The DBM approach for setting engineering design criteria for an oil sands mine closure plan

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Outline

1. Closure planning in the oil sands
   - What is the closure goal?
   - Integrated planning elements
   - Adaptive management, an iterative approach
2. Recycling an old tool...
   - Beaver activity in the closure landscape
   - Avoid ponded water near slope crests
3. MRM Closure Landscape Planning
   - Some lessons learned
Closure Planning in the oil sands

Planning with the end in mind…
What is the closure GOAL?

“...create a landscape that is capable of supporting a self-sustaining, locally-common boreal forest”

Source: Hatfield Consultants 2008
Goal is achieved through

- Integrated Planning Process
- Regulations
- Adaptive Management
Integrated Planning Elements

Phase I
- Dewatering
- Tree Clearing
- Reclamation soil salvage
- Ore mining
- Dyke and dump construction
- Tailings infilling
- Closure feature construction
- Mine waste mining
- Plant

Phase II
- Revegetation
- Reclamation soil placement
- Monitoring & maintenance

Land

Modified from “Hachey and Lanoue, Sept. 2011"
Recycling an old tool
Benefits of an integrated approach….

- Links mine, tailings and closure plans to create the proposed closure topography.
- Identifying closure assumptions and risks in planning, schedule and costs
- Provided opportunity at design phase to minimize rehandle and rework,
- Increase transparency in reclamation & closure plans.

As a result of this process, a strategy document and a DBM were developed
Closure DBM

The design basis:
- supports closure landform design
- defines objectives to meet the goals
- documents the closure landform design criteria.
Beaver Activity in the closure landscape

- **Expected activity:**
  - Damming streams and rivers, enlarging wetlands, digging canals, flooding large areas
  - Beaver dams to 3 m high expected
  - Dams wash out in large flood events.

**Design accommodations:**
- Freeboard requirements for channels and outlets adjusted to account for beaver activity
- Riparian planting prescriptions with species that beavers prefer for food and for construction
- Dams assumed to wash out in 1 in 100 - year runoff events.

Avoid ponded water near slope crests.

- **Risk activity:**
  - Ponded water near slope crests can cause gullying, washouts and overall geotechnical instability of the landform.

- **Design accommodations:**
  - Create a geotechnical buffer zone to preclude permanently ponded water near crests.
  - Create a geotechnical critical zone to preclude temporarily ponded water near crests.

Integrate designs across lease boundaries

- Risk Activity:
  - Landforms with long linear unnatural appearance
  - Misalignment of elevations across legal boundaries.

- Design accommodations:
  - Maintain landform continuity across lease boundaries where reasonably practicable
  - Adjust soil placement, site types and planting prescriptions at boundaries to avoid linear differences in forest appearance.
What did we learn by using this approach

Examples from our closure plan
Potential watershed outlets & connections

Outlet to Athabasca River

Design recommendation:
Reduce quantity of water to this outlet location to minimize erosion.

Outlet to Muskeg River

Design recommendation:
• Eliminate outlet (reduce disturbance) and direct watershed to Sharkbite EPL.

Aurora North Boundary

Design recommendation:
• Working with Syncrude on boundary watershed and site-types and vegetation prescriptions.

Outlet to Muskeg River

Design recommendation:
• Direct most of landscape watershed to these outlets.

Inlet from Natural Watershed

Design recommendation:
• Design more wetlands on east side of Muskeg River.
Resultant Landscape Plan

Legend

Site Type
- Dry
- Moist
- Wet
- Wetland
- PDA Boundary
- EPEA Boundary
Summary

- The DBM approach can be challenging but valuable for meeting closure goals
- Closure goals mostly founded on target end land uses
- Need a multidisciplinary team
- Design involves tradeoffs as measured against the objectives
- Volumetrics and sequencing are critical – they keep the closure plan real
- Iteration within and between plans is critical to success. It’s a journey
- The DBM approach allows close collaboration between designers, mine operators, local communities, and regulators and links mine development, operations, and the post-mining landscape.
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Questions and Answers