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Regulatory requirements for reclamation and closure planning at Alberta's oil sands mines

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Abstract

All oil sands mine operators are required to conserve and reclaim land disturbed for their operations, and to obtain a reclamation certificate under Alberta Environment (AENV)'s Environmental Protection and Enhancement Act (EPEA). Each operator is given specific operating approval conditions related to conservation, reclamation and closure activities. Other conditions identify what plans and reports must be submitted and authorised by AENV prior to implementation. AENV works closely with Alberta Sustainable Resource Development, the government department whose mandate includes managing forest resources, biodiversity, fish and wildlife.

Using an adaptive management approach in response to new knowledge and technology, EPEA approval conditions are updated over time with changes specific to expectations associated with soil salvage and placement, wetland reclamation, annual reporting, and closure plan development, amongst other things.

Since three major oil sands mine public hearings held in 2006, AENV has clarified expectations by updating approval conditions, providing industry specific templates for reporting, developing consistent and clear definitions, and defining a table of contents for upcoming reclamation and closure plan updates. Future reclamation plans and reports submitted to AENV by the operators will include data in a common geodatabase (GIS) format. Work is ongoing within the Government of Alberta to develop a comprehensive geodatabase for the mineable oil sands region, which will make information more easily accessible to regulators, industry, and the public.

This paper will highlight the regulatory requirements related to conservation and reclamation activities at the oil sands mines, including but not limited to soil salvage, storage, and placement, revegetation, wildlife and biodiversity, and wetlands. The paper will focus on the recent efforts made by the regulators to ensure consistent and clear expectations surrounding submission of reclamation and closure plans as well as annual reporting requirements. A summary of the current status of the tree clearing, land disturbance and reclamation activities associated with the oil sands mines will be presented.

1 Introduction

Alberta's oil sands are situated in the northern portion of the province of Alberta, Canada. Oil sand deposits are primarily made up of sand, clay, bitumen and water. There are currently two main methods of oil sands extraction: in situ (which means in place) recovery and open pit mining. In situ methods of bitumen recovery are used in places where the oil sands deposits are too deep for open pit mining to be economic. The bitumen is recovered through vertical or horizontal wells drilled through the oil sands deposits that are assisted with steam or solvent injection to make the bitumen less viscous and therefore more amenable to pumping. Open pit mining is a truck and shovel operation, where the oil sands are dug up and hauled to a facility where hot water and various chemicals are used to separate the recoverable oil from the sand. This paper focuses on reclamation and closure planning associated with oil sands mining operations. The provincial government states that Alberta has proven oil reserves of 171.3 billion barrels, consisting of bitumen (169.9 billion barrels) and conventional oil (1.4 billion barrels). These reserves make up the third-largest proven crude oil reserve in the world, next to Saudi Arabia and Venezuela. This is enough oil to meet Canada's current oil demand for almost 400 years (ERCB, 2010).

The Government of Alberta (GOA) regulates oil sands development through a number of Acts and Regulations, supported by a number of provincial government departments. Reclamation is primarily

regulated under the *Environmental Protection and Enhancement Act* (EPEA) administered by Alberta Environment (AENV), supported by the *Public Lands Act* (PLA) administered by Alberta Sustainable Resource Development (ASRD). Through EPEA approvals issued to companies, GOA regulates air, water quality, waste, land conservation and reclamation, fish, wildlife and biodiversity. ASRD provides access to the land through a Mineral Surface Lease issued under the PLA. The Energy Resources Conservation Board (ERCB) regulates mine development including landform design and tailings management.

As per EPEA, all oil sands mine operators have a duty to conserve and reclaim land disturbed for their operations, and a requirement to obtain a reclamation certificate. Each operator is given specific EPEA approval conditions related to conservation and reclamation activities and closure planning. Other conditions identify what plans and reports must be submitted and authorised by AENV prior to implementation.

Over the past five years, the regulators have identified the need to become more consistent and clear on our expectations within approvals issued to oil sands mine operators related to operational expectations, planning and reporting requirements. A shift to increasing public accountability, in part due to the high profile that the mineable oil sands industry now has, has also driven the need for better public access to disturbance and reclamation information. Working closely with the operators, regulators have made strides in the field of conservation and reclamation regulation.

The following initiatives support the enhancement of reclamation and closure planning at the oil sands mines, some of which have been packaged as part of the "Progressive Reclamation Strategy", led by AENV:

1. Updated EPEA approval conditions:
    a. Soil salvage and placement.
    b. Wetlands reclamation (operational and research).
    c. Annual reporting, including electronic submission.
    d. Consistent reclamation and closure planning submission dates.
2. Defined expectations for the submission of reclamation and closure plans, including development of a consistent table of contents.
3. Updated annual reporting standards and definitions, including better public access to information.
4. Submission of annual report and closure plan data in geospatial format.
5. Applied research and development efforts driven by multi-stakeholder forums and research consortia to support updates to regulatory guidelines and the development of criteria and indicators for reclamation certification.
6. Clarification of the administrative process for reclamation certification.

These will each be discussed in detail in this presentation.

2 Regulatory and policy changes

2.1 EPEA approval updates

The EPEA approval template for oil sands mines was updated after the GOA participated in three major oil sands mine public hearings, held by the ERCB (at that time, the Energy and Utilities Board) in 2006. Two of the hearings were related to project expansions and one hearing was related to a new oil sands mine development. The GOA provided the ERCB with written submissions for consideration in their public interest decision.

At that time, the GOA stated (Alberta Justice, 2006) "Alberta supports reclamation that is done in a timely, progressive manner for all mining projects. Reclamation should be planned and carried out at the project, adjacent lease and regional level, to produce seamless, less fragmented reclaimed landscapes." The GOA further stated "Alberta expects mined areas to be reclaimed to naturally appearing and functioning boreal landscapes." The position taken by the GOA on conservation and reclamation at these public hearings led to a change in the EPEA approval template going forward.

Since 2007, EPEA approvals for oil sands mines include the following conditions, amongst other updated conditions: "The approval holder shall reclaim the land so that the reclaimed soils and landforms are capable of supporting a self-sustaining, locally common boreal forest, regardless of the end land use" and similarly "The approval holder shall revegetate the disturbed land to target the establishment of a self-sustaining, locally common boreal forest, integrated with the surrounding area…" The EPEA approvals now have a greater focus on integration at lease boundaries, between adjacent mine sites and with undisturbed lands, and they also focus more on the return of regional ecosites, including the separate salvage and use of upland surface soils and the forest floor material (LFH) in reclamation, to support greater establishment of locally common vegetation species.

More attention has also been placed on wetlands reclamation, with the expectation that operational field trials to reclaim bog/fen wetlands will occur, and that wetland reclamation will be supported by appropriate watershed design. Support for adaptive wetland reclamation will come from research efforts, and through monitoring, model validation, and technology transfer. More detailed planning regarding overall wetland reclamation and monitoring is now required, including plans for soil placement and revegetation, and water quality and quantity. By bringing the wetland reclamation soil salvage, soil placement and revegetation plans (including source and propagation techniques), directly into the wetlands reclamation planning process (rather than in the more upland focussed soil salvage and placement plan and revegetation plan), a more comprehensive and specific planning document for wetland reclamation can be developed. Expected criteria and performance measures for reclaimed wetlands are being developed through research and monitoring. With a greater focus on the re-establishment of wetlands reflective of a boreal forest, well-defined expectations and evaluation criteria can be developed, tailored to the unique qualities of wetland and aquatic habitats.

A shift regarding soil salvage and placement also occurred in 2007. Previously, the most typical soil salvage and placement technique used was the over-stripping of organic soils into the mineral material below. This material, salvaged, stockpiled, and placed at a 60:40 or 70:30 ratio, is called peat mineral mix. Since 2007, the EPEA approvals have required separate salvage, stockpile, and placement of the following soil materials: upland surface soil (further segregated into soils from drier vs. moister ecosites), subsoil of different qualities (good/fair vs. poor) as well as continued salvage of the peat mineral mix. The requirement to use all upland surface soil (including the LFH) in reclamation was added, as was the requirement to salvage all upland subsoil rated good or fair for subsequent use in reclamation. There was also a shift in the depth of reclamation material required. Previously, a 20 cm reclamation material (soil) placement depth was the minimum, with some operators voluntarily placing 30 cm. Current requirements are for a 50 cm reclamation material (soil) placement depth, with some flexibility, depending on the quality of the underlying material. The requirement that clean capping material be placed over deleterious materials (e.g. lean oil sands, oil sands reject, consolidated tailings, saline or sodic overburden material, the plant site area) prior to the placement of reclamation material has been enhanced from 80 to 100 cm minimum.

With the focus on the use of upland surface soil and its LFH in reclamation, traditional operational practices of smoothing out the reclaimed surface are not appropriate. Smoothing the soil surface is not conducive to establishing microsites for the propagules within the LFH to establish and grow or for those likely to disperse into the site. However, a rough surface is not conducive to easy measurement for determining whether minimum soil placement depths have been met. The regulators are working with the operators to establish a process for confirming that enough soil has been placed on the area. For example, a system of tracking volume over area is acceptable to the regulators when the principle of maintaining surface roughness for reclamation success is of more importance.

Since 2007 oil sands mine operators have adapted their operations to meet the enhanced soil salvage, stockpile, and placement conditions of the revised EPEA approvals. EPEA approval conditions have been updated to require the submission of annual soil salvage and placement plans. The operators develop these annual plans, reflective of the current mine reclamation plan, and submit them to AENV for review and authorisation. Through the annual soil salvage and placement plan submissions, regulators now have increased understanding of the planning and operations at any given point in time. The annual review schedule can be time consuming to both government and industry, since it includes the development of the plan by the operators, review of the plan by the regulators, requests for supplemental information and subsequent revision if necessary, one on one meetings between the operators and regulators, followed by

written authorisation by AENV, and implementation and monitoring by the operators. Submission of an acceptable soil salvage and placement plan is required before a company can begin annual operations, but the requirement for the regulator to do a detailed review and provide written authorisation can be waived. Whereas this requirement has not been waived to date, it will likely occur in the future as both operators and regulators become more comfortable with the interpretation, implementation, and evaluation of EPEA approval requirements. Obviously operators are hopeful for this to occur sooner rather than later.

A number of individual plans related to reclamation have historically been requested through the EPEA approvals, often submitted separately, and at different points in time. These plans include the revegetation plan, biodiversity plan, wetlands reclamation plan, forest resource plan, and updates to the 10-year mine reclamation plan and to the life of mine closure plan. Since 2007, EPEA approvals have required the submission of these updates at the same time, in an integrated submission. The regulatory requirements of the individual plans must still be met, whereas the coordinated development and submission of the plans supports better planning and integration, and provides regulators an opportunity to better evaluate closure planning and integration across mine operations and lease boundaries.

2.2 Reclamation and closure planning

Discussions regarding the regulatory expectations of the integrated reclamation plans due (in full or in part) by 31 December 2011 were initiated and led by AENV in 2009. Whereas a fairly comprehensive list of approval conditions exists to provide direction for the content for mine reclamation plans and life of mine closure plans, the full meaning of those conditions is sometimes questioned. Thus, an understanding of the individual plans (revegetation plan, biodiversity plan, wetlands reclamation plan, forest resource plan, 10-year mine reclamation plan update, life of mine closure plan update) was required, as was an understanding of the expected outcome for the integrated package. A consolidated table of contents for the integrated package was developed by AENV with input from ASRD and the operators. The table of contents is based on the understanding that all components of the integrated package be linked to ensure effective and appropriate short and long term planning and to ensure operational practices are supported by planning assumptions. A concordance table submitted with each operator's integrated plan will ensure that all regulatory requirements are met.

This coordinated planning exercise supports the regulatory expectation that operators identify both opportunities and challenges associated with integration and natural appearance of mine features at lease boundaries. Because the plans are being submitted at the same time, regulators now have the opportunity to assess regional integration and to ensure consistency in reclamation and closure expectations. It is understood that regulatory review of these submissions will take a significant amount of time and effort by the various regulatory professionals including specialists in: soils, vegetation, wetlands, limnology, hydrology, hydrogeology, health, wildlife, and forestry.

The approach for establishing consistent submission dates for reclamation and closure plan updates has thus far been successful. There is strong industry support to continue on the path of comprehensive and integrated plans. Considerations for future EPEA approvals may include the development of even more integration of conditions for reclamation planning, perhaps with reference to a formal guidance document outside of the EPEA approvals. Based on the review and assessment of the integrated reclamation and closure plans being submitted by 31 December 2011, the regulators will have the information necessary to make a decision regarding future EPEA approval amendments and associated guidelines. AENV and ASRD will develop a process for reviewing and assessing the large amount of information that will be collected from the operators through the 31 December 2011 submissions.

2.3 Annual reporting

In 2009, AENV worked with ASRD and the operators to review the way that disturbance and reclamation information was historically reported to the GOA through annual conservation and reclamation reports. It was understood that there were challenges and inconsistencies in how disturbance and reclamation were being defined by the operators, and clear direction from regulators was required.

Alberta's State of the Environment website (http://environment.alberta.ca/02863.html) provides a public summary of this information, previously reporting on these categories: active, reclaimed, and certified, with little clarity on what the active and reclaimed categories represented.

New definitions were developed representing a clear, concise, and consistent way for information to be provided to AENV for tracking and public reporting. The new information gives a clear snapshot of the status of the land, at the time of reporting (31 December of each year).

The new definitions provide a better system for tracking the level of disturbance associated with each oil sands mine, and the reclamation progress that is being made. Progressive reclamation activities are better represented, and a clear definition of each milestone ensures better accuracy in reporting. The definitions are presented below.

- Cleared: Areas where vegetation has been removed for the purposes of preparing the land for drainage, soil removal, overburden removal, mining, etc. but where soil has been left mostly intact and relatively undisturbed.
- Disturbed – used for mine or plant purposes: Areas where at a minimum, soil has been removed or covered by other materials and soil would be required for reclamation purposes. This category includes, for example, all areas where soil removal, overburden removal, active mining, discard placement, or material storage has occurred. End Pit Lakes are reported in the disturbed category.
- Ready for reclamation – no longer used for mine or plant purposes: Areas that are no longer required for mine or plant purposes and are available for reclamation but where reclamation activities have not yet commenced.
- Soils placed (terrestrial; wetlands and aquatics): Areas where reclamation material has been placed, reporting a combination of both the terrestrial, and the wetlands and aquatics permanent reclamation categories. Land moves from the disturbed category to the soils placed category once reclamation material is placed as per the approved reclamation and soil placement plans.
- Temporary reclamation (terrestrial): Areas being managed where vegetation has been seeded, planted, or ingressed, where there is an expectation that future disturbance may occur at that location.
- Permanent reclamation (terrestrial, wetlands and aquatics): Land is considered permanently reclaimed when landform construction and contouring, clean material placement as required, reclamation material placement and revegetation has taken place. Land cannot be listed under permanent reclamation until revegetation has occurred which is reflective of the approved reclamation and revegetation plans.
- Certified: Areas that have received a reclamation certificate under the EPEA. These areas are not counted in the Total Active Footprint calculation because they are no longer active (they are returned to the Crown).

Due to the significant shift in definitions used for reporting, the new reclamation and disturbance data cannot be compared to historic records. Company specific information will remain separate instead of being combined, thus showing true land status by operator, making it more relevant to the status of any mine at a given time. Below is the disturbance and reclamation data as of 31 December 2010.

Table 1 Oil sands mine disturbance and reclamation status (in hectares) as of 31 December 2010. Due to space limitations, the 104 hectares of land associated with the Syncrude Canada Ltd. Mildred Lake site that has been certified and returned to the Crown is not shown in the table. The EPEA approved footprint is the total project area approved by AENV, also associated with the ERCB approved footprint

Mine Site/ Facility	EPEA Approved Footprint	Cleared	Disturbed: Used for Mine or Plant Purposes	Ready for Reclamation: No Longer Used for Mine or Plant Purposes	Soils Placed (Terrestrial; Wetlands & Aquatics)	Permanent Reclamation (Terrestrial)	Permanent Reclamation (Wetlands & Aquatics)	Temporary Reclamation (Terrestrial)
Canadian Natural Horizon	17,193	2,469	4,721	0	89	56	0	197
Imperial Kearl	26,480	1,182	2,091	31	28	1	0	20
Shell Albian Sands Jackpine	7,669	828	2,708	0	0	0	0	5.6
Shell Albian Sands Muskeg River	12,572	726	5,393	0	0	16	0	111
Suncor Base Operations	22,548	4,340	13,543	362	198	1,254	40	0
Suncor Fort Hills	18,863	4,431	1,363	0	3.5	0	0	24.4
Syncrude Aurora North	9,549	660	4,858	0	310	67	0	16
Syncrude Mildred Lake	20,283	2,419	12,223	0	906	2,249	1,152	406
TOTALS	**135,157**	**17,055**	**46,899**	**394**	**1,534**	**3,643**	**1,192**	**780**

In working with the oil sands mine operators to better define the categories for tracking disturbance and reclamation activities, it was proposed by the operators that the reporting period for the annual report be shifted to better coincide with the annual soil salvage and placement plans that typically provide plans to salvage and place reclamation materials over the winter months, when the ground is frozen. This shift in reporting period from January to December to 1 October to 30 September was accepted by the regulators, and the 2009 data was reported from 1 October 2008 to 30 September 2009. However, after one year under the new regime, the operators realised that this reporting period did not align with other reporting periods such as for financial reports and reports to other regulators, most of which are from January to December. In 2010 the operators requested that the reporting period for the annual conservation and reclamation information therefore be returned to January to December. This request was accepted by the regulators, and the companies re-calculated their 2009 numbers for the January to December period.

The new categories and associated definitions have been considered a significant step forward in terms of public accountability and clarity of information. Through the GOA State of the Environment website and the upcoming Oil Sands Information Portal, the more detailed information related to disturbance and reclamation activities at the oil sands mines is necessary to provide better access and information to the public, thereby enabling a better understanding of the current state of the land disturbed by oil sands mining in Alberta. As well, better, more detailed reporting will provide more clarity for regulatory inspections and reclamation certification.

2.4 Research and development to support guideline development

The EPEA approvals make reference to a number of guidance documents recommended to the GOA by a multi-stakeholder organisation called the Cumulative Environmental Management Association (CEMA). These guidelines support the development of an oil sands mine operators reclamation plans, and they are updated regularly based on new information obtained through research and monitoring. The following guidelines are commonly used in reclamation planning at the oil sands mines:

- Land Capability Classification System (LCCS) for Forest Ecosystems in the Athabasca Oil Sands, 3rd Edition (AENV, 2006).
- Guideline for Wetland Establishment on Reclaimed Oil Sands Leases, 2nd Edition (AENV, 2007).
- Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region, 2nd Edition (AENV, 2010).

Since 2007 AENV and ASRD have worked within CEMA to develop guidelines related to the development of soil salvage and placement strategies, as has been referenced in EPEA approvals for oil sands mines. In 2011, the Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region (CEMA, 2011) document was completed by CEMA and is being referred to the GOA for consideration as a guidance document. It is expected, because of the continued AENV and ASRD support

throughout the development of the document, that it will be accepted by the GOA and implemented as a GOA guideline.

The GOA is also working within CEMA to develop criteria and indicators for reclamation certification. Incorporating the knowledge and experience of the aquatics and terrestrial experts from industry and government, this framework outlining goals, objectives, criteria, indicators, methods, and standards, will be a tool used by the operators and regulators to consistently plan for and target for the expectations of certification (return of the land back to the Crown). The development of criteria and indicators for reclamation certification within CEMA is very important to the GOA and it has been recognised as a component of the GOA's "Progressive Reclamation Strategy". It is expected that this project will be completed by the end of 2012, resulting in a suite of criteria and indicators to support the current overarching goal that "reclaimed soils and landforms are capable of supporting a self-sustaining, locally common boreal forest, regardless of end land use." The objectives, criteria and indicators which support this goal will be recommended to the GOA as a tool to support reclamation certification of oil sands mines.

CEMA is also working on a guideline for the establishment of end pit lakes, expected to be recommended to the GOA for the first time in 2012.

The EPEA approvals explicitly describe research requirements associated with tailings reclamation, end pit lakes, and wetlands reclamation. Directed research is intended to support the evaluation of mine and tailings practices to ensure they are capable of meeting reclamation and closure objectives and to support continuous improvement through adaptive management.

AENV and ASRD continue to work within CEMA to update the other guideline documents continually used as planning tools for reclamation.

2.5 Geospatial data collection

The EPEA approvals provide an avenue for AENV to request information in a geospatial, or digital, format. The information collected through annual reporting of as-built activities has historically been collected in tabular and map format – on paper. Only since recently have companies been providing their annual conservation and reclamation reports on CD as well. However, this information has not been presented in a format that is useable within a geographic information system (GIS). Starting in 2011, there is an expectation by AENV that annual as-built information be submitted in a consistent geospatial format as well as a paper/CD format. This process will support policy analysis and assurance and compliance assessment at both an individual operation and at the regional scale. This data will also form the foundation of the disturbance and reclamation interactive maps on the upcoming public website, the Oil Sands Information Portal, in development by the GOA.

The submissions of updated and integrated mine reclamation plans and life of mine closure plans, due by 31 December 2011, will also include geospatial data. The opportunity to view and analyse life of mine closure plans in a geospatial data format will allow the regulators to better understand and evaluate future development scenarios, to identify where issues regarding landform and vegetation integration across lease boundaries may exist in the future, and to evaluate the implications of policy options.

A comprehensive set of geospatial information for the conservation and reclamation activities and reclamation and closure plans for all oil sands mines in the region does not currently exist – expectations for this information is high. Oil sands mine operators are generally supportive of this new direction, as well as the efforts to better share information in a public forum.

2.6 Reclamation certification process

Only one reclamation certificate for an oil sands mine has been issued; however, it should be noted that only one application has been received. This was for a 104 ha parcel of land on the Syncrude Canada Ltd.'s Mildred Lake site. The reclamation certificate was issued, and the land returned to the Crown in 2008. Throughout the process it was clear that direction provided by the outdated regulatory guidance documents for how the regulatory review of the application would proceed was not sufficient. Starting in 2009 regulators worked with a consultant to develop a comprehensive and updated "Administrative Guide to the Oil Sands Mine Reclamation Certification Process" (AENV, DRAFT 2011).

The draft administrative guide incorporates recommendations received from CEMA concerning the GOA's reclamation certification application process, and it incorporates recommendations from those involved in the one application already received and reviewed. The document outlines the regulatory framework in which oil sands mine reclamation exists, the roles of the different regulatory agencies (AENV, ASRD, and the ERCB) and the applicant, and it goes into specific detail about the application process. Expectations regarding pre-submission discussions between the operator and the regulators, what needs to be included in the application, what standards the reclamation will be assessed against, the regulatory review process (administrative and technical), the field inquiry, and the final decision to issue or reject the application are all included in this process document. The appeal process is outlined, and a summary of the reclamation and contamination liabilities is provided.

Although there are no reclamation certificate applications expected to be submitted to AENV in the near future, the "Administrative Guide to the Oil Sands Mine Reclamation Certification Process" is expected to provide clear guidance to operators who may be considering what the process will be for them. By having a clear process outlined, the pre-application discussions can occur sooner rather than later, and the operators know what to expect. It is expected that this process document will be finalised and published in 2011.

3 Conclusions

The authors of this paper have associations with various oil sands regulatory agencies, stakeholders and oil sands mine operators. Both time and effort have been expended to build open relationships within and among these groups to enable appropriate and effective change over time, within the regulatory system that currently exists. A solid understanding of the EPEA approvals issued to an operator, and the linkages to policy, regulations, guidelines, and best practices is key to knowing what can be changed and when. Adaptive management is best when supported by all stakeholders including the oil sands mine operators being forced to change. For example, industry buy-in to allow for better clarity, transparency, and public accountability has enabled many of the recent changes.

The support of technical expertise found through multi-stakeholder forums is important in developing new guidelines and revising outdated ones. Multi-stakeholder forums also provide opportunities for relationship building and buy-in.

Solid support for and understanding of science and emerging knowledge and technology is also key to change. Through adaptive management based on knowledge and experience gained from research and monitoring over time, the EPEA approvals for oil sands mines have incorporated modern expectations, through clear and consistent definitions, relevant conditions, integrated planning expectations, and updated reporting requirements, including the submission of geospatial information. The 31 December 2011 will be the first opportunity for the regulators to review the short and long-term plans of all oil sands mines at the same time, and to assess integration at a regional scale.

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