBINA INSTITUTE

Rather than altering its regulatory approach, in 1999 the government of Alberta crafted a Regional Sustainable Development Strategy (RSDS) for the Athabasca Oil Sands in recognition of "The unprecedented pace of development in the Athabasca Oil Sands Area" and the resultant "increased potential for effects on environmental quality, species diversity and abundance, and human health."[242] The purpose of the RSDS was to develop a framework that would, among other things: "Create an enhanced management framework that will adapt to the changing needs of the area, which will guide government's environmental and resource managers" and "Develop a strong foundation of environmental information and science to assist in making decisions on sustainable resource and environmental management in the region."[243]

4.5.3 Implementing the Plan

In 2000, the Cumulative Environmental Management Association (CEMA)[244] was established to work with the Government of Alberta to implement the RSDS by collecting scientific information and making recommendations for how best to manage the cumulative environmental impacts of industrial development in the region.[245] In the hopes of replicating Alberta's Clean Air Strategic Alliance (CASA)[246] success in developing provincial air quality management systems for other industrial activities, CEMA was established as a consensus-based, multistakeholder group comprised of representatives from the oil industry, the governments of Alberta and Canada, Aboriginal and Métis groups, and environmental non-governmental organizations.[247] The 72 environmental issues identified in the RSDS were prioritized, and it was anticipated that the highest priority issues (Category A) would be addressed within two years.

4.5.4 Slipping Timelines

In 2001, the government of Alberta released a progress report on the RSDS, in which it noted that, contrary to the RSDS plan that had stated that management objectives for category A themes would be completed in two years, no management objectives had been completed. This lack of progress was linked to "the complexity of the environmental issues and the consultative, interactive nature of the partnership process, and the work group's demand for a thorough approach make the strategy's original targets unrealistic."[248] Further, the report noted: "The effort required by the working groups is very intensive and necessitates individuals to commit their time over and above their regular work activities.... This is compounded by the increasing pace of development and large number of projects in the oil sands area that are often drawing on the same consultants."[249]

While all stakeholders have placed significant emphasis on the success of CEMA, it has been far less effective than originally envisioned. Between 2000 and the end of 2004, CEMA's working groups produced 52 reports and four recommendations to the government of Alberta, including one

regional environmental management framework.[250] As demonstrated in Table 7, the timelines for CEMA delivering management plans have been consistently delayed and may not be complete before many more approvals are granted for oil sands development. Given the importance and scope of conducting research to define environmental thresholds and develop regional environmental management systems, undertaking this work in parallel to ongoing oil sands development is a challenge. The steady stream of applications for proposed oil sands projects submitted for regulatory and stakeholder review imposes a significant workload on the government and Aboriginal and ENGO members of CEMA, competing for their time and resources.

Regulatory decision makers such as the EUB have acknowledged that CEMA has not been keeping pace with the rate of oil sands development in the region. While the EUB has made recommendations to various provincial and federal government agencies regarding their role in ensuring that CEMA is effective and the RSDS is implemented, these agencies have done little in response. As a result, an ongoing lack of human resources and limited government leadership has hampered CEMA's ability to achieve its objectives.

LOTS OF TALK, LITTLE ACTION

"The [Energy and Utilities Board] Board notes that OSEC [the Oil Sands Environmental Coalition] has requested that the Board conduct a public inquiry into the ecological carrying capacity of the region. In this case, the Board believes that as long as the various initiatives are making adequate progress such an inquiry is unnecessary. However, it is clearly possible for a number of reasons that the proposed consensus based processes may not be able to move forward as quickly as needed. Accordingly, the Board has decided to reserve its decision on OSEC's request for a Section 22 proceeding, and may reconsider this request at some time in the future."[251]

Alberta Energy and Utilities Board, Muskeg River Mine Decision Report, 1999

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"In a series of decision in this area, the Board has placed significant reliance on the success of the CEMA process to verify that both existing and future oil sands developments remain in the public interest. The Board believes that CEMA's work is important and that the results will assist the Board in meeting its regulatory mandate to ensure that energy developments are carried out in an orderly and efficient manner that protects the public interest. The Board understands that CEMA is dealing with complex and difficult issues within a multistakeholder forum. Nonetheless, it is concerned with delays in the issuance of recommendations."[252]

Alberta Energy and Utilities Board, True North Fort Hills Mine Decision Report, 2002

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"The [Joint Federal-Provincial Review] Panel has concerns that CEMA's effectiveness may also be influenced by the volume and complexity of its work, multiple priorities of stakeholders, and funding mechanisms that may not keep pace with CEMA's increased workload from oil sands expansions, new oil sands mining and in situ projects, and other contributors of regional cumulative effects"[253]

Alberta Energy and Utilities Board, CNRL Horizon Mine Decision Report, 2004

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"The [Joint Federal-Provincial Review] Panel understands that there is good support in general for CEMA but widespread concern about delays in delivery of environmental management objectives and plans &The Panel has serious concerns about delays in the issuance of recommendations and the ability of CEMA to meet the proposed timelines."[254]

Alberta Energy and Utilities Board, Shell Jackpine Mine – Phase 1 Decision Report, 2004

NO_x/SO_2 Management WG	Acid Deposition Management Framework	Q2* 2002	Q4 2002	Recommendation delivered August 2004	–
	Nitrogen Management Framework			2006	Deferred indefinitely
	Ground Level Ozone	Q4 2003	Q4 2003	2005	Deferred to 2006
Surface Water WG	Instream Flow Needs Management Framework	Q2 2004	Q4 2004	Q4 2005	Interim system by end of 2005 with further refinement in 2006
	Watershed Integrity Management Framework	Q4 2003		Q4 2005	Deferred to 2006
	Surface Water Quality Objectives	Q2 2003	Q3 2003	No longer being worked on by CEMA.	
Sustainable Ecosystem WG	Ecosystem Management Tools		Q4 2002	Completed February 2004	
	Management Systems far Cultural and Historical Resources	Q2 2002	Q4 2003	Q4 2005	Deferred to Q4 2006
	Management Systems for Wildlife and Fish	Q3 2003	Q4 2003	Q4 2006	Deferred to Q4 2007
	Management Systems for Biodiversity	Q1 2003	Q4 2004	Q4 2007	
Trace Metals & Air Contaminants WG	Trace Metals Management System	Q4 2001	Q2 2002	Implemented May 2002	
	Trace Air Contaminants Management Objective	Q1 2003	Q2 2003	Q4 2006	Deferred to 2007/08
	Health Risk Assessment for Fort McKay			2007	Revised to general health risk assessment 2007
Reclamation WG	Landform Design Performance Objective (landform design checklist)	Q4 2002	Q4 2002	Completed Q1 2005	
	Land Capability Classification System (2nd Edition)			Q4 2005	
	Revegetation Manual (2nd Edition)			Q4 2005	Delayed to 2006
	Criteria for Reclamation Certification	Q4 2004	Q4 2004	Q1 2005	Delayed to 2006
	Landscape Design Guide			Q1 2005	Q4 2005 Expected
	Guidelines on Practical Methods to Re-establish Biodiversity and Wildlife	Q4 2005	Q4 2005	Q4 2005	
	Guidelines for Designing End Pit Lakes			Q4 2007	
	Guidelines for Wetland Establishment (2nd Edition)			Q3 2009	

*Q = annual quarter (i.e., January–March (Q1); April–June (Q2); July–September (Q3); October–December (Q4))

▲ *TABLE 7: Projected timelines for CEMA Working Group deliverables from 2001, 2002 and 2005*