Assessing Environmental Regulation in the Canadian Oil Sands

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About This Report

Purpose. This IHS CERA report assesses the environmental regulation system in the oil sands. How does the regulatory system in the Canadian oil sands compare with those of other jurisdictions? Are project approvals, ongoing monitoring, and final project reclamation requirements comparable? What are the similarities and differences?

Context. This is the second in a series of reports from the IHS CERA Canadian Oil Sands Energy Dialogue 2011. The dialogue convenes stakeholders in the oil sands to participate in an objective analysis of the benefits, costs, and impacts of various choices associated with Canadian oil sands development. Stakeholders include representatives from governments, regulators, oil companies, shipping companies, and nongovernmental organizations. The 2011 Dialogue program and associated reports cover three oil sands topics:

- **Major Sources of US Oil Supply: The Challenge of Comparisons**
- **Assessing Environmental Regulation in the Canadian Oil Sands**
- **Life-cycle Greenhouse Gas Emissions Reexamined**

These reports and past Oil Sands Dialogue reports can be downloaded at www2.cera.com\oilsandsdialogue.

Methodology. This report includes multistakeholder input from a focus group meeting held in Calgary, Alberta, on June 28, 2011, and participant feedback on a draft version of the report. IHS CERA also conducted its own extensive research and analysis, both independently and in consultation with stakeholders. IHS CERA has full editorial control over this report and is solely responsible for the report's contents (see end of report for list of participants and IHS CERA team).

Structure. After the introduction, the report has three parts followed by a conclusion and an appendix.

- **Introduction**
- **Part I—**The Project Approval Process
- **Part II—**Ongoing Operations
- **Part III—**Project Closure
- **Conclusion**
- **Appendix—**Website Links to Data Sources

We welcome your feedback regarding this IHS CERA report. Please feel free to e-mail us at info@ihscera.com and reference the title of this report in your message. For clients with access to IHSCERA.com, the following features related to this report may be available online: downloadable data (excel file format); downloadable, full-color graphics; author biographies; and the Adobe PDF version of the complete report.

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ASSESSING ENVIRONMENTAL REGULATION IN THE CANADIAN OIL SANDS

KEY IMPLICATIONS

The environmental regulatory system in the Canadian oil sands has been depicted as "weak" by its critics and "stringent" by its supporters. Comparing the oil sands environmental regulatory system with those in South Australia and Alaska demonstrates that, for the cases considered, there are many more similarities than differences:

- **Project-level regulation in the Canadian oil sands is generally similar to its peers, considering the procedures, data requirements, and measures to protect the environment.** The project approval, ongoing operations, and project closure phases of a project's life—including the data required and process—are similar across all three jurisdictions.

- **Data availability and transparency for oil sands are comparable, if not superior, to others when considering project approvals, reclamation financial security, enforcement, and inspections.**

- **There are differences in process sequence.** For Canadian oil sands, lands are leased to industry for the purpose of oil or resource extraction prior to studying the environmental impacts or consulting the public. In Alaska, the process proceeds in the opposite order.

- **Some oil sands reports are not digitized.** For South Australia and Alaska mining, since detailed environmental reports can be accessed online, the public can more easily monitor the activities of industry. For oil sands, since these reports are not online, it is more difficult for the public to scrutinize operations.

- **Financial security differs.** For surface mining, in case operators go bankrupt and cannot reclaim their disturbed lands, all regulators require financial securities. For the oil sands, the method differs from that of South Australia and Alaska.

—December 2011

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ASSESSING ENVIRONMENTAL REGULATION IN THE CANADIAN OIL SANDS

SUMMARY OF KEY INSIGHTS FROM IHS CERA'S ANALYSIS

The environmental regulatory system in the Canadian oil sands has been depicted as "weak" by its critics and "stringent" by its supporters. To understand the rigor of the regulatory system, first an appropriate peer group must be identified. A screening process identified South Australian mining and Alaskan mining and oil operations as suitable peers for oil sands—their operations are of similar size and scope, and they have comparable governance, resource investment, and development philosophies. Comparing the oil sands environmental regulatory system to South Australia's and Alaska's demonstrates that, for the cases considered, there are many more similarities than differences.

Project-level regulation in the Canadian oil sands is generally similar to the peers in this report, considering the procedures, data requirements, and measures to protect the environment. The project approval, ongoing operations, and project closure phases of a project's life—including the data required and process—are similar across all three jurisdictions. Similarities include the approval process, public consultation and outcomes during approvals, the use of inspections and enforcement, and requirements for environmental monitoring. Although it is too early to fully assess the success of oil sands mine closure regulations—since oil sands mines have yet to be closed—the system is currently being strengthened to provide more specific mine closure performance metrics that are similar to those of the other jurisdictions.

Data availability and transparency for oil sands are comparable, if not superior, to others when considering project approvals, reclamation financial security, enforcement, and inspections. For all three jurisdictions, information supporting the project approval process—including environmental impact assessment reports, public comments, and operator's responses to these comments— is readily available. Considering the transparency of inspections and enforcement activities, oil sands data availability ranges from comparable to superior to others. For reclamation financial securities, oil sands regulators provide information on both the funds reserved and the lands disturbed by operations, a level of information that is comparable to Alaska and better than South Australia.

Although there are many similarities, there are also differences. For Canadian oil sands, lands are leased to industry for the purpose of oil or resource extraction prior to studying the environmental impacts or consulting the public. In Alaska, the process proceeds in the opposite order. In Alaska, before a major area is opened up to oil and gas or mineral extraction, an environmental impact assessment is conducted, and stakeholders are consulted. Only after the decision is made to approve resource extraction are lands awarded to resource developers—with stipulations and conditions for the region as a whole. With oil sands, however, only *after* the lands are awarded to developers for oil extraction are the environmental impacts of the proposed development studied and communicated to the public. Over the past decade, as the number of oil sands projects increased, questions were raised about the impacts of the development on the region as a whole. For instance, would biodiversity be sufficiently protected? Would water supplies meet growing demands?

To address these regional issues, Alberta is in the process of establishing a regional plan that encompasses the oil sands development area. If approved, the plan aims to establish regional environmental limits to manage the cumulative effects of development—setting regional thresholds for water, air, biodiversity, and land. In the future, all development in the region (including oil sands projects) will need to stay within these limits. Consequently, under the proposed plan, oil sands projects, similar to projects in Alaska, would have regional stipulations and conditions.

For South Australia and Alaska mining, since detailed environmental reports can be accessed online, the public can more easily monitor industry activities. For oil sands, since these reports are not online, it is more difficult for the public to scrutinize operations. The recently launched Oil Sands Information Portal (OSIP) provides one window for the public to view key oil sands metrics (for instance, regional and project-level metrics for water, land, greenhouse gas [GHG] emissions, and tailings ponds), but not all monitoring information is online. For instance, oil sands operators regularly submit environmental monitoring reports (totaling hundreds of pages) to the regulators. These types of reports are available online for Alaska mining and South Australia projects, but they are not online for oil sands. However, the public can obtain these operator reports through an information request or, for mining projects, at the Government Library. These detailed oil sands monitoring reports are not digital, and consequently often an inquirer must visit Edmonton, Alberta, to actually view the reports.

Although active mines in Alaska and South Australia have formal requirements for frequent public consultation during operations, their oil and gas developments have no formal requirements. For the oil sands industry, during the operational phase of a project, the regulatory system also has no formal requirement for regular consultation. Even when there is no formal requirement, in all three jurisdictions, many operators consult voluntarily with local stakeholders on a regular basis. The amount of information provided to stakeholders has increased over time, as companies are responding to growing demands for information.

For surface mining, in case operators go bankrupt and cannot reclaim their disturbed lands, all regulators require financial securities. For the oil sands, the method differs from the peer group. For Alaska and South Australia, the financial securities are intended to cover all estimated reclamation costs, whereas in oil sands, only part of the reclamation cost is paid by the funds in the government's financial security; the remainder of the cost is covered by the value of the resource (which in this case is bitumen). Only when the project starts nearing the end of its life (defined as when 15 years of reserves remain) are more funds required from the operator.

INTRODUCTION: ASSESSING ENVIRONMENTAL REGULATION IN THE CANADIAN OIL SANDS

REGULATION OF RESOURCE DEVELOPMENT

Oil supply from the Canadian oil sands has come under scrutiny on various fronts. One issue is the comprehensiveness of environmental regulation in oil sands development. The purpose of this IHS CERA report is to consider how the environmental regulation system in the oil sands compares with those of other jurisdictions. Are project approvals, ongoing monitoring, and final project reclamation requirements comparable? What are the similarities and differences?

In developing oil and gas or mineral resources, government regulation aims to account for the needs of a wide group of stakeholders. For instance, the owners of the resource (whether government or individuals) require financial gain in exchange for efficient and responsible exploitation of their resources. Others, especially those directly affected by the project, need to understand both the positive and negative impacts that could arise from the development and to be assured that the regulator is protecting their interests.

Within this broader context, the primary goal of environmental regulation is to minimize the adverse effects, to manage the risks associated with resource development, and to inform stakeholders by providing information about these effects and risks.

FINDING PEERS FOR CANADIAN OIL SANDS: SOUTH AUSTRALIA AND ALASKA

To compare regulation in the Canadian oil sands to others, an appropriate peer group with high regulatory standards must first be identified. The peer group is an important consideration; without a peer group, one could set unreasonable standards for comparison and therefore make an inaccurate assessment. Ideally, the regulators should be similar—quasi independent, with projects of similar size and scope to those in the oil sands (see the box "Oil Sands Primer") and with comparable resource investment and development philosophies.

The independence of regulators varies considerably across the globe. For the oil sands, energy regulation is the responsibility of government agencies that, by design, have checks and balances among them to protect the public. The primary regulator for the Canadian oil sands is the Province of Alberta—with regulatory authority over resources, environment, First Nations consultation (related to resource development), and surface disturbance.[1]

The Canadian federal government also has jurisdiction over, and primary regulatory responsibilities for, among others, fish and fish habitat, changes to the navigation of waterways, and migratory birds and endangered species.[2]

1. In 1930, when the natural resources in Alberta were transferred from the federal government to the provincial government, the obligation to consult with First Nations groups under Treaty 8 fell to the province as well. The federal and provincial government must both consult with Aboriginal communities where they "contemplate crown conduct" that could have an impact or infringe on asserted rights.
2. Other federal responsibilities include to assess the impacts of proposed projects and to monitor and regulate pollutants—including toxic substances, air pollutants, and GHGs.

The approach to investment and development also influences the style of regulation. Jurisdictions like Alberta and Canada that are open to investment by independent companies generally provide transparent resource regulation. Countries that place more limits on who can develop resources generally provide less publicly available data, and this makes regulatory comparisons difficult.

The following criteria were used to identify a peer group for oil sands:

- **Developed countries, defined by membership in the OECD**. The OECD requires member countries to have an advanced regulatory system that is transparent and inclusive.
- **Jurisdictions with sizable volumes of land-based oil production (more than 0.5 million barrels per day [mbd]) and/or have an established mining industry.** Although Norway and the United Kingdom are large OECD oil producers, their oil is produced offshore. Many offshore regulatory requirements are not comparable with those in the oil sands.
- **Countries open to independent investment for resource development.** Mexico is a large OECD oil producer, but the state-owned oil company is the sole producer, and thus Mexico currently does not have sufficient transparency in its regulatory system to support a comparison to oil sands.

Using these criteria, Canadian oil sands peers include the United States and Australia. In Australia and the United States, similar to Alberta, the state or province typically leads the regulation of resource development. Therefore, states with comparable operations to Alberta must be identified.

Since oil sands are extracted through two means, surface mining and wells, the size of the mining and oil sectors in each jurisdiction is pertinent (see the box "Oil Sands Primer"). Table 1 highlights the relative size of the mining and the oil industries for South Australia, Alaska, and Alberta. Alberta is the only jurisdiction that extracts oil from surface mining, so the economic value of the total annual production between the mining industry for South Australia and Alaska (all resources extracted) is compared with that of the oil sands.

Alaska both produces oil and mines minerals. By quantity, some of the top minerals mined are lead, zinc, and coal. In Alaska, both the conventional oil and the mining industries are sizable—each has individual projects comparable in size to oil sands projects. South Australia's oil industry is small compared with that of Alaska and Alberta; therefore, in this report, Alberta regulations are compared mostly with South Australian mining projects. In South Australia, by quantity some of the top minerals mined are iron ore, coal, and copper.

ALASKA AND SOUTH AUSTRALIA ARE "PROJECT-LEVEL" PEERS

Although only part of the oil sands region will be developed at any one time, in aggregate about 21% of the total area of Alberta is leased for eventual oil sands development (18% for in-situ development and 3% for surface mining). The oil sands total area is about 55,000 miles square, or similar to the size of the state of New York. To date, land disturbed by surface mining is about 250 square miles, or about half the size of the central city of Houston,

Oil Sands Primer

The immensity of the oil sands is their signature feature. Current estimates place the amount of oil that can be economically recovered from Alberta's oil sands at 170 billion barrels—enough oil to solely supply 25 years of US oil demand.*

The oil sands are grains of sand covered with water, bitumen, and clay. The oil in the oil sands is called bitumen, extra-heavy oil with high viscosity. Given their black and sticky appearance, the oil sands are also referred to as "tar sands." Tar, however, is a man-made substance derived from petroleum or coal.

Oil sands are unique in that the vast majority is produced via both surface mining and in-situ thermal processes.

- **Mining.** About 20% of currently recoverable oil sands reserves lies close enough to the surface to be mined. After the sand is dug out, it is transported by truck and sometimes by pipeline to a processing facility. Slightly less than half of today's production is from mining, and we expect this proportion to be roughly steady through 2030.
- **In-situ thermal processes.** About 80% of the recoverable oil sands deposits are too deep to be mined and are recovered by drilling wells. After steam is injected into the wells, oil flows to the surface through the production wells. Such methods are used in oil fields around the world to recover very heavy oil. Two thermal processes are in wide use in the oil sands today: steam-assisted gravity drainage (SAGD) and cyclic steam stimulation. In-situ thermal makes up about 35% of 2010 oil sands production and is expected to grow to more than 45% of oil sands production by 2030. Thermal recovery methods have reduced the amount of energy needed to recover bitumen, and such innovations are likely to continue in the future.
- The remaining oil sands production is extracted without steam or mining using conventional heavy oil cold-flow methods.

*Assumes average US petroleum demand over the next 25 years (excluding biofuels) is 18 mbd.
Source: IHS CERA.

Table 1

Size of Mining and Oil Sectors: Oil Sands, Alaska, and South Australia

	2010 Oil Production (bd)	2010 Mining Commodity Values (US dollars per year)
Canadian oil sands	750,000 (production from wells)[1]	$23 billion (production from surface mining)[2]
Alaska	647,000[3]	$3.1 billion[4]
South Australia	16,000[5]	$3.6 billion[6]

Source: IHS CERA.
1. Alberta Energy Resources Conservation Board (ERCB), *Alberta's Energy Reserves 2010 and Supply/Demand Outlook 2011–2020,* June 2010. Note: combined volume of in-situ (CSS and SAGD) and primary bitumen production.
2. Ibid. Value of SCO production at Alberta bitumen reference price, and average 2010 exchange rate used is 1.03 US dollar/Canadian dollar.
3. Alaska Department of Natural Resources (DNR) Division of Oil and Gas, Annual Gross Production Off State Lands, 2010. http://dog.dnr.alaska.gov/Royalty/Production.htm.
4. DNR, 2010 Alaska's Mineral Industry, 2010. Note: includes all mined resources, such as gold, silver, coal, tin, peat, rock, jade, soapstone, and ceramics.
5. Primary Industries and Resources South Australia (PIRSA), *MESA Journal,* March 2011, Volume 60. Note: includes both crude oil and condensate production.
6. Ibid. Note: includes all mined resources, such as opal, copper, iron ore, gold, and uranium oxide, and average 2010 exchange rate used is 1.09 US dollar/Australian dollar.

Texas. Oil production could grow from 1.5 mbd currently to between 3.0 mbd (moderate growth case) to 6.3 mbd (stretch growth case) by 2035.[1] Because of the potential scale, geographic reach, and undeveloped state of much of the land already leased for oil sands development, there are concerns about the cumulative impacts of this scale of development. To prepare for the projected growth in oil sands, initiatives are under way. For instance, the Cumulative Environment Management Association (CEMA) studies the environmental effects from development as a whole, and regional air and water monitoring systems are in place and are being further strengthened. These types of regional initiatives, at the scale of oil sands, were not observed in the other two jurisdictions. However, comparatively, the projected growth of the mining and oil and gas sectors of South Australia and Alaska are relatively small; consequently, although the project-level regulatory systems are generally comparable, the regional regulatory, planning, and monitoring requirements are not necessarily comparable (given the different growth trajectories). For that reason, in most cases this report focuses on the project-level requirements.

COMPARING ENVIRONMENTAL REGULATION IN OIL SANDS

The remainder of this report is in three parts, followed by a conclusion. The three parts compare how the regulatory system manages and communicates risk throughout three stages of an individual project's life cycle: approval, the ongoing operations, and the final closure of the project. To be sure, this report is not a comprehensive list of all aspects of oil and gas regulation; rather, it serves as an illustrative case study to evaluate some specific examples.

- Part I—Project Approval Process
- Part II—Ongoing Operations
- Part III—Project Closure
- Conclusion

The appendix provides data sources and website links that support this analysis.

1. See the IHS CERA Special Report *Growth in the Canadian Oil Sands: Finding the New Balance.*

PART I: PROJECT APPROVAL PROCESS

An objective of the project approval process is to inform decision makers and stakeholders about the proposed operation—including the benefits, potential adverse environmental impacts, and risks. For a brief description of Alberta, Alaska, and South Australia's project approval process, see Table 2 and the box "Comparing Project Approval Processes."

Among Alberta, Alaska, and South Australia, many features of the approval process are similar. Project-specific data requirements are similar. All involve a multiyear process that

Table 2

Key Metrics: Comparing Project Approval Processes

	Alberta	Alaska	South Australia
Approval process for large projects	Project-level approval after lands are leased	For larger, multiproject developments, first step requires regional environmental assessment/approval; next step is leasing lands, and final step is specific project-level approval process	Project-level approval after lands are leased
Data to support application	Topics covered are similar to others; initial application report (EIA) in the range of 1,800 to 4,000 pages of text	Topics covered are similar to others; federal application report (Environmental Impact Statement [EIS]) in the range of 1,200 to 2,000 pages of text or more	Topics covered are similar to others; major projects application report (EIS) over 2,000 pages of text
Timeline for project approval	Three to six years, depending on complexity, opposition, and/or federal involvement	For development fitting within a previous regional assessment/ approval, typically between 12 to 18 months but can be as long as three years	Recent major mining project took six years
Public consultation requirements	Written comments, plus some projects have formal hearings—like court proceedings, often span two weeks	Written comments, plus some projects have "town hall" style meetings	For major projects, written comment and "town hall" style meetings
Data availability	Readily available on Internet	Readily available on Internet	Readily available on Internet

Source: IHS CERA.

comprehensively documents the project, its potential risks, and plans to mitigate these risks. Also, all three jurisdictions ensure that the public can comment on the planned project and that data and documents regarding the project are readily available to the public.

Public Consultation: Some Differences in Process

There are some differences in the public input process. In South Australia, depending on the scope of the project, formal consultation is not always required, whereas generally the Alaskan approval process provides for public comments. For both jurisdictions, the comments can be written, or they may be provided at open "town hall" style meetings in affected communities; typically, the meetings are less than one day. Anyone can comment—even individuals not from the community or even the country.

Similarly, in Alberta, public comments are open to anyone and can be provided in writing to the regulator and project developer. When a concern is raised that cannot be resolved through dialogue with the developer, or if the regulator requests, a formal hearing can be initiated. The hearing meetings can span a few weeks or more and are similar to court proceedings. For Alberta-only applications (as opposed to joint federal/provincial applications) to trigger a formal hearing, the individual or group must prove that it is directly affected by the project. However, once a hearing has been triggered, hearing proceedings are open to anyone—as in Alaska and South Australia.

When considering the effectiveness of public consultation, it's important to consider whether the efforts result or can result in any material changes to projects. In Alberta, South Australia, and Alaska, project approvals are typically subject to numerous conditions that are a direct outcome of stakeholder input. For instance,

- In Alaska, responding to public concerns, the True North mine had to build an expensive highway crossing and add light and noise provisions to address public, safety, and agency concerns.[1]

- ConocoPhillips Alaska "CD5 Drillsite Development" project was redesigned in response to the North Slope Borough and native residents. However, despite these changes, the project was still denied approval at the federal level. After a year of appeals and negotiations, ConocoPhillips won the appeal with additional conditions for development.

- In the Alberta oil sands, Suncor Energy's approval for a mine extension and upgrader had seven conditions. One condition required Suncor to speed up tailings pond reclamation. Another required a change in the mine plan to protect a wildlife corridor. Suncor agreed to meet all conditions.[2]

1. Source: Alaska Department of Natural Resources (DNR) and University of Alaska Fairbanks Cooperative Extension.
2. Big Reserves, Big Responsibility—Developing Alberta's Oil Sands, Alberta Energy Resources Conservation Board (ERCB), March 2011.

- In South Australia, the recent approval for the Olympic Dam, a copper and uranium mine, had more than 100 conditions. One condition requires the developer to create an offset area of 140,000 hectares to conserve biodiversity.[1]

It is important to note that although all jurisdictions have numerous examples in which public concerns result in material changes to a proposed project, this is not always the case. Public concerns are not always addressed in project approvals. Sometimes the potential alternative is deemed cost prohibitive or the best available alternative is deemed to create new, equally adverse consequences.

What Is First: Approval or Land Sale?

In the Alberta oil sands, lands are leased to industry for the purpose of oil or resource extraction prior to initiating the project approval process. The Alberta system differs from Alaska in this respect. In Alaska, for a substantial development, one that includes multiple projects, before a major area is opened up to resource extraction, the public is notified, and an environmental assessment of the impacts for the region as a whole must be approved, including effects on habitat of fish and wildlife and foreseeable cumulative effects.[2] Only after the decision is made to approve resource extraction are lands awarded to resource developers in a lease sale. The lease sale offering is made to operators with full knowledge of all stipulations and conditions associated with the approval for the region as a whole. For Alaska, because the overarching development has already been subject to the previous regional environmental assessment (prior to the lease sale), each individual project fitting under this umbrella may have a shorter review period. This regional assessment approach is typically used only for larger-scale developments or when projects are subject to federal rules. Recently, this approach was used for a new oil and gas development—about one-fifth the area of oil sands.[3]

This required regional environmental impact assessment (to set environmental goals for the area as a whole) prior to deciding to develop the resource is a significant difference between Alaska and Alberta. As demonstrated by our research, Alberta oil sands developments go through a comprehensive project-specific approval process and evaluation. But as the scale of development and the number of projects have increased dramatically, concerns about the cumulative impact of development on the region as a whole have emerged. To address this issue, the province of Alberta is now introducing a regional plan for the oil sands, called the Lower Athabasca Regional Plan (LARP). The draft plan, released in August 2011, considers the potential regional impacts under different oil sands growth scenarios. If approved by government, the plan will create new conservation areas and set regional environmental limits for air, water, land, and biodiversity for the oil sands (see the conclusion of this report for more information on LARP). Under the proposed plan, oil sands projects, similar to projects in Alaska, would be subject to regional stipulations and conditions.

1. See more information on the Olympic Dam copper and uranium mine October 2011 approval: http://www.environment.gov.au/minister/burke/2011/mr20111010.html.
2. Typically, for federal lands this is a National Environmental Policy Act (NEPA) Environmental Impact Analysis (EIA), or for state lands a Best Interest Finding (BIF).
3. The BIF for the North Slope Foothills area covered 7.7 million acres; the oil sands covers 55,000 square miles, or over 35 million acres.

What comes first, the land sale or the regional environmental assessment, is a factor shaping the timeline for project approval. In Alberta and Australia, a "significant impact" project can take up to six years between initiating the project application and finally receiving approval. For Alaska, for a project that falls under a previous regional approval, the process for a new approval is usually shorter, approximately 12–18 months, but legal suits on more controversial projects can even out the timelines. In Alaska, a legal challenge with multiple appeals can add two or more years to the regulatory timeline. In South Australia, following a decision on a major project, there are no appeal rights with the regulatory agency. In Alberta, appeals to the regulatory agency are rare and appeal rights are limited. However, for both Alberta and Australia, legal complaints on regulatory decisions can still be filed with the courts, and in Alberta, disputes can also be reviewed by the Environmental Appeals Board.

Rubber Stamp Approvals?

One criticism of oil sands is that projects are always approved. To date, no commercial-scale oil sands project has been denied approval. Comparatively, looking at major projects from South Australia, of the 29 projects assessed since 2003 (ranging from major mining projects to installing new lighting at a stadium), just two projects were refused. For Alaska over the past 10 years, only one federal project has been denied approval, and the appeal for this case is pending.[1] For all jurisdictions, one reason for few project denials is that during the approval process, if a project developer discovers that it cannot meet the requirements, it generally terminates the costly application process or changes the project design to meet the alternative approach preferred by the regulator. These changes can increase project costs and/or delay the timeline. For Alberta, Alaska, and South Australia, although most projects that do successfully navigate the process are approved, they are not "rubber stamped."

For Alberta, because the government leased oil sands lands to developers for the purpose of oil extraction *prior* to the regional environmental assessment and study of overall cumulative impacts (see What Is First: Approval or Land Sale? above), if the project meets the project-level requirements of the regulators and addresses affected stakeholders concerns, an approval should be expected. However, this system is now being adjusted. Assuming the proposed regional plan or LARP system is approved, future project approvals will consider regional environmental thresholds in addition to project-level requirements. As a result, in upcoming approvals, if development of a project would result in exceeding regional limits for land, air, water, or wildlife (based on evaluations of the status of environmental conditions), it would not be approved—or probably never even applied for.

1. This excludes wetland jurisdictions.

Comparing Project Approval Processes

Alberta

Process. To obtain approval for an oil sands development, the project developer (termed proponent) is subject to the provincial Environmental Assessment (referred to as an EA) process (under the Environmental Assessment Regulation, Mandatory and Exempted Activities, which lists activities that must undergo EIAs in Alberta).* In addition, if a federal "trigger" such as a fish compensation plan or authorization to cross a navigable waterway is required, a joint federal/provincial EIA is initiated. A federal/provincial review panel is appointed to review and assess the project, and the Canadian Environmental Assessment Agency (CEAA) is the lead federal regulator in the project application process.

The EA is the first step of the provincial regulatory process. First, the proponent issues a "proposed terms of reference" and a "project summary table." These documents provide high-level information on the project and information to be included within the EA report. If required, proponents also provide a First Nations Consultation Plan. After an open comment period, the Environmental Assessment Director issues the "final terms of reference." The next step is delivering the substantial amount of documentation required for the integrated application, which includes the EIA report and applications for approval (those required by the Alberta Ministry of Environment and Water and the ERCB).

Alberta Environment and Water and associated government agencies undertake a technical review of the EIA report to ensure the information meets the requirements set out in the final Terms of Reference for the Project. After this review, a determination is made on whether the EIA report is complete. The determination of EIA completeness does not represent acceptance or approval of the proposed project. The EIA report is then referred to the ERCB, which issues a decision on whether the project may continue the regulatory process. If the ERCB approves the project, the project application still requires a regulatory decision by Alberta Environment and Water under the Environmental Protection and Enhancement Act and Water Act. Sustainable Resource Development must also render a decision on the application under the Public Lands Act.

In Alberta, during the regulatory process, project proponents address comments from the public. Anyone can submit comments during the proposed terms of reference comment period. In a province-only approval process, either a "directly affected" stakeholder or the regulator can also trigger a public hearing; at the hearing, anyone can comment on the project. In a joint federal/provincial review, the regulators determine whether a public hearing is required. In a hearing under a joint review, just like in the provincial hearing, anyone can comment. Not all oil sands projects have public hearings.

If held, formal hearings allow regulators and the public to present their concerns and project developers to address them. These hearings are formal quasi-judicial proceedings, similar to court proceedings, and can span many days—a recent oil sand mine hearing lasted nine days. Following the hearing and responses to the concerns raised, a formal decision to approve or deny the project is issued. The complete process can take from two to six years depending on complexity, opposition, and/or federal involvement.

*Small in-situ projects (normally pilots) under 12,500 bd are considered discretionary activities, where Environmental Assessment Director determines whether an EA is required. If an EA is not required, the project has a shorter regulatory process.

Comparing Project Approval Processes (continued)

Data required. The integrated application document (which includes the EIA report and associated applications) for a typical oil sands mine is 10-plus volumes of text with over 4,000 pages. The report is a comprehensive overview of the project. The information provided includes plans for public consultation; health and safety requirements; economic benefits; animal and potential human health effects; impacts to water (including surface water and groundwater technical analysis), vegetation, and soil and analysis of numerous potential environmental impacts; traditional land use assessment; reclamation plans; and baseline environmental data. The integrated application also includes an assessment of the cumulative effects of the planned and approved projects on the environment near or downstream of the proposed project—including water, soil, air, and potential health effects. In addition to the EIA and approval application documentation, the application includes numerous other documents related to the project, including comments from affected stakeholders and the project developer's response to the comments.

For typical in-situ oil sands projects (which are smaller than mining projects), the integrated application is about six volumes of text, with over 1,200 pages. The EIA report comprehensively covers all aspects of the project, similar to the subjects covered within the mining application (see the appendix of this report for the website link to the Alberta Environmental Protection and Enhancement Act, which outlines the contents of an EIA report and approval application).

Data availability. All documents related to the application are posted online by the ERCB during the decision process. For a joint federal/provincial approval, the documents are also available online at the CEAA website. In addition, all approvals can be accessed online at the newly created OSIP (see the appendix of this report for website links to the approval documents).

Alaska

Process. The state-level environmental approval process in Alaska is decentralized. A major development project requires multiple approvals and permits from federal, state, and borough/local authorities. The specific approval process for each project is unique, depending on the project scope, the impacts, and whether the land is owned by state, federal, borough, or native authorities.

If the project falls within federal jurisdiction, a NEPA process is required. To determine the level of NEPA analysis required, a federal agency must first assess the project's impacts. There are three levels of NEPA; if the impacts are low, the proposed activity can be excluded from NEPA analysis. The second level is the environmental assessment (also known in this process as the EA) to determine whether a project would significantly affect the environment. The third level—reserved for projects with significant environmental impact—is the EIA. Most often, numerous federal agencies have jurisdiction over a project; therefore, one lead agency is assigned responsibility for conducting the NEPA analysis on behalf of all agencies. In some cases, an agency will begin a project with the less-detailed EA, and through its analysis determine that the potential impacts are significant, requiring the detailed EIA.

A project that only requires permits from the State of Alaska does not go through the NEPA process. However, state agencies still assess the impacts of the proposed project. For example, before a significant multiproject development (one that approaches the scope and geographic reach of oil sands) is approved for resource extraction, the regulator must first determine in a written finding that the activity is in the state's best interest—termed the BIF. The BIF discusses the potential cumulative regional environmental impacts from the activity—including foreseeable effects on the area's fish and wildlife, historical and cultural resources, and communities. The report is prepared for public review and comment. Sometimes the federal authorities cooperate

Comparing Project Approval Processes (continued)

with the state agencies on a BIF. However, for smaller projects in the state, such as an individual mine, an alternative approach is used—here the environmental assessment is made at the project level only, similar to Alberta.

For an onshore oil and gas development, the permitting and siting can involve as many as 20 regulatory stakeholders, each with unique requirements. Alaska does not have a formal comprehensive public consultation policy. However, most state permits require a public comment period and many allow for public hearings. Permitting agencies typically allow a 30-day comment window for the public to register concerns, which regulators can extend if public interest warrants it. In addition, project developers are encouraged to consult with the public early in the process and to show previous consultation efforts in their permit applications.

For the federal NEPA process, if the project is determined to have a significant environmental impact, a Draft Environmental Impact Statement (DEIS) is issued. The lead regulator conducts public scoping meetings to identify issues that need to be addressed in the DEIS. Once the DEIS is prepared, it is presented for public review and comments, and additional public hearings or open houses are conducted in the affected communities. The meetings use either a "town hall meeting" format or a formal public hearing meeting that is open to anyone. Following this process, the final Environmental Impact Statement (EIS) is issued that includes a response to the public comments. If a federal agency conducts an EA in lieu of an EIS and determines the project would not significantly affect the environment, a Finding of No Significant Impact (FONSI) is issued. After public comments and consulting other agencies and regulators, the lead regulator issues a decision to approve or deny the project. The approval process for a significant development, one that requires both state and NEPA approvals, typically takes between 12 and 18 months but can be more than three years. If only the shorter EA is required, a project approval process can typically be completed in less than 10 months.* For smaller state projects, such as an individual mine, that do not fall under an existing regional approval, the timeline for an approval typically ranges between two and three years.

Data required. Since the NEPA process is typical for a project on the scale of oil sands, we look at NEPA data requirements here. The EIS for a significant mine or oil development project typically totals from 1,200 to 2,000 pages or more. However, documents referenced, such as baseline studies on many projects, can greatly increase this number. Examples of information typically provided in the EIS include the purpose and need for the project, a description of the affected environment (including the human environment), potential alternatives to the project, impacts to the environment—both direct and indirect and cumulative (with both the proposed project and alternatives), plans to mitigate and monitor adverse effects, reclamation requirements, other permits under application (state, federal, and local agencies), tribal and regional consultation plans, and public comments from both hearings, with written responses from the developer. In addition to the EIS materials, more documentation is required for various permits at the state, federal, and local levels and for compliance with other federal acts, such as the Endangered Species Act. The EIS also lists all public meetings held, identifies speakers, and includes the developer's responses to each concern raised (see the appendix for a website link to the regulations for implementing NEPA, which outline the contents of an EIS report).

Data availability. For NEPA approvals, the final EIS documents are posted online at the lead agency's website. In Alaska, they are also available at the agency's office, in libraries, and in other public places. Active mining projects have a comprehensive summary of permits online. For oil and gas developments, the permits for individual projects are not online but can be requested from each regulator (see the appendix for websites with approval documents).

*Source: US Department of Energy, *NEPA Lessons Learned,* September 1, 2011, Issue No. 68, Third Quarter FY 2011.

Comparing Project Approval Processes (continued)

South Australia

Process. In South Australia, mines and oil and gas developments have separate processes. Mines go through a two-stage process—first obtaining a mining lease and second obtaining approval for a project's Program for Environmental Protection and Rehabilitation (PEPR).* The mining lease proposal identifies the project's risks and presents the likely outcomes of the project, and demonstrates the benefit to the public. The mining lease proposal includes the baseline environmental description, risks associated with the project, and details on vegetation clearing. For mining, the PEPR process requires that environmental outcomes are developed in consultation with landowners and any stakeholders at the mining lease assessment stage of the project approval.

Petroleum activities have another approval process, governed by the Petroleum and Geothermal Act 2000. Each land area in South Australia is governed by a Statement of Environmental Objectives (SEO) that includes regional environmental objectives and the criteria to measure the success or failure of projects in meeting these objectives. South Australia oil projects are much smaller in scale and environmental impacts than projects in Alberta and Alaska. Therefore, the SEO documentation is relatively less detailed.

Projects deemed "major projects"—those with similar scope to many oil sands projects—require a separate and more detailed assessment process, with multiple chances for the public to comment. First, the project must prepare an application, followed by an Environmental Impact Statement (also known as an EIS) that is made available for public comment. The project developer holds a series of public meetings in communities potentially affected by the development. The project developer must respond to comments raised by the public and government agencies in a written response or a supplemental EIS. The next step is a second round of comments on this response, followed by additional responses from the developer, before the government agencies render a decision to approve or deny the project. A recent approval for a copper and uranium mine (called the Olympic Dam)—estimated to eventually cost between AUS$20 and $30 billion, or about two to three times more than a typical oil sands mine—took six years.

Data required. For a major project, the EIS is typically over 2,000 pages. The EIS is a comprehensive summary of the project. Examples of information provided include the need for the project, potential alternatives to the project, impacts to the environment (from both the proposed project and alternatives), plans to mitigate and monitor effects, reclamation requirements, Aboriginal and nonaboriginal cultural heritage, consultation plans, social considerations, labor supply, health and safety, and public comments from both public meetings and written responses. The documentation also includes major public concerns—grouped into major issues/themes—and the developers' plans to mitigate these concerns (see the appendix for a website link to the Development Act 1993, which outlines the requirements for the major projects process and the EIS document).

Data availability. Information on major projects currently being assessed can be found online. Older documents related to approved resource developments can be searched using an online database called South Australian Resource Information Geoserver (SARIG). Documents supporting mine projects that do not fall into the major projects category can also be found on the SARIG database. Documents supporting the oil and gas approval process are found at the Primary Industries and Regions South Australia (PIRSA) Petroleum website. Also, if a document is not available to download directly from the database or website, it can be requested (see appendix for website links to SARIG database and PIRSA).

*The South Australia mining act was amended in July 2011; prior to this the approval was called Mining and Rehabilitation Program (MARP).

PART II: ONGOING OPERATIONS

Regulatory regimes place considerable focus on the project approval process, although it represents a relatively small part of a project's life. Major resource developments are often operational for 30 years or more. The primary objective of regulators during ongoing operations is to ensure that operators comply with regulations.

To compare regulation during the operational phase for Alberta, Alaska, and the state of South Australia, the following activities are analyzed:

- Environmental monitoring
- Ongoing consultation
- Inspection and enforcement

ENVIRONMENTAL MONITORING

Monitoring is required to check whether project outcomes and impacts are consistent with the project approval, with environmental protection standards, and with statutory obligations. Alberta, Alaska, and the state of South Australia all require operators to regularly submit environmental monitoring data.

Table 3 and the box "Comparing Project-level Environmental Monitoring" evaluate project-level monitoring requirements for air, water quality, and biodiversity. To be sure, the aspects considered are not a comprehensive list of all environmental attributes that should be monitored; rather, they serve as illustrative case studies to evaluate requirements across these regions.

Regulatory requirements for air, water quality, and biodiversity monitoring across the three locations are similar, and when specific requirements differ, most often project-level

Table 3

Key Metrics: Project-Level Environmental Monitoring Processes

	Alberta	Alaska	South Australia
Air, water, and biodiversity monitoring requirements	Similar project-level requirements in all three locations	Similar project-level requirements in all three locations	Similar project-level requirements in all three locations
Data availability	Some project level environmental data online at OSIP; more detailed operator environmental reports at library or by request	Mining operations make detailed environmental reports available online. Some oil and gas data are online; most detailed information requires request	For both mining and oil and gas, detailed operator environmental reports are accessible though online database

Source: IHS CERA.

requirements are not directly comparable. For instance, requirements for monitoring surface water in South Australia, where most oil and gas or mining operations are in desert areas, are different from those for the Alberta oil sands, a wetland region. Monitoring requirements also vary by the type of development; gold or zinc mines have different potential contaminants and monitoring needs from oil sands developments. Even within a jurisdiction, environmental thresholds for similar projects can vary. For Alaska, some areas within the state are designated as "protected" and consequently they have stricter environmental thresholds.[1]

Overlapping Authority Can Create Conflict

For all three jurisdictions, overlapping authority between state and federal regulators or sometimes even among regulators within the same state or province can lead to conflict. Often, when the environmental impacts are transboundary (meaning that they cross borders), environmental limits and monitoring are subject to multiple authorities. For instance, pollutants made mobile in air or water can cross provincial or state boundaries. Biodiversity impacts can also cross borders. At times, this overlap in authority causes conflict, as the pollutants are subject to multiple regulatory agencies and rules.

In one example, the US federal government has listed beluga whales as an endangered species, and as a result some areas slated for oil and gas development in Alaska have become protected. Meanwhile, the State of Alaska (which is likely to lose oil and gas revenues from this decision) does not agree with the endangered status.

In South Australia, the federal Murray-Darling Basin Authority (MDBA) was established to protect an environmentally stressed water basin that spans five states and supports one-third of Australia's food supply.[2] With the formation of the MDBA, the federal government can override any state-level rules. In an effort to improve the river habitat, MDBA issued a draft plan to reduce water withdrawals by 27%–37%. With less water available for use, Australian states expect that they will suffer economic and social consequences, and they strongly oppose the plan.

The oil sands region also has overlapping jurisdiction between federal and provincial regulators. In one example, the federal government has jurisdiction over species at risk. If a species is considered endangered, the federal government can enact rules that override other activities in the region. Recently, environmental groups took the federal government to court over an overdue plan to protect and recover the oil sands region's caribou. The federal government—which currently lists these caribou as threatened under the Species at Risk Act—issued a draft plan two months later. In another example, authority for surface water overlaps between provincial and federal regulators. In the oil sands region, the Regional Aquatics Monitoring Program (RAMP) has been monitoring surface water since 1997. Over the years, the RAMP program had been criticized as being inadequate for detecting all changes in the watershed. In 2011, two independent studies were separately conducted by the federal and provincial governments, and both recommended development of a new

1. In Alaska, regions with stricter environmental thresholds for air because they do not meet national air quality standards are called nonattainment areas, whereas other areas such as national parks are protected under their class 1 area status.
2. Source: Australian government Murray-Darling Basin Authority.

oil sands regional monitoring system. The exact timing of the new system is uncertain, and plans are now being proposed. To date, regulatory authority overlaps have not created significant conflict for oil sands development, but the potential exists.

Differences in Data Availability

Although the monitoring requirements across the three locations are similar, public access to project-level environmental monitoring information varies across the three jurisdictions—Alberta, Alaska, and South Australia.

Oil sands data are available through Alberta Environment and Water's OSIP: the website includes project-level metrics and data covering air quality, GHG emissions, production, water, and land. The OSIP also publishes regional data for biodiversity, water, and aggregate environmental metrics for oil sands (total land disturbed, total tailings area, total water use, etc.). These regional metrics are unique and not readily available in South Australia or Alaska.

Although the Alberta OSIP provides data and metrics, in comparison to Alaska mining and South Australia operations the detailed data are less available. For instance, in Alberta each operator regularly submits detailed environmental monitoring reports to the regulators. These reports can span hundreds of pages and provide detailed monitoring data for each site. Although such reports are available online for Alaska mining and South Australia projects, they are not online in Alberta, nor are they digital, but they are publicly available. For mining operations, the reports may be obtained through the Alberta Government Library system. For in-situ projects, the reports can be accessed via an information request to the regulator. Because they reports are not digitized, after making an information request, one must personally visit the regulator's office in Edmonton Alberta to view the information.

Although the detailed environmental monitoring data for oil sands are less readily available than for Alaska mining and South Australia, Alberta does make data more accessible than Alaska does for its oil and gas operations. For Alaska oil operations, some data (air permits, water quality, water injection, federal biodiversity, and log data) are readily available online, but other environmental data must be requested from the appropriate regulator. In addition to providing more online data, the Alberta OSIP provides one window to find information. In Alaska, the online data are distributed among the numerous regulators' websites and can be difficult to track down. Also, the complexity of Alaska's state and federal jurisdictions requires a good understanding of all authorities in order to know who to ask to obtain information pertaining to one issue or permit. It is easiest in South Australia, where one regulator manages and provides most project-level information.

ONGOING CONSULTATION

During the project approval process, project operators in all jurisdictions undertake efforts to inform affected parties about the potential effects of the project. But after the project is built and operating, what requirements do the project operators have to keep impacted communities informed? Are a project's near-term plans and possible effects communicated to affected communities, and if so, how?

Comparing Project-Level Environmental Monitoring

Alberta

Air. Both oil sands mines and in-situ facilities are required to provide air quality reports to Alberta regulators. The reports include information from passive ambient air monitoring (including data on hydrogen sulfides [H_2S], sulfur dioxide [SO_2], nitrogen oxides [NO_x], methane, ozone, total suspended particles, and total hydrocarbons) and calculated total emissions of SO_2, NO_2, and fugitive emissions.* A number of facilities have continuous air monitoring installed, either on site or at a nearby regional station.** The oil sands region has 15 regional air monitoring stations providing online, real-time air monitoring data for pollutants (see appendix for website link to real-time oil sands regional air monitoring data). Each site classified as a large emitter must also report its GHG emissions. Air pollution can travel over provincial boundaries, and under the Canadian Environmental Protection Act, federal authorities monitor and make data available for air pollutants and GHGs as well as other pollutants.*** To date federal authorities have not enforced unique air regulations for oil sands. In the future, if the federal government were to regulate GHGs, it would be the first time the Canadian federal government exerted jurisdiction over air for oil sands.

Water quality. Projects that fall under the Navigable Waters Protection Act and projects that affect fish or fish habitat are under federal rules. Also, the federal government shares responsibility for water quality for transboundary waters (between provinces, territories, or federal-provincial crown lands). Therefore, both the federal and provincial governments have jurisdiction, and the Canada Water Act calls for joint consultation between federal and provincial authorities. For groundwater, typically the Alberta government is the lead authority, but federal authorities can also have jurisdiction if there is interaction with surface water.

To ensure that surface water and groundwater are not being adversely affected by operations, each oil sands facility monitors water level and quality in groundwater and surface water (streams, ponds, and lakes) around its site. Chemical analysis confirms conventional water quality parameters (such as total dissolved solids, pH, and hardness) and parameters indicative of pollution, such as dissolved metals, total metals, and dissolved hydrocarbons. Surface water is also tested for total suspended solids and biological changes (monitoring of fish and other species in the water). For oil sands sites that affect navigable water or fish habitat, both the provincial and federal authorities require monitoring reports.

Biodiversity. The federal government has developed a national biodiversity strategy in cooperation with the provinces and territories. A number of provinces and territories also have developed and implemented their own frameworks in accordance with the national guidance. The province is the lead regulator for most components of biodiversity. The exception is for migratory birds and national species at risk; here the federal government has certain responsibilities and can intervene if it is demonstrated that the province is not providing adequate protection.

For monitoring vegetation, each oil sands site is required to report infestations of harmful weeds and take all actions to mitigate their spread. Operators also report revegetation activities, such as progress to store native seeds and to reforest. Operators also conduct wildlife and bird monitoring, including documenting sightings and movements, and reporting activities to mitigate human interactions. All known wildlife and bird incidents are documented—including an itemized list of deaths and injuries.

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*Passive sampling gives indication of long-term values but is not sensitive enough to catch short-term peaks.
**Continuous sampling provides frequent measurements, capable of catching short-term peaks.
***Federal government is responsible for the National Pollutants Release Inventory (NPRI).

Comparing Project-Level Environmental Monitoring (continued)

Data availability. Production data, reports on tailings accumulations, and various operating data are online. Also regional and project-level environmental metrics are available through the OSIP. As for more detailed data, oil sands operators provide environmental data in various reports—conservation and reclamation, groundwater monitoring, soil management, and air quality monitoring. Report frequency varies by type—some are required monthly, quarterly, or annually. In addition, each mining project submits a comprehensive annual environmental report, totaling over 300 pages and consolidating the results of a number of reports into an annual review.

Although the more detailed operator environmental monitoring reports are public, the ease of accessing the data varies. The large annual mining reports can be found at the Alberta Government Library. Viewing in-situ reports requires an information request to the regulator. Information requests are common; currently, Alberta Environment and Water responds to between 25 and 75 information requests each week.

Although the detailed reports are available, the process is not always evident. For instance, it took a number of inquiries to learn that project-level annual mining environmental reports were at the library. Likewise, it took numerous inquiries to clarify the information request process needed to obtain the in-situ environmental reports. A further complication is the lack of digital reports, since viewing the documents requires a visit to the office or library, where they are located—often in Edmonton, Alberta.

Environment Canada also monitors and publishes pollutants in the NPRI (see appendix for website links to monitoring data).

Alaska

Air. As in Alberta, air quality in Alaska is regulated at both the state and federal levels. Although regulations typically follow the federal structure, the state's air quality program has some unique requirements for oil and gas developments. The air pollutants monitored are similar to those in Alberta—H_2S, SO_2, NO_X, methane, ozone, lead, total suspended particles, and total hydrocarbons.

All mines and oil production facilities require an air permit to construct and operate that governs the amount of contaminants each operation can emit. To comply with the permit, sites must monitor and report ambient and fugitive emissions, including any that exceed permit limits. For instance, a compressor station in Prudhoe Bay must continuously monitor air from exhaust stacks and estimate total carbon monoxide and NO_X emissions. For mining sites, monitoring dust is a key concern, especially in protected areas.

Air standards and reporting requirements are not uniform for every location or site. For instance, when an area is already under environmental stress or when a site frequently exceeds permit thresholds (termed *nonattainment areas*), more strict environmental requirements are often established. Also, as of July 2011, the US Environmental Protection Agency (EPA) requires Alaskan operators to report their GHG emissions.

Water quality. For mining and oil and gas developments in Alaska, numerous regulators (both state and federal) ensure that operations are not contaminating groundwater or surface water.

For mines, operations are required to monitor and report ground and surface water collection and treatment, hazardous chemical storage and containment, and disposal of wastes—everything from disposing mine tailings to sending solids to landfills.

Comparing Project-Level Environmental Monitoring (continued)

For oil and gas developments, a key concern is waste disposal into deep wells. Although oil and gas disposal wells are permitted by three state and federal agencies, the primary regulator is the Alaska Oil and Gas Conservation Commission (AOGCC). In addition to requiring that disposal volumes and reservoirs are monitored, the AOGCC requires groundwater to be monitored around the site. Surface water from nearby ponds, rivers, and creeks is tested. The water quality is checked by chemical analysis for total dissolved solids, pH, hardness, dissolved metals, total metals, and dissolved hydrocarbons. For surface water, biological changes are tested.

In addition to the AOGCC conditions, the state's Department of Environmental Conservation (DEC) also has authority over water quality—requiring monitoring and reporting from wells and surface waters. Other groundwater regulators include the federal EPA and numerous divisions within the state's DNR.

Biodiversity. Although both state and federal agencies regulate biodiversity, in many cases the federal government has the highest authority. Offshore, the state formerly had input through a coordinating agency (the Alaska Coastal Management Program), but this state-level program was discontinued in 2011 when the state legislature failed to reach an agreement on the renewal of the program, and funding was cut.

As in Alberta, the federal regulator also has authority over endangered species. The US Fish and Wildlife Service monitors threatened and endangered plant and animal species and their habitats and annually updates the candidate species considered for protection.

The state considers biodiversity when issuing permits for oil and gas or mining developments. Operators are often required to report and track changes in vegetation, wildlife observations and interactions, and any actions undertaken to mitigate conflicts with wildlife. For many projects, operators maintain wildlife interaction plans and require employee training before field operations begin.

Although it is a less frequent regulator for oil and gas projects, the state's Department of Fish and Game is tasked with the protection of fish and game and their habitat in the region. For instance, it has a wildlife action plan and manages in-stream flows to keep water levels sustainable for fish and other wildlife.

Data availability. For major mining operations, environmental data are easily accessible online. The Alaska Division of Mining, Land, and Water publishes annual environmental reports for each mine on its website. The environmental reports are similar in content and length to the Alberta mining annual environmental reports.

For biodiversity, the US Fish and Wildlife Service publishes notices regarding species and habitat status at the Federal Register, which are also made available on the agency website. For oil and gas developments, some permit and monitoring data are available online, including air quality permits, water quality data (through the EPA Enforcement and Compliance History Online [ECHO] database), well logs (DNR), and injection well data (AOGCC).

For other information, environmental reports can be obtained through information requests to the operator or the regulatory agency. Although not required, some operators post environmental reports on their company websites.

Because many different agencies issue permits (and therefore require environmental monitoring data), it can be difficult to identify the right agency for a data request (see the appendix for website links to environmental permits and reports). As in Alberta, not all data are digital. In these cases, typically there is a service (and fee) to reproduce and send the information.

Comparing Project-Level Environmental Monitoring (continued)

South Australia

Air. The state's regulator, South Australia Environmental Protection Authority (EPA), is the lead regulator for air. However, like the other jurisdictions compared, there is overlap with federal legislation and the Mining Act.* To comply with both requirements, large mining projects (comparable to oil sands projects) are required to submit air quality monitoring data. As with mines in Alaska, dust is a concern. Ambient dust monitoring sites are established to collect passive dust samples. Emissions from facility stacks are also monitored for pollutants such as acid gases (SO_2, NO_x) and particulates.

Water quality. Both the federal and state governments have jurisdiction over water. Generally the state is the lead regulator. However, in at least one region (the Murray-Darling Basin), the federal government is responsible for all water resource regulation and allocation.** Here the federal government can override state-level rules.

Large mining projects monitor groundwater and surface water. For groundwater, well bores are established around the site to collect water quality and level data. Chemical analysis tracks conventional water quality parameters (total dissolved solids, pH, and hardness). Sites track the water consumed, stored, and released to the environment. Because of the desert location, most sites in South Australia do not have permanent surface water. However, following each major rainfall event, surface water sediments, erosion, and flooding are tracked and reported.

Biodiversity. Typically the state is the lead regulator for biodiversity, but both federal and state levels have jurisdiction. For instance, in the Murray-Darling Basin, the federal regulator has authority over fish and river habitat. And like the other jurisdictions, the federal government can protect threatened species.

Large mines in South Australia must monitor vegetation, identify invasive weeds, and document actions taken to mitigate their spread. For mammals, reptiles, and birds, operators document actions to mitigate human interaction. For instance, systems to deter fauna from approaching tailings ponds (fences, deterrent lighting, and gas guns) must be in place. Employees track fauna sightings on a regular basis; periodically, animal movements are monitored and recorded.

Data availability. For major mining operations, detailed annual environmental reports are accessible online. South Australia has a comprehensive online database, SARIG, from which annual environmental reports for mines (similar to the mining reports for Alberta and Alaska) can be downloaded.

Oil and gas operators must prepare annual reports that are made available online. The reports include general updates on project activities, including some environmental data. Regional air and water quality data are also available online.

Compared with Alberta and Alaska, where finding the correct regulator can be an obstacle in accessing environmental data, South Australia is simpler. One regulator manages the development and conservation of resources, environment, and public safety (see the appendix for website links to environmental data for Australian mining and oil and gas operations).

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*The national air standards are called the National Environment Protection Measures (NEPMs).
**Source: Australian government Murray-Darling Basin Authority.

See Table 4 and the box "Comparing Ongoing Consultation" for a synopsis of the ongoing consultation process in each jurisdiction.

Alaska and South Australia Mining Operations Have Formal Requirements

For large mines, both Alaska and South Australia require frequent formal consultation during the project's operational phase. For Alaska, large mines are required to conduct annual public meetings; in South Australia, large mines require a "community engagement plan" as part of their approval, sometimes requiring quarterly meetings. For oil and gas developments in both jurisdictions, however, there are no formal requirements for consultation during operations.

With Alberta oil sands, there is no formal requirement for frequent, ongoing consultation. However, each project's environmental approval must be renewed every 10 years, and this renewal provides an opportunity for public consultation.

Although not always required, most companies engage in voluntary consultation efforts to inform affected stakeholders about ongoing operations, and many have established formal stakeholder relations programs. In general, the amount of information provided voluntarily to stakeholders has increased over time as companies respond to growing demands for information from both affected stakeholders and the public.

Table 4

Key Metrics: Ongoing Consultation Processes

	Alberta	Alaska	South Australia
Formal requirement for frequent ongoing consultation	No formal requirement	Large mines require annual meetings. Oil and gas have no formal requirement	Large mines require frequent meetings, sometimes quarterly. Oil and gas have no formal requirement

Source: IHS CERA.

Comparing Ongoing Consultation

Alberta

In Alberta, there is no requirement for ongoing consultation once a project has been approved, assuming that the developer stays within the boundaries outlined in the approval. However, if the developer needs a change from the approval, one that creates new environmental consequences and risks, it must submit an application related to the change. The new application requires the operator to issue public notices, receive comments, and document the possible impacts of the change. Also, each project's environmental approval must be renewed every 10 years, and this provides an opportunity for public consultation.

Although not required by the regulatory process, in practice most oil sands operators regularly engage stakeholders and effected communities. Data are shared through regular community information meetings or open houses, site tours, regular project updates, e-mail, mailings, and other formal and informal communications.

Alaska

In Alaska, large mines are required to host an annual public meeting to review activities with nearby communities, including information on spills and releases, inspections, construction activities, future plans, and reclamation status. Annual environmental performance reports are also readily available. In addition to the required meetings, most large operations engage in voluntary efforts—for instance, regular newsletters or performance reports.

For oil and gas developments in Alaska, an ongoing formal stakeholder consultation policy is not in place. However, as in Alberta, new permits are required when an operation changes from its approved permit conditions. To obtain new permits, the impacts of the change and efforts to mitigate these impacts must be documented. A 30-day open public comment period is required.

For oil and gas, although formal requirements are limited, operators voluntarily inform nearby communities about operations and future plans. For example, the North Slope Borough community has monthly meetings with operators in the region to communicate information on current and upcoming activities.

South Australia

In South Australia, all major mines require an approved "Community Engagement Plan"; the plan usually involves a community representative group that meets regularity with the regulator and project operator to review the environmental compliance reporting. However, oil and gas developments do not have a formal requirement.

In one example, a mine hosts quarterly advisory meetings, biannual consultative committee meetings, and annual community days and reports data regularity to the public and affected land owners.*

In addition to formal requirements, large mine operations also engage in voluntary consultation efforts as well as regular meetings and conduct community perception surveys every three years.**

*Example: Heathgate, Beverley Mine – Mining and Rehabilitation Program, September 2008.
**Source: BHP Billiton, *Sustainability Report 2011.*

INSPECTION AND ENFORCEMENT

Site inspections provide another check that operations are complying with the regulations established in their approvals. Regulators in Alberta, Alaska, and South Australia all rely on site inspections to ensure that rules are followed. But how do inspections compare among these three jurisdictions? Enforcement is related to inspection—but when an operator is found to be noncompliant, are there consequences?

See Table 5 and the box "Comparing Inspection and Enforcement" for a synopsis of the site inspections and enforcement actions for each jurisdiction.

All Regions Inspect and Enforce Rules, but Direct Comparisons Are Difficult

All three jurisdictions actively use inspections and penalties to enforce regulation. However, a direct comparison is difficult because of limited data.

Gaining a comprehensive view of all inspection activities is one challenge. Numerous regulators perform inspections in each location, and although some regulators report annual inspections, most do not. A second challenge is the definition of an inspection. An inspection could range from a phone call to a multiday facility audit. Because individual inspection reports are hard to access, even when the total number of inspections is available, the numbers are not necessarily comparable.

Enforcement is also difficult to compare. Whereas some regulators—including Alberta ERCB, Alberta Environment and Water, and US EPA—make violations and penalties available, many do not. Even when data can be compared, the lack of penalties or other enforcement actions may reflect a highly effective and compliant industry rather than a lax regime. A regulatory process is best measured by how quickly it remedies a noncompliance issue, not by the frequency or size of its penalties. It is also difficult to directly compare fines for violations, because violations and the associated risks tend to be unique and thus not comparable.

Striking a Balance: Inspection Activity and Government Funding

Financial and other resources shape regulators' ability to inspect and monitor operations. Regulators prioritize inspection activities within financial and staffing constraints. In times of rapid investment growth, inspection activity often falls behind. A past survey compared the growth in US wells drilled to the growth in enforcement staff. From 2004 to 2008, the number of US wells drilled increased by 41%, but enforcement staff increased by only 9%.[1]

In the past decade, as Alberta oil sands production grew steeply (more than doubling), inspection activities have had to scale up too. In 2003, the ERCB opened an oil sands office with 20 staff to respond to growing demands in the region. By 2008, the office had grown to 42 staff to keep pace with growth. Between 2007 and 2008, with the staff additions, the number of oil sands mining inspections rose from 18 per year to more than 50.[2] The ERCB

1. "State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs," December 30, 2009, Pro Publica Inc. Study summarizing data from 22 states http://www.propublica.org/article/state-oil-and-gas-regulators-are-spread-too-thin-to-do-their-jobs-1230, November 2011.
2. Source: ERCB Year in Review 2008.

continues to scale up staffing to keep pace with oil sands activity. Between 2009 and 2010, the number of oil sands inspections almost doubled: ERCB conducted 65 inspections in 2009 and 120 in 2010.

The budget for inspections does not always grow, and budgets are cut when government income decreases. In Alaska, owing to low oil prices and reduced government income, the AOGCC faced a 40% budget cut between 1983 and 1987. Alaskan inspectors publicly complained that reduced inspection activity was increasing the risk of safety issues in oil and gas operations.[1] Since then, spending and inspections in Alaska have increased. Alberta regulators have also faced budget cuts. During the 1990s, the provincial government reduced government spending and debt, cutting funding for many government activities, including for environmental regulation. By 2000, the budget for Alberta Environment and Water was less than C$100 million. That trend has now reversed; the total budget for Alberta Environment and Water (funds for all activities, of which inspections are a small part) increased threefold and is expected to surpass C$300 million in 2011.[2]

To help scale up regulatory staffing through oil and gas activity, some regulators have implemented fees. For example, in Alaska the DEC requires operators to cover the costs incurred by inspections. Alberta's ERCB charges the industry a levy—like a tax—to cover the costs of regulation and also generates revenues by making oil and gas data available for a fee.

1. Source: AOGCC, *Our Resources, Our Past, Our Future: AOGCC - 50 Years of Service to Alaska,* 2008.
2. Alberta Government, *Budget Business Plans—Environment,* 2011 and 2000 http://www.finance.alberta.ca/publications/budget/index.html, December 2011.

Table 5

Key Metrics: Inspection and Enforcement Processes

	Alberta	Alaska	South Australia
Are on-site inspections conducted?	Yes	Yes	Yes
Are site-inspection data available?	ERCB provides information on total inspections conducted each year. Other regulators inspect, but do not report activities	Few agencies provide information on inspection activities online. Exceptions are DNR (which makes actual site-specific reports available) and EPA	For oil and gas sites, total number of inspections is reported annually. For mining, inspection data are not available
Is enforcement a tool available to regulators?	Yes. ERCB can suspend or constrain operations. Alberta Environment and Water generally imposes fines for noncompliance	Yes. Regulators most often enforce through violation notices, and fines if required	Yes. Maximum oil and gas fine is $120,000. As of July 2011, for the first time, mining regulators have the power to use enforcement
Are site-specific enforcements available?	Both ERCB and Alberta Environment and Water frequently report noncompliance issues on a site-specific basis	Most agencies publish violations online; few post information on fines (AOGCC and EPA are the exceptions)	Enforcement data are not available

Source: IHS CERA.

Comparing Inspection and Enforcement

Alberta

Inspections. In 2009, the ERCB's 80 inspectors conducted over 25,000 inspections and audits in the province. In the oil sands, 65 site inspections were conducted in 2009; 120 were conducted in 2010.* Two other oil sands regulators—Alberta Environment and Water and Alberta Sustainable Resource Development—also frequently inspect oil sands facilities. Although these two do not publish information on the total number of inspections, oil sands operators report that Alberta Environment and Water inspections are of similar duration and frequency to the ERCB.

Regulators in Alberta also rely on voluntary self-disclosure. When operators discover their noncompliance, they are obligated to alert the regulatory authorities immediately. One advantage of self-disclosure (in addition to proactively reducing environmental and/or safety risks) is that typically the fines or punishments are less severe compared with noncompliance discovered through site inspections or audits.**

*Source: ERCB, Field Surveillance and Operations Branch Provincial Summary, 2009; and House Energy and Commerce Committee, Subcommittee on Energy and Power, *Dan McFadyn written Statement,* May 23, 2011.
**Source: ERCB, *Directive 019 Revised Edition,* September 1, 2010.

Comparing Inspection and Enforcement (continued)

Although ERCB reports inspection activities in the aggregate, detailed information from each inspection is not available (for instance, the site visited, the parameters checked, pictures, and notes). However, the ERCB describes site inspections as lasting several days.

Enforcement. The ERCB publishes a monthly noncompliance report, and Alberta Environment and Water publishes a quarterly enforcement report. Both reports document the details associated with noncompliance events and actions taken by the regulator. Although the ERCB has the authority to suspend operations until compliance is achieved, to date no oil sands project has been suspended. However, the ERCB has mandated a production cutback to bring a site into compliance with regulations.*

Alberta Environment and Water generally issues fines for noncompliance. The fine varies based on several factors: the severity of the offense, whether the offense was reported voluntarily, the speed with which the violation was reported, any history of prior violations, and any mitigation actions undertaken by the operator. Typically fines or prosecutions for minor violations—for instance a small oil spill or withdrawing slightly more water than licensed—range between $5,000 and $10,000. Examples of higher severity fines issued by the court include $275,000 for storm water escape, $3 million for bird mortalities (from landing in tailing ponds), $675,000 for failing to install pollution control equipment and venting H_2S, and $400,000 for dumping sewage.

Data availability. Aggregate information about inspections by the ERCB is online, whereas other regulatory agencies do not readily report inspections information. However, both Alberta Environment and Water and ERCB make noncompliance and enforcement actions available online, and the Alberta Environment and Water enforcements are available on the OSIP (see website links in the appendix).

Alaska

Inspections. Numerous agencies regulate and have authority to inspect mining and oil and gas operations in Alaska. Visits to remote faculties in Alaska are often costly endeavors, so efforts are frequently combined. On-site inspectors will look for violations outside their authority and report potential violations to the appropriate regulators.

Few agencies provide inspection reports online. The exception is the Alaska DNR (Division of Mining). Its online reports include pictures of the facility and inspector notes. Judging by these reports, large mines have two to three inspections per year from this one agency. Other regulatory agencies make data available upon request. For instance, the AOGCC has seven inspectors focused on oil and gas operations and until 2004 provided a summary of annual inspections online (since the report is no longer available, an information request is required to access current information). The AOGCC generally inspects all new facilities and has two inspectors on the North Slope at all times, plus five available statewide for inspection as needed.

As in Alberta, regulators in Alaska also rely on voluntary self-disclosure and are typically more lenient with penalties when a violation is reported voluntarily.

At the federal level, the EPA also conducts site inspections (sometimes called evaluations). The number of inspections can be tracked with EPA's online database.** Based on the database, in

*In one example for the Suncor Firebag operation, the ERCB determined the "historical and current venting, flaring, and H_2S emissions at the Firebag facility did not comply with ERCB requirements." The ERCB capped the production at the site so that emissions would not exceed limits. The Firebag site ran at restricted capacity for about 10 months, until the issue was resolved. Source: ERCB July 22, 2008, press release, "ERCB rescinds production constraints on Firebag project."

**The EPA online database ECHO has information on compliance with the Clean Water Act, Clean Air Act, Safe Drinking Water Act, and hazardous waste laws. See appendix for website link to database.

Comparing Inspection and Enforcement (continued)

a five-year period, most Alaskan mines have one or two inspections from this regulator. The EPA issues an annual report that includes the aggregate number of countrywide inspections (21,000 in 2010 and 20,000 in 2009). The individual site inspection reports (inspection notes or pictures) are not readily available.

Enforcement. Although most agencies post violation information online, fewer post information on fines. The AOGCC is one exception and posts fines levied. Fines for minor violations range from no fine (voluntary disclosure of failure to perform routine integrity tests) to $10,000 (failure to test blowout prevention system). Examples of more serious violations include a $400,000 fine for not testing safety valves and a $1.2 million fine for an oil production facility operating above the allowed pressure. The EPA also posts information about each of its enforcement actions and fines online.

Other state regulators make Notices of Violations (NOVs) public (on websites or in newspapers). The NOVs outline the specifics of the incident, typically reporting the maximum fine that could be assessed. Most often, after the notice is made public and before any fine is assessed, the operator is offered the opportunity to remedy the violation. In most cases, a fine can be appealed or remedies recommended before a fine is assessed. Only in high-profile cases are the actual fine amounts made public.

Data availability. In Alaska, two regulators provide current inspection information online—EPA and Alaska DNR (Division of Mines). As noted, the EPA and AOGCC make fines available online. Most state regulators post notices of violation at their websites or in newspapers, but not fines, unless the enforcement action is unusually controversial or the fine is extremely large.

South Australia

Inspections. Aggregate data on oil and gas site inspections and noncompliance incidents are published annually. For mining, a subset of selected inspection activities is published annually (for the previous two annual reports, data were limited to inspections on opal fields and exploration activities).

Enforcement. For oil and gas, serious incidents are recorded in the annual compliance report. Once a site is found to be in noncompliance, persuasive measures are taken to instigate corrective action. Punitive measures, such as noncompliance fines, are considered as a last resort. Regulators prefer to work with the operator to resolve issues. To date, no punitive measures have been required. If required, fines will not exceed $120,000 for each issue. Other measures the regulator can levy include prosecution or license cancellation.

For mining, prior to July 2011 the South Australia Mining Act had virtually no tools available to enforce compliance. However, with recent (July 2011) amendments to the Mining Act, there are now "environmental directions" and "rehabilitation orders" which enable enforcement. Since implementation of the changes to the Mining Act three Environmental Directions have been issued.*

Data availability. For oil and gas, compliance information is available for download in the annual reviews published in the regulator's (Division of Minerals and Energy Resources) *MESA Journal,* and more detailed compliance reports can also be downloaded from regulators' websites (see website links in the appendix). At this time, data are not readily available for mining operation enforcement actions.

*Source: Discussion with PIRSA minerals contact. Data on specific Environmental Directions are not publicly available at this time.

PART III: PROJECT CLOSURE

At the end of a project's life, the regulators' objective is to ensure that land is reclaimed and returned to productive use. For all jurisdictions for both mining and oil and gas operations, after operations end, the land must be reclaimed. Reclamation requirements for oil developments and surface mining projects differ. With oil developments, instead of completely clearing the land, only part of the land is cleared. As a result, the land is often returned in a condition that is relatively close to its predisturbance state. Surface mining disturbs land to a much greater extent, and consequently, reclamation is of great importance.

Since surface mining is the most important reclamation issue, the scope of this section is limited to a subset of regulation, comparing the closure requirements for mining projects in Alberta, Alaska, and the state of South Australia, considering

- Reclamation and mine closure
- Financial securities and bonds

RECLAMATION AND MINE CLOSURE

Alberta, Alaska, and the state of South Australia all require operators to reclaim their disturbed land, close mines, and return the land to public use. Table 6 and the box

Table 6

Key Metrics: Reclamation Requirements

	Alberta	Alaska	South Australia
Are mine closure plans updated regularly?	Yes, every five years	Yes, every five years	Yes; requires a current closure plan
Is there a clear certification process with measurable outcomes?	Current framework exists, and this is now being strengthened with more specific sign off criteria	Yes, outcomes defined in closure plans and laws; multiple regulators have authority and sign off separately	Yes, closure requirements have outcomes with measurable criteria
Are project-level data available?	Similar among these locations. Project-level status on amount of land disturbance and reclamation progress is online at OSIP. More detailed information requires request	Similar. Project-level status is online in annual reports (amount of land disturbance and reclamation). Other information requires request	Similar. Reclamation plans and annual mining reports (that provide high-level reclamation status) are online. Other information requires request

Source: IHS CERA.

"Comparing Reclamation Requirements" highlight project-level reclamation requirements for each jurisdiction.

For all three jurisdictions, mine closure plans are included within each project's approval documents. Most often these include details on the pre- and postdevelopment land capability, a conceptual plan to close the mine, and timelines for reclamation progress. Despite the level of detail in each mine's approval, the definition of "reclaimed" land and the pace of reclamation are often open questions for stakeholders who want the land restored as closely as possible to its predisturbance state.

Allowing for Flexibility in Mine Closure Plans

For Alberta and South Australia, the legislative or regulatory definition of reclaimed land is somewhat vague and open to interpretation. For Alberta, the goal is "equivalent land capability." South Australia provides a series of broad reclamation objectives, such as reducing or eliminating adverse effects and financial liabilities after closure, ensuring that future risk and liability are controlled to an acceptable level, and reducing the need for long-term monitoring requirements.[1] Although these broad definitions can leave room for interpretation, they are also widely applicable—they could equally be applied to restoring boreal forest, desert, or arid grasslands ecosystems. And they are flexible, allowing the reclamation plans to accommodate the uncertainty of planning long into the future.

Alaska's DNR takes a slightly different approach by providing more specific reclamation performance standards and milestones in its general regulations. For instance, the DNR mining regulations stipulate that one year after reclamation, the land should achieve revegetation, and within five years, the land should not need fertilizer or reseeding. It also outlines conditions to stabilize and recontour the land and water streams.[2]

In their original project applications, most mines assume a long life—typically spanning two or three decades or more. However, because of volatile commodity price cycles, resource mines have a history of early closures. For this reason, Alaska, Alberta, and South Australia all require every mine to have a current closure plan. Alaska requires the mine closure plan to be updated every three to five years and also requires a third-party environmental audit prior to this renewal process. For Alberta, the mine closures plans are updated every five years.[3] South Australia also requires mine closure plans to be updated regularly.

In addition to keeping the mine closure plans current to ensure that plans evolve with the mine's actual development, in each jurisdiction the lead regulator requires operators to provide annual update reports; these can include research initiatives, past reclamation achievements, current level of disturbance from mining, and future plans relative to the closure plan. Collaborative research is important to help reduce the uncertainty associated with reclamation—all three jurisdictions outlined plans to research and pilot new techniques for reclamation areas, so these new techniques remain uncertain. The Alberta and Australia plans for new research were the most detailed and included local stakeholder input.

1. Source: Australian and New Zealand Minerals and Energy Council, *Strategic Framework for Mine Closure,* 2000.
2. Source: Alaska DNR, *Mining Laws and Regulations, Land Reclamation Performance Standards,* 11 AAC 97.200.
3. At least every 10 years, with the renewal of Alberta Environment and Water's approval for the mine, and an additional requirement for an update in the middle of the approval.

The US Army Corp of Engineers (COE), which is one of the regulators with authority over mine reclamation in Alaska but typically not the lead regulator, avoids the problem of out-of-date closure plans. The COE stipulates in the original approval that reclamation will require an additional permit, but this permit (and the detailed reclamation plan that supports it) is only needed near the time of closure. One advantage of the COE approach is that the plan reflects current technologies and public expectations—as opposed to a carry-over approval that can be out of date.

Strengthening Performance Metrics for Mine Closure

Ideally, the mine closure plans include measurable criteria to enable the regulator, operator, and the public to clearly gauge when closure outcomes are achieved. Of the three jurisdictions compared, the Alaska mine closure plans provided the most specific objectives—outlining specific periods to meet water quality and vegetation performance metrics within their approval documents.

Alberta recognizes the need to augment existing mine closure plans with more specific objectives. In Alberta, to help clarify the definition of reclamation, specifically for oil sands mines, CEMA is creating specific indicators to define and measure the success of reclamation. Its recommendations will be used to help to inform Alberta's updated mine closure policy. In addition, the Alberta government is now developing a more detailed process to guide future oil sands mining land certifications in the province.

Surface Mining Makes for Changes

In all jurisdictions, when land is disturbed on the scale and extent required for surface mining, the land is changed. In all regions, development rock piles (or overburden piles) and tailings piles are sloped, topsoil is applied, and vegetation is planted; but the piles remain permanent features.[1] Terraced slopes left from mining are contoured and planted with trees; however, their slope is permanently altered.

Finding the balance between environmental and economic prudence is complex, and sometimes postmining land changes are very large. In a recent South Australian project approval, a 1 kilometer deep open pit will remain after mine closure since filling a hole this large would be cost prohibitive. The pit will be a permanent land feature and is considered to have the potential to become a tourist attraction. This is not a unique situation. In Lead, South Dakota, after a 2002 mine closure, a 2 kilometer deep open pit is now open for mining tours. Alaska's DNR has even codified this situation within its regulations, stating that the mining pit can remain after the site is closed if the steepness of the wall makes it impracticable to contour or backfill; however, the operator is required to leave it in a stable condition for safety reasons.

Disposal of mine tailings—the sometimes toxic mining waste left over after processing the mined ore—is another concern. In oil sands mining, current mine closure plans assume that part of the oil sands tailings will be disposed of in end-pit lakes (EPLs).[2] EPLs are an untested part

1. For all locations, the original topsoil is stored and reused for reclamation.
2. Oil sands tailings waste has been found to be toxic to aquatic life in assays involving fish and microorganisms, but the toxicity decreases over time. Naphthenic acids removed from bitumen during the extraction process are the primary source of this toxicity.

of oil sands mining reclamation. The plan is to create engineered bodies of water in mined-out areas that contain fluid fine tailings and other mining waste at the bottom, topped by a layer of fresh water; these would become a permanent part of the landscape after reclamation. However, the use of EPL is still conditional based on a successful, large-scale demonstration that proves tailings can be contained at the bottom of the lake—not released into the environment. Such a demonstration is planned for 2012.[1] Disposal of mining waste can be contentious. In Alaska, a gold mine was permitted to dispose of mining waste (crushed rock and produced water, called "froth flotation") in a naturally occurring lake. Environmental groups challenged the decision, but after numerous appeals, the mine was eventually permitted to dispose of the waste, provided that the fresh water that fed into the lake was rerouted into the watershed free of contamination. In other cases, toxic tailings are entombed and permanently impounded at mining sites.

Comparing Reclamation Requirements

Alberta

Definition of reclaimed land. For each oil sands mining operation, mine closure plans define reclamation obligations, including conceptual plans and timelines, and broad performance goals. Areas in which reclamation plans and procedures have greater uncertainty are highlighted, and plans to research and pilot new methods are detailed (for instance, research new methods to restore wetland areas or dry tailings). These plans are generally updated about every five years.

The current draft of the proposed LARP also refers to Alberta's new progressive reclamation strategy, which includes an enhanced reclamation certification program, a transparent public reporting system, and a new progressive reclamation financial security program. In support of these objectives, the CEMA, a multistakeholder group that includes members of industry, government, and the local community, has undertaken an effort to help clarify the definition of reclamation for specific oil sands mines. The CEMA Reclamation Working Group issued a report that outlines 59 specific indicators to define and measure the success of reclamation efforts.* These recommendations are being used to inform future policy.

What does reclaimed mining land look like? After mining and reclamation, the land cannot return to its state before development. For example, the external tailings areas (large dikes built aboveground to hold tailings) will remain hills and be sloped and planted with vegetation. Some of the mine's open pits will not be backfilled and will become lakes. Some open pits as EPLs could contain mining wastes. However, using EPLs as a reclamation method is still contingent on its successful demonstration.

Prior to development of oil sands mines, much of the mined area consisted of wetlands—bogs, fens, and swamps. Although collaborative research involving industry, academia, and local Aboriginal groups is under way to increase knowledge on restoring biodiversity in land reclamation, the science of restoring wetlands is in its infancy. Successful restoration of peaty wetlands (bogs and fens) is a particular challenge and has not been successfully demonstrated to date. Therefore, reclaimed land is likely to consist of a combination of highland forest and wetlands.

**A Framework for Reclamation Certification Criteria and Indicators for Minable Oil Sands,* December 2009, CEMA.

1. The first large-scale test is set to start in 2012 at the Syncrude oil sands mining operation.

Comparing Reclamation Requirements (continued)

Process to certify land "reclaimed." For oil sands mining projects to date, one small parcel of land (about 1 square kilometer, or 0.4 square miles) has been certified as reclaimed by the Alberta government and released back to the public. To date, the regulator's approach has been to not certify lands within an active mining site, so although technically operators have reclaimed more lands, these have not been officially certified as reclaimed.

The current certification process for mines is outlined in the government of Alberta's "Guide to the Preparation of Applications and Reports for Coal and Oil Sands Operation (1991)." The guide details the need for site inspections and monitoring of soil chemistry and erosion potential, forest growth, water characteristics, and wildlife and fisheries inventories. Consistent with the objectives of LARP and leveraging the recommendations made in the CEMA Reclamation Working Group's Framework, the Alberta government is now developing a more detailed process to guide future oil sands land certifications in the province.

Data availability. Land reclamation certificates are available online from Alberta Environment and Water's Environmental Site Assessment Repository (ESAR) database. However, the certificate documents are brief, only one or two pages. For detailed information on the certification process (and supporting documentation), an information request is required. Through the life of the project, oil sands operators must update the regulator on the status of land disturbance, monitoring, and reclamation progress. Summary metrics for each operation—including the total area disturbed and reclaimed—are available at the OSIP. Each operation submits more detailed information to the regulator in an annual Conservation and Reclamation report, and this information is available at the Alberta Government Library in Edmonton.

Alaska

Definition of reclaimed land. In Alaska, multiple regulators are responsible for reclamation. Three key regulators are the DNR, Bureau of Land Management (BLM), and the US Army COE. Although not discussed here, the Alaska Department of Environmental Conservation (ADEC), the EPA, the US Forest Service, and local authorities or boroughs also have jurisdiction. Although numerous agencies have authority over reclamation, the DNR is the lead regulator for mining reclamation and typically coordinates activities with other regulators.

DNR requires an approved reclamation plan, updated every five years, and bonding for all mining operations in Alaska regardless of the type of land being developed (private, state, municipal, or federal lands). The DNR requires each mining operation to outline site-specific reclamation requirements within its plan of operations. The plan includes details on postclosure land use (water, soil, biodiversity) and timelines. The plan also details reclamation areas that are uncertain, identifying potential areas for future research. In addition to site-specific plans, the DNR's regulations and laws also outline performance metrics for mine closure.

What does reclaimed mining land look like? For surface mining projects, postdevelopment land is not the same as before mining. In fact, the DNR regulation clearly states that land will be altered postclosure. Restoration work could include "backfilling, contouring, and grading, but a miner need not restore the site's approximate original contours." Further, the mining pit can remain after the site is closed if the steepness of the wall makes it impracticable to contour or backfill.

Process to certify land "reclaimed." For Alaska mines, the DNR regulation outlines specific metrics for successful reclamation. Combined with the metrics in each project approval, operators must meet these requirements for certifying the land as reclaimed. Typically, and as in the Alberta oil sands, an operator will reclaim sections of the mine no longer in operation even though other acreage is still being mined. Federal regulators, including BLM and the COE, also sign off on

Comparing Reclamation Requirements (continued)

mine reclamation. Although DNR is typically the lead regulator, the federal agencies maintain their own discretionary authority to determine when a site has been reclaimed or restored on federal lands and have their own specific criteria and sign-off.

Data availability. For mining sites, the original reclamation plans and criteria to reclaim the land are available online with DNR. In addition to the operating plan, the mines are required to provide annual updates similar to those in Alberta (status of area disturbed, reclamation efforts, research, and monitoring). For documents outlining the procedure and information supporting a specific mine closure, a data request to the regulator is required.

South Australia

Definition of reclaimed. In Australia, the term for reclamation is "rehabilitation." A current mine closure plan must define the requirements for rehabilitation and closure. For large mines, plans include a conceptual representation of the mine at end of its life, broad goals such as plans to reestablish vegetation, methods to minimize seepage from tailings, and timelines. Reclamation areas that are uncertain are outlined with plans for future research, for instance, on reclaiming tailings or optimizing growth of vegetation. The plans are updated regularly.

In South Australia mining, a key aim of the mine closure plans is to eliminate any "third party" residual impacts (for instance, a tailings dam that remains postclosure would require the operator to establish a system to continually monitor and maintain the dam to avoid any adverse effects to public lands or future costs to the government). Mine closure plans include closure outcomes with measurable criteria.

What does reclaimed mining land look like? As elsewhere for surface mined projects, the land looks different. For example, in one reclamation plan, terraces of over 200 meters will be sloped and planted with vegetation. Tailings are left on site—sometimes encapsulated, either in earth-lined pits or, for more toxic tailings, sealed in lined pits and covered.

Process to certify land "reclaimed." The closure objectives are defined within the mining approval. Specific objectives include targets to meet acceptable water quality standards within three years, assurance that waste pits are stabilized and not contaminating the ground or water, and plans to ensure that land forms remain stable.

Data availability. Each mine submits annual mining and rehabilitation compliance reports with high-level information on the amount of land disturbed. As in the other regions, specific information related to a mine closure must be requested.

FINANCIAL SECURITY AND BONDS

Despite the specific criteria outlined in mine approvals, mines have a long history of failing to meet closure requirements, and governments are still paying for this legacy. In 2010 alone, Alaska spent over $2 million mitigating safety issues posed by the state's abandoned mines.[1] Today, South Australia is saddled with the costs for reclaiming three abandoned mines. To protect the government in the future, all three jurisdictions—Alberta, Alaska, and South Australia—now require that mine operators post financial securities to protect taxpayers from covering the costs of reclaiming abandoned mines.

1. Funds come from the Abandoned Mine Program that addressed abandoned mines prior to August 1977 and include both federal and state funds.

Table 7 and the box "Comparing Financial Securities and Bonds" evaluates the financial protection required for surface mining operations in Alberta, Alaska, and South Australia.

Alberta's Unique Financial Security Method

Many aspects of financial securities for reclamation are similar across the regions. For instance, all regions require operators to provide regular updates and estimates of the current liability. The Alberta system has a different methodology from the other jurisdictions, however. For Alaska and South Australia, the financial security funds are intended to cover all estimated reclamation costs; whereas in Alberta, the value of the resource (which in this case is bitumen) is considered an asset that offsets the cost of reclamation (unless the mine is within 15 years of the end of its life). This is a key difference between Alberta's program and the others. In Alberta, initially, the estimated reclamation liability is not required to be 100% funded by the security.

The lack of 100% coverage of reclamation liability in the early and middle stages of a project's life introduces some uncertainty on the ultimate payment of reclamation costs. For instance, if the oil price drops sharply, the value of the corresponding asset assumed to cover the reclamation liability also drops. To address this potential scenario, however, each operator submits an annual estimate of its reclamation liability, assuming a third party performed the work. At any time, if the combined value of the bitumen asset and the financial security is not three times higher than reclamation liability, then the mine must provide an additional financial security to fund the gap. By this mechanism, the program is designed to cover the liability even when the price of oil is low.

Table 7

Key Metrics: Financial Securities for Mines

	Alberta	Alaska	South Australia
Financial security methodology	Asset-to-liability approach; bitumen covers a significant part of the reclamation liabilities in early to middle stages of project life	Bond must provide 100% of the current reclamation costs	Bond must provide 100% of the maximum annual liability at any time in the mine's life
Frequency of security updates	Annually	Every five years at least	At any time
Range of financial securities for an individual mine	$30 to $359 million	$16 to $300 million	Not available
Availability of project-level data	Status of disturbed land and the value of the security are online	Status of disturbed land and the value of the security are in some annual reports; others available by request	Not available

Source: IHS CERA.

How Does the Size of Alberta's Security Compare?

Sometimes to compare the financial securities among jurisdictions, the size of the security (dollars) is compared to the amount of land disturbed (area). Because mining reclamation costs vary significantly across various mining operations, at times these types of metrics can be misleading. For example, some mines in Alaska are in remote locations with fly-in/fly-out access only; other operations must generate power on site, while others are on the grid; and some mining processes have toxic effluents that are costly to reclaim. Considering all active surface mining operations in Alaska, the size of the security currently ranges from US$40,000 to over US$130,000 per hectare of land disturbed (average is US$75,000 per hectare of land disturbed), and the total value of the bond for an individual mine ranges from US$16 million to over US$300 million.[1]

In Alberta, the total value of the financial security for an individual mine ranges between C$30 million and C$359 million. Because Alberta has a different methodology, and not all of the reclamation liability is covered by the value of the financial security, a metric such as the value of the financial security per hectare of land disturbed is not useful. A more comparable value could be the money that Alberta requires if the operator fails to reclaim the hectares promised, which is C$75,000 per hectare of land disturbed (this value will be reviewed in three years to confirm that it is sufficient to cover actual reclamation costs). Also note that the value of the Canadian and US dollars is currently near parity.

Alberta and Alaska provide readily available data on both the funds reserved for reclamation and the status of the land disturbance from mining. South Australia has the lowest data availability in this regard—both the disturbed land area and the funds reserved to cover reclamation costs are not readily available.

Comparing Financial Securities and Bonds

Alberta

Financial security. Although financial securities were required in the past, Alberta Environment and Water announced new requirements in 2011, termed the asset-to-liability approach. With the new program, at the start of a project's life, the operator is required to provide immediate funds—C$30 million for mine and C$60 million for mine and upgrader. For most of the project's life, the value of the bitumen is used to cover the remainder of the reclamation costs. Only when the project starts nearing the end of its life (defined as when 15 years of reserves remain) are more funds required. By the time six years of reserves are left, the cost for all outstanding reclamation must be backed by financial securities.

Although an additional financial security is not typically required in the early to middle stages of a project's life, each operator must submit an annual estimate of its reclamation liability, assuming that a third party would perform the work. The Alberta government may audit the estimate.

Most oil sands mines operating before 2011 (before the new program was introduced) had more than C$30 or C$60 million in their financial security, and these funds have been retained. In these cases, the value of the financial security for an individual mine ranges between C$110

1. Source: DNR, supplied by request and includes reclamation costs for Red Dog mine, Rock Creek Mine, and Fort Knox mine, November 2011.

Comparing Financial Securities and Bonds (continued)

million and C$360 million.* The security is released back to the operator when the estimated liability is reduced.

Since no oil sands mines have reached the 15 years of reserve life milestone, the security values do not reflect the total reclamation liability. Part of the liability is covered by the value of the bitumen reserve. A more comparable value could be the money that Alberta requires if the operator fails to reclaim the hectares promised, which is C$75,000 per hectare of land disturbed.

Data availability. The Alberta government reports detailed information on the financial securities for oil sands mines in its Environmental Protection Security Fund Annual Report. The report publishes the amount of security posted by each operation and is available online. Alberta Environment and Water has also started to post the status of mining lands and the value of financial securities for each operation on an annual basis at the OSIP (see appendix for website links).

Alaska

Bond. In Alaska, large mine operators must provide a bond that covers 100% of the costs associated with reclaiming the land. The bond amount can be increased at any time and during project amendments if needed. At minimum, the bond amount is revisited every five years. As an alternative to an individual financial assurance, the DNR established a bonding pool for mining operations. The bonding pool significantly reduces the financial requirements for an operator, but the bonding pool is not typically available to large or higher risk mines.

The regulator (typically the DNR, although sometimes comanaged with other state or federal agencies) establishes the amount of money required for the bond. The value of the bond varies significantly depending on the type of mine, the area of land disturbed, and the risks associate with contamination.

Currently, monies reserved for an active individual surface mine range from US$16 million to over US$300 million, or from US$40,000 to over US$130,000 per hectare of land disturbed (average value is US$75,000 per hectare of land disturbed).**

Data availability. The bond amounts and current reclamation cost estimates are contained within each mine operator's annual environmental report (see website link in the appendix). The current status of land disturbed is sometimes reported in a mine operator's annual environmental report, but not in every case. When not available, the data can be requested from the regulator.

South Australia

Bond. Mines in South Australia require a bond to cover the maximum annual liability at any time in the mine's life; this may not be the value in the final year of operations. The full value of the bond is due before mining starts. The value of the bond is estimated based on the approved mine plan and assumes costs for a third party to perform all of the reclamation work. The amount can be updated at any time.

Data availability. The bond amounts provided by each operator are not readily available and would require an information request to access. For individual mines, the annual mining and rehabilitation compliance report has only high-level data on the amount of land disturbed by operations.

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*Source: Ministry of Environment, Environmental Protection Security Fund Annual Report, March 2010.
**Source: DNR, supplied by request and includes reclamation costs for Red Dog mine, Rock Creek Mine, and Fort Knox mine, November 2011.

CONCLUSION

THE FUTURE OF REGULATION IN OIL SANDS

This report is a snapshot of regulation today. Regulation of oil sands (as well as in other jurisdictions) is continually evolving, adapting to changing levels of environmental stress and keeping pace with the changing expectations of the public. For oil sands, major areas of change on the horizon include the development of a regional plan and work to strengthen regional monitoring.

Land Use Framework for the Oil Sands Region

When oil sands development was collectively of a lesser scale than it is today, a regulatory environment that focused on project-level criteria may have been sufficient. However, oil sands are now poised for rapid growth (doubling over the next 10 years), and the regulatory system must keep pace with its larger scale.

To respond to that need, after multiple drafts and three stakeholder consultation cycles, Alberta released the draft LARP oil sands regional plan in August 2011.[1] The proposed plan has not yet been approved, and prior to being ratified, it must clear one final step: approval by the Alberta government cabinet. The plan aims to adopt a cumulative management approach for the region—setting thresholds for water, air, biodiversity, and land that apply to the region as a whole. In the future, the environmental impacts from all development (including oil sands operations) need to stay within the regional thresholds.

The plan establishes approximately 16% of the region's land to be managed as new conservation areas, in addition to the 6% that was already protected as wildland provincial parks intended for conservation management.

Strengthened Regional Monitoring

In the oil sands region, local stakeholders have raised concerns for many years that the monitoring of rivers and streams is not robust enough to detect contaminants. Although oil sands operators are not permitted to release mining contaminated water from their sites, it has been suggested that some waste could unintentionally enter the water system, potentially leaking through the dikes that hold tailings and waste water. Contaminants could also be carried by the air and deposited onto the snowpack.

To better understand these issues and the monitoring requirements for the region in general, the Alberta and federal governments separately formed expert panels to independently investigate the issues and make recommendations to strengthen monitoring in the region—including air, water, and biodiversity. In 2011 each released reports that make recommendations to improve regional monitoring. Going forward, the two governments are expected to join efforts in implementing the new recommendations.

1. Government of Alberta, *Draft Lower Athabasca Regional Plan 2011–2021,* August 2011.

CONCLUDING REMARKS: ASSESSING ENVIRONMENTAL REGULATIONS IN THE CANADIAN OIL SANDS

The environmental regulatory system in the Canadian oil sands has been depicted as "weak" by its critics and "stringent" by its supporters. Oil sands development, like all forms of energy extraction, has environmental impacts. However, risks from oil sands development are something to be managed. They cannot be viewed in isolation; they must be compared with alternatives. The critical question is, Does the oil sands regulatory system minimize the risks in a way that is comparable to other places?

To be sure, this report is not a comprehensive list of all aspects of the environmental regulatory system or a comparison to all possible jurisdictions; rather, it serves as an illustrative case study using some specific examples. In comparing the regulatory regime in the oil sands to two peers—Alaska and South Australia—across specific examples, there are many more similarities than differences. Of course some aspects make direct comparisons difficult; but for the cases considered, regulation in the Canadian oil sands is similar to these peers in procedures, data requirements, and measures to protect the environment.

Project Approval

In general, the project approval, including the data required, data availability, public input, outcomes, and process, is similar across the three jurisdictions. There are some differences in how public consultation is conducted; Alberta's hearings are formal, courtlike proceedings, whereas Alaska and South Australia typically use a "town hall" style meeting.

Public consultation is an important part of project approvals in all places, but consultation is meaningful only if can effect an outcome. In all locations, we could find examples where public input materially changed some aspect of a project.

Alberta has not yet denied an oil sands approval. For Alaska and South Australia denied approvals are also relatively rare, but regulatory delays are common.

In the Alberta oil sands, lands are leased to industry for the purpose of oil extraction prior to initiating the study of environmental impacts and public consultation. In Alaska, for developments approaching the size of oil sands, the process proceeds in the opposite order. Before a major area is opened up to oil and gas or mineral extraction in Alaska, an environmental impact assessment is conducted and stakeholders are consulted. Only after the decision is made to approve resource extraction are lands awarded to resource developers. For Alaska, state regional land management plans (that identify development and conservation goals for the region as a whole) are already established before the lands are leased for resource extraction. The province of Alberta is now considering a regional plan (LARP) for the oil sands region. Under the proposed plan, approval for oil sands projects, as for projects in Alaska, would have regional stipulations and conditions.

Ongoing Operations

During the ongoing operations, the most significant difference among the three jurisdictions is the level of data availability. For Alaska mining and South Australia, detailed project-

level environmental reports are generally more readily available than for Alberta oil sands and Alaska oil and gas operations. In the Alberta oil sands, the recently launched OSIP provides project and regional metrics. However, to access more detailed environmental data, such as the comprehensive environmental reports that each operator submits to the regulator, an information request to the regulatory agency is required. One exception is for oil sands mining projects; for these operations, detailed project-level data can be accessed from the Alberta Government Library.

Another difference is that regulations in Alaska and South Australia require mine operators to consult regularly with the public and key stakeholders during operations; however, oil and gas operators do not have formal requirements. In Alberta, oil sands projects do not have formal requirements to consult regularly with the public during ongoing operations. However, even when not formally required, many operators consult voluntarily with local stakeholders on a regular basis.

All regions use inspection and enforcement to ensure that regulations are followed. Alberta is comparable to or better than the other jurisdictions when comparing the availability and transparency of inspection and enforcement data.

Project Closure

For project closure we focused on mining operations, as these projects pose the most critical reclamation issues. Creating specific goals to define successful reclamation is a challenge for all jurisdictions. However, Alaska has the most detailed requirements (contained in project-specific state and federal approvals as well as codified into regulations). Alberta is in the process of strengthening its mine closure processes.

All three regions require funds to be reserved to cover an operator that goes bankrupt or cannot deliver on reclamation requirements. The method for covering the costs in Alberta differs from the others. For Alaska and South Australia, the funds are intended to cover all estimated reclamation costs; whereas in Alberta, the value of the resource (which in this case is bitumen) can be used as an asset to offset part of the reclamation cost (unless the mine is within 15 years of the end of its life).

In Summary

Among the aspects we compared, there are many more similarities than differences between Alberta's regulation and those of its peers, Alaska and South Australia. Similarities include the approval process, the use of inspections, enforcement, public consultation, data requirements, monitoring, and outcomes. Returning to the key question, among the aspects that we considered, the oil sands regulatory system is certainly not "weak" and manages project-level risks in a way that is, in many respects, comparable to South Australia and Alaska.

REPORT PARTICIPANTS AND REVIEWERS

On June 28, 2011, IHS CERA hosted a focus group meeting in Calgary, Alberta, providing an opportunity for oil sands stakeholders to come together and discuss perspectives on the key issues related to environmental regulation. Additionally, a number of participants reviewed a draft version of this report. Participation in the focus group or review of the draft report does not reflect endorsement of the content of this report. IHS CERA is exclusively responsible for the content of this report.

Alberta Department of Energy
Alberta Energy Resources Conservation Board (ERCB)
Alberta Ministry of Environment and Water
American Petroleum Institute (API)
BP Canada
Canadian Association of Petroleum Producers (CAPP)
Canadian Natural Resources Ltd.
Canadian Oil Sands Limited
Cenovus Energy Inc.
Chevron Canada Resources
ConocoPhillips Company
Devon Energy Corporation
Energy and Environmental Solutions, Alberta Innovates
Imperial Oil Ltd.
In Situ Oil Sands Alliance (IOSA)
Marathon Oil Corporation
Natural Resources Canada
Nexen Inc.
Oil Sands Research and Information Network (OSRIN)
Pembina Institute
Primary Industries and Regions South Australia (PIRSA)
Shell Canada
State of Alaska Department Natural Resources
Statoil Canada Ltd.
Suncor Energy Inc.
Total E&P Canada Ltd.
TransCanada Corporation

IHS CERA TEAM

Jackie Forrest, IHS CERA Director, Global Oil, leads the research effort for the IHS CERA Oil Sands Energy Dialogue. Her expertise encompasses all aspects of petroleum evaluations, concentrating on refining, processing, upgrading, and products. She actively monitors emerging strategic trends related to oil sands among capital projects, economics, policy, environment, and markets. She is the author of several IHS CERA Private Reports, such as a recent investigation of West Texas Intermediate oil prices. Additional contributions to research include reports on the life-cycle emissions from crude oil, the impacts of low-carbon fuel standards, and the role of oil sands in US oil supply. She led the team that developed the North American unconventional oil outlooks and recommendations the 2011 National Petroleum Council report *Prudent Development of Natural Gas & Oil Resources*—covering the Canadian oil sands, US oil sands, tight oil, oil shale, and Canadian heavy oil. Ms. Forrest was the IHS CERA project manager for the Multiclient Study *Growth in the Canadian Oil Sands: Finding the New Balance,* a comprehensive assessment of the benefits, risks, and issues associated with oil sands development. Before joining IHS CERA Ms. Forrest was a consultant in the oil industry, focusing on technical and economic evaluations of refining and oil sands projects. Ms. Forrest is a professional engineer and holds a degree from the University of Calgary and an MBA from Queens University.

Molly Birnbaum is a Principal Scientist with ARCADIS-US and has over 25 years of experience in the environmental and natural resources profession dealing with in-field applications, planning and project design, permitting strategy, regulatory and policy issues, and dispute resolution. Her expertise includes the fields of natural resources management, energy policy, and law. She has worked in the United States, primarily in Alaska, as well as in Alberta, Canada, and conducted project work with both government and private industry in matters relating to air, land, and water management. Regulatory experience includes energy (oil and gas) and electrical generation permitting and permitting strategies, with particular expertise in state and federal gaps analysis, regulatory compliance application analysis, permitting strategy and coordination, and policy research. In addition to working with the energy industry in Alaska, she has consulted with the electrical power generation industry in researching renewable energy initiatives and strategies, used in both Canada and the United States. Ms. Birnbaum holds a BA, an LLB from the University of Calgary, and a LLM from the University of Houston.

ARCADIS is full service international company providing consultancy, design, environmental, engineering and management services in the fields of oil and gas exploration, infrastructure, water, environment and buildings. ARCADIS has over 16,000 professionals worldwide, with over 300 offices and in 40 countries assisting national and international companies to solve engineering and environmental problems since 1888. The ARCADIS group of companies has its headquarters in the Netherlands, and its network of offices stretches across Europe, the United States, the Middle East, the Caribbean, Latin America, Africa, Asia, and the Russian Federation. The ARCADIS Alaska office is primarily active in upstream planning and permitting, and its services are generally in support of oil and gas and mineral exploration and development and government projects. ARCADIS also offers compliance services to clients for existing facilities and development.

Samantha Gross, IHS CERA Director, specializes in helping energy companies navigate the complex intersection of policy, environment, and technology. She is the manager of the IHS CERA Global Energy service. She led the environmental and social aspects of IHS CERA's Multiclient Study *Growth in the Canadian Oil Sands: Finding the New Balance,* including consideration of water use and quality, local community impacts, and Aboriginal issues. Ms. Gross was also the IHS CERA project manager for *Towards a More Energy Efficient World* and *Thirsty Energy: Water and Energy in the 21st Century,* both produced in conjunction with the World Economic Forum. Additional contributions to IHS CERA research include reports on the water impacts of unconventional gas production, international climate change negotiations, US vehicle fuel efficiency regulations, and the California low-carbon fuel standard. Before joining IHS CERA she was a Senior Analyst with the Government Accountability Office. Her professional experience also includes providing engineering solutions to the environmental challenges faced by petroleum refineries and other clients. Ms. Gross holds a BS from the University of Illinois, an MS from Stanford University, and an MBA from the University of California at Berkeley.

We also gratefully acknowledge the contribution of **Jason Beck** to this report.

APPENDIX
WEBSITE LINKS TO DATA SOURCES

MAJOR REGULATORY AGENCIES IN ALBERTA, ALASKA, AND SOUTH AUSTRALIA

Alberta

Although numerous other government agencies have jurisdiction, the primary agencies that regulate oil sands are

- Energy Resources Conservation Board (ERCB)—development and conservation of resources
- Alberta Department of Environment (AENV)—regulates the environmental parameters of operation
- Alberta Department of Sustainable Resource Development (SRD)—regulates surface disturbance

The Canadian federal government also has oversight. The primary agencies are

- Department of Fisheries and Oceans and Transport Canada—fish habitat or changes to the navigation of waterways
- Environment Canada—migratory birds and endangered species
- Canadian Environmental Assessment Agency (CEAA)—coordinates federal review of project applications and environmental applications
- Major Projects Management Office (MPMO)—single window to facilitate major resource projects regulatory review process

Alaska

Although numerous other government agencies have jurisdiction, in Alaska the main regulators are

- Department of Natural Resources (DNR)—regulates use of resources (oil, gas, minerals, water) and oversees the protection of cultural sites and fish habitat
- Department of Environmental Conservation (DEC)—issues air quality permits and regulates the disposal of waste
- Alaska Oil and Gas Conservation Commission (AOGCC)—prohibits the waste of crude oil and natural gas, strives to ensure greater resource recovery

Other regulators in Alaska include the Department of Fish and Game, the Department of Public Safety, and the Department of Labor and Workforce Development. Federal agencies

include the Army Corps of Engineers (COE), the Bureau of Land Management (BLM), the Environmental Protection Agency (EPA), and the Bureau of Indian Affairs, among others.

South Australia

The central regulator for the energy industry in South Australia is Primary Industries and Resources South Australia (PIRSA). South Australia has a unique system, with a single regulator managing the development and conservation of resources, environment, and public safety.

PART 1—PROJECT APPROVAL PROCESS LINKS

Alberta

Alberta Environmental Protection and Enhancement Act for EIS contents:. http://environment.alberta.ca/01530.html

Canada Federal Environmental Assessments and related documents:

http://www.ceaa.gc.ca/default.asp?lang=En&n=4F451DCA-1

Alberta ERCB process for environmental assessments, and current projects and documents:

http://environment.alberta.ca/01495.html

Alaska

Alaska—Regulations for Defining National Environmental Policy Act (NEPA) (40 C.F.R. 1502 for EIS requirements):

http://ceq.hss.doe.gov/nepa/regs/ceq/toc_ceq.htm

Alaska—Final Environmental Impact Statement (EIS) listing for major offshore oil developments:

http://www.alaska.boemre.gov/ref/eis_ea.htm

Alaska—Listing of large mines and associated permits and EIS by project:

http://dnr.alaska.gov/mlw/mining/largemine/

South Australia

South Australia—Major project's approval process, EIS documents, and decisions:

http://www.planning.sa.gov.au/index.cfm?objectId=B0D6F25D-96B8-CC2B-63BE28584A11F809

South Australia—PIRSA Minerals South Australian Resource Information Geoserver (SARIG) online database stores past EIS documents related to resource development:

http://www.pir.sa.gov.au/minerals/sarig

South Australia—Oil and Gas approval process and links to documents:

http://www.pir.sa.gov.au/petroleum/environment/regulation/eir_intro

South Australia—Mining approval process:

http://www.minerals.pir.sa.gov.au/publications_and_information/guidelines

South Australia Current Mining Act, including July 2011 Amendments:

http://www.legislation.sa.gov.au/LZ/C/R/Mining%20Regulations%202011.aspx

PART 2—ONGOING OPERATIONS LINKS

Environmental Monitoring Data Links

Alberta

Alberta—Oil sands air monitoring stations. Wood Buffalo Environmental Association (WBEA):

http://www.wbea.org/

Alberta Environment and Water Oil Sands Information Portal (OSIP):

http://environment.alberta.ca/apps/osip/

Summary of National Pollutant Release Inventory (NPRI):

http://www.ec.gc.ca/inrp-npri/default.asp?lang=en&n=629573FE-1

Alaska

Alaska—Environmental data for large mines:

http://dnr.alaska.gov/mlw/mining/largemine/

Alaska—Enforcement and Compliance History Online (ECHO) includes water quality reports by major facility:

http://www.epa-echo.gov/echo/index.html

Alaska—Air quality permits:

https://myalaska.state.ak.us/dec/air/airtoolsWeb/PublicPermitListings.aspx

Alaska—Oil and gas injection data:

http://doa.alaska.gov/ogc/orders/dio/dioindex.html

Alaska—US Fish and Wildlife Service annual notices regarding species considered under protection under the Endangered Species Act:

http://www.nmfs.noaa.gov/pr/species/esa/other.htm

http://alaska.fws.gov/fisheries/endangered/pdf/consultation_guide/4_Species_List.pdf

South Australia

South Australia—Mining annual environmental reports—PIRSA Minerals SARIG online database:

http://www.pir.sa.gov.au/minerals/sarig

South Australia—Oil and gas annual reports:

http://www.pir.sa.gov.au/petroleum/legislation/company_annual_reports/cooper_and_eromanga_basins_annual_reports

South Australia—Environmental Protection Authority (EPA) air and water monitoring data:

http://www.epa.sa.gov.au/environmental_info/monitoring_data

Inspections and Enforcement

Alberta

Alberta—ERCB Field Surveillance and Operations Branch Provincial Summary (ST57):

http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_240_2547123_0_0_18/

Alberta—ERCB Monthly Enforcement Action Summary (ST108):

http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_308_265_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/publications_catalogue/publications_available/serial_publications/st108.aspx

Alberta—Alberta Environment and Water Compliance Assessment Enforcement Reports:

http://environment.alberta.ca/01292.html

Alberta Environment and Water online oil sands portal (has enforcement data by project):

http://environment.alberta.ca/apps/osip/

Alaska

Alaska—Inspection reports for large mines:

http://dnr.alaska.gov/mlw/mining/largemine/

Alaska—AOGCC Field Inspection Summary from 1980 to 2004:

http://www.doa.alaska.gov/ogc/annual/2004/2004_Inspections_Final.pdf

Alaska—EPA Inspections and Evaluations ECHO database (look up inspection data for each facility):

http://www.epa-echo.gov/echo/index.html

Alaska—EPA Compliance and Enforcement Annual Results for 2010:

http://www.epa.gov/compliance/resources/reports/endofyear/eoy2010/index.htmlAlaska—Alaska Oil & Gas Conservation Commission enforcement actions (listed as commission orders):

http://www.doa.alaska.gov/ogc/orders/como/otherindex.html

South Australia

South Australia—Mining—*MESA Journal* annual reports (Volume 60 is 2010 annual review; volume 59 is 2009 annual review):

http://www.pir.sa.gov.au/minerals/publications_and_information/mesa_journals

South Australia—Implements policy and processes for mine closure using the Ministerial Council on Mineral and Petroleum Resources' (MCMPR) Strategic Framework for Mine Closure:

http://www.ret.gov.au/resources/mcmpr/Pages/StrategicFrameworks.aspx

South Australia—Oil and Gas Compliance reports:

http://www.pir.sa.gov.au/petroleum/legislation/compliance/petroleum_act_annual_compliance_report

PART 3—MINE RECLAMATION AND FINANCIAL SECURITIES LINKS

Reclamation

Alberta

Alberta reclaimed land certificate online database:

http://environment.alberta.ca/01520.HTML

Alberta—Oil sands mines development and reclamation indicator:

http://environment.alberta.ca/02863.html

Alberta Environment and Water online oil sands portal (has financial securities and status of reclaimed land by project):

http://environment.alberta.ca/apps/osip/

Alaska

Alaska—DNR mining regulations; includes reclamation performance:

http://dnr.alaska.gov/mlw/mining/2009Reg_book.pdf

Reclamation Security

Alberta

Alberta—Mine Financial Security Program details:

http://www.environment.alberta.ca/03388.html

Alberta—Current status of reclamation for oil sands lands:

http://environment.alberta.ca/02863.html

Alberta Financial Securities Data—Environmental Protection Security Fund Annual Report:

http://environment.alberta.ca/01874.html

Alaska

Alaska—Financial bonds and outstanding reclamation liabilities by mine:

http://dnr.alaska.gov/mlw/mining/largemine/