7 CONSERVATION AND RECLAMATION

The purpose of the C&R Plan is to outline C&R practices to be followed for the Project. This C&R Plan presents a series of practices and protection measures that apply to construction, operations and reclamation, and outlines monitoring to assess and adapt mitigation for reclamation of the Project. Grizzly understands the C&R requirements regulated under EPEA only apply to the CPF and associated facilities; however, details regarding soil handling and final reclamation for well pads are included as part of this C&R plan.

Information sources consulted and considered in the C&R plan design include:

- Project Design (Section 5);
- relevant regulatory guidance documents, including the Guide to Content for Industrial Approval Applications (Government of Alberta 2013) and the AER Draft Directive 023: Oil Sands Project Applications (ERCB 2013);
- Guidelines for Submission of a Pre-Disturbance Assessment and Conservation and Reclamation Plan (PDA/C&R Plan; AENV 2009a);
- biophysical information (including soils and vegetation) collected for the Project;
- other in situ thermal recovery projects and their respective C&R plans;
- oil and gas facilities reclamation experience; and
- published documents of reclamation research.

7.1 CONSERVATION AND RECLAMATION OBJECTIVES AND KEY ACTIVITIES

The objective of reclamation, as defined by the EPEA Conservation and Reclamation Regulation, is to reclaim areas disturbed for industrial development to equivalent land capability, wherever possible (Government of Alberta 1993). Equivalent land capability is defined as “…the ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical.” (ESRD 2013c). The C&R Plan also aims to:

- Summarize the reclamation plan for the life of the Project;
- Discuss the management of Project footprint during the life of the Project, including progressive reclamation;
- Identify and discuss areas affected by the Project that may be difficult to reclaim;
- Discuss the end land-use objectives at Project closure; and
- Summarize the monitoring and follow up activities necessary to assess the effectiveness of reclamation throughout the life of the Project.

This C&R Plan presents general guidelines to mitigate potential impacts that may result from the construction and operation of the CPF and associated facilities. Key Project activities that will integrate C&R measures include soil salvage and stockpiling, weed control, surface water management, erosion control, decommissioning, and final reclamation.

The conservation and reclamation objectives for the Project include:

- Conserving existing resources as much as practical;
• Adopting measures to mitigate, minimize or prevent environmental impact that will reflect applicable reclamation guidelines at the time of construction, operation and final reclamation;
• Reclaiming disturbances to baseline equivalent land capability;
• Ensuring reclaimed lands conform with surrounding landform and drainage patterns;
• Meeting reclamation criteria at the time of reclamation; and
• Providing self-sustaining ecosystems on reclaimed lands.

Adjustments may be made on a site-specific basis to account for topography, soils, vegetation and other factors that might differ from the conditions observed in the field that were used in developing this C&R Plan. Grizzly commits to following the guiding principles and the measures for conservation and reclamation presented in the Conservation and Reclamation Guidelines for Alberta (AENV 1997).

7.2 PROJECT OVERVIEW

Project components including design, schedule and figures are presented within Sections 1 and 5. Details of the CPF facilities are presented in Section 4.2.

Lands subject to direct disturbance discussed in this C&R plan include the CPF and associated facilities (as permitted as part of the anticipated EPEA approval): the CPF (58.4 ha), Camp (3.3 ha), Borrow 1 and access road (13.1 ha), and Laydown (1.2 ha; Figure 7.2-1). The Borrow Pit 1 Access Road will tie into the nearby well pad production ROW. Only the road south of Borrow 1 that connects to the production ROW is considered for this C&R Plan. Grizzly will reclaim the Project footprint, including the existing disturbances within the footprint.

7.2.1 Environmental Setting

The Project is located approximately 14 km northwest of Conklin, Alberta in the Central Mixedwood Natural Subregion of the Boreal Forest Natural Region. The subregion contains mixed aspen-white spruce forests with a significant component of bogs and fens in poorly drained areas. Terrain in the subregion predominantly comprises level to nearly level slopes at lower elevations and very gently to gentle slopes in upland areas. White spruce and trembling aspen are often the dominant tree species in pure and mixed stands (Natural Regions Committee 2006). Sections of the Project lease area were burned in recent forest fires. Vegetation in these areas consists of natural regeneration and is dominated by Jack pine and blueberry.

The main land uses in the area include forestry, trapping, oil sands development, conventional oil and gas development, and traditional land use, (Section 6.1.2).

The ecosite phases and AWI classes were mapped for the Project. A summary of the wetlands mapping is discussed and presented in Section 6.3. The ecosite phases of the CPF and associated facilities mainly comprise of the b3 blueberry aspen-white spruce upland ecosite phase and the d regeneration forest class (Table 6.3-1). Soil series identified in the CPF and associated facilities are included in Table 7.2-1.
Table 7.2-1  Soil Series Identified in the CPF and Associated Facilities

<table>
<thead>
<tr>
<th>Soil Series</th>
<th>Description and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitumount (BMT)</td>
<td>An Orthic Gleysol developed on glaciofluvial material. LFH or O/Om is at the surface. Lower subsoil Bg and Cg mineral horizons are fine textured.</td>
</tr>
<tr>
<td>Dover (DOV)</td>
<td>An Orthic Gray Luvisol developed on fine textured silty clay to silty clay loam glaciolacustrine parent material.</td>
</tr>
<tr>
<td>Hartley (HLY)</td>
<td>A Terric Fibrisol or Terric Mesisol developed on fen peat. This soil series is found on the CPF and with an average peat depth of 60cm. The water table is usually within 50 cm of the peat surface.</td>
</tr>
<tr>
<td>Kinosis (KNS)</td>
<td>An Orthic Gray Luvisol developed on medium textured sandy loam to clay loam till parent material. Soils are acidic to neutral with 10 – 20 % coarse fragments.</td>
</tr>
<tr>
<td>Mildred (MIL)</td>
<td>An Eluviated Dystric Brunisol developed on sandy textured glaciofluvial outwash material.</td>
</tr>
<tr>
<td>Steepbank (STP)</td>
<td>An Orthic Gleysol developed on till parent material. LFH or O/Om is at the surface. Lower subsoil Bg and Cg mineral horizons are moderately fine textured.</td>
</tr>
<tr>
<td>Stream Channel (SC)</td>
<td>Stream channel consisting of open water and stream banks.</td>
</tr>
</tbody>
</table>

Source: Adapted from Alberta Soil Names File, User’s Handbook (ASIC 2006) and the NE Alberta Soil Update (ASIC 2013).

Soil map units (SMUs) were mapped for the CPF and associated facilities, and are presented on Figures 7.2-1 and Table 7.2-2.

Table 7.2-2  Soil Map Units for the CPF and Associated Facilities

<table>
<thead>
<tr>
<th>Soil Map Units</th>
<th>CPF</th>
<th>Laydown Area</th>
<th>Camp</th>
<th>Borrow 1 and associated access road</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMTpt(a)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.4</td>
</tr>
<tr>
<td>HLY</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>0.4</td>
</tr>
<tr>
<td>KNS</td>
<td>25.5</td>
<td>0.4</td>
<td>0.1</td>
<td>12.6</td>
</tr>
<tr>
<td>MIL</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MILxt(b)</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>18.1</td>
</tr>
<tr>
<td>SC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>STP</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>0.2</td>
</tr>
<tr>
<td>Disturbed</td>
<td>30.3</td>
<td>0.8</td>
<td>3.1</td>
<td>0.6</td>
</tr>
<tr>
<td>Total(c)</td>
<td>58.4</td>
<td>1.2</td>
<td>3.3</td>
<td>13.4</td>
</tr>
</tbody>
</table>

(a) pt: peaty surface horizon of greater than 15 cm.
(b) xt: Till present at 30 to 99 cm.
(c) Values may not add up to total values due to rounding.
7.3 ENVIRONMENTAL PROTECTION MEASURES

7.3.1 Timber and Brush

7.3.1.11 Merchantable Timber

Grizzly will work with the FMA holder, Al-Pac, to coordinate timber management processes during development. Timber salvage, land clearing, debris management and fire control management will be done in accordance with applicable Alberta legislation and guidelines such as the *Forest and Prairie Protection Act*, the *Timber Management Regulation* and External Directive: Management of Wood Chips on Public Land (ASRD 2009). Merchantable timber removal will be concurrent with construction. Estimated merchantable timber volumes have been calculated and are presented in Section 6.3.3.4.

7.3.1.12 Non-Merchantable Timber and Brush

Non-merchantable timber and brush will be cleared using a bulldozer and the ground surface integrity will be maintained in areas where grading is not required. Stumps will be mulched or grubbed. Woody debris will be disposed of as directed by ESRD by the following methods:

- Excess woody debris, if any, will be slashed and burned as the preferred method of disposal;
- A portion of woody debris will be stockpiled for use as rollback on linear developments and for spreading across reclamation sites; and
- A portion of coarse woody debris might be rough mulched. Coarsely mulched woody debris, if any, will not exceed a thickness of 5 cm when spread for use in reclamation (ASRD 2009).

Where clumps of surface soil are removed with woody debris, the soil may be shaken from the woody debris using equipment to assist in the conservation of topsoil material.

7.3.2 Water Body Protection

Measures will be taken at the Project to minimize potential effects to adjacent wetlands and watercourses. Grizzly will use berms and surface runoff impoundments to direct overland flow of water around production facilities. Ditches and culverts will be placed as the topography dictates to maintain drainage patterns and water flow, and minimize potential effects to surface water.

Internal ditching and a perimeter earthen berm will be constructed at the CPF and onsite runoff will be directed by grading and ditches towards a lined runoff pond. The CPF will also have a perimeter ditch, where required, to divert offsite flow and maintain offsite drainage. A description of the stormwater runoff drainage plan for the Project is presented in Section 5.2. Storage and containment at production facilities will comply with the containment systems requirements of ERCB Directive 055, Storage Requirements for the Upstream Petroleum Industry (ERCB 2001).

Runoff stormwater collected at the ponds will be analyzed to confirm that it meets criteria of the anticipated EPEA Approval before being used for process makeup water, dust control or discharged to adjacent areas. Smaller water quantities accumulated in the runoff pond will be left to evaporate. When discharging, the water will be discharged in a manner that minimizes erosion. Releases of stormwater will be monitored downslope and corrective action will be taken to minimize potential
offsite effects if erosion develops. Any areas disturbed by water discharged offsite will be reclaimed to stable, vegetated conditions. Runoff deemed not suitable for release or use as process water will be disposed at an approved third party facility.

7.3.3 Wildlife Protection

Strategies to limit the impact of Project activities on wildlife will be implemented where practicable. Mitigation measures for potential Project effects on wildlife are presented in Section 6.4.4.

7.4 SOIL HANDLING

Surface soils are important aspects of land capability. The goal of soil salvage and proper soil handling is to preserve soil integrity for reclamation use. Proper handling and storage are essential to limiting soil erosion, degradation, compaction, and admixing of topsoil and subsoil. The following conservation measures for soil handling will be followed to conserve soil quantity and quality.

- A qualified environmental scientist with training in soil science will supervise and provide guidance to field personnel on soil stripping and handling.
- Soil salvage operations will be suspended if high wind velocities or wet conditions are expected to result in degradation of topsoil or subsoil quality or result in soil erosion.
- Silt fencing or settling ponds may be used during construction to contain sediment during runoff.
- Disturbed surfaces will be graded to manage water flow and prevent the formation of gullies.
- Salvaged soil will be used for reclamation only and will not be used for grading.
- Remediation of harmful substance spills will meet ESRD requirements.

Soil salvage and handling activities completed for the CPF and associated facilities will be reported to ESRD as outlined in the anticipated EPEA approval.

7.4.1 Soil Salvage and Storage

In general, soil handling at the CPF and associated facilities will include two-lift salvage of all mineral topsoil materials (LFH/O horizon + A horizon) and up to 30 cm of suitable subsoil. Soil salvage will be completed as follows:

- CPF – Topsoil, subsoil and peat in the CPF area will be salvaged and stockpiled separately onsite (Figure 7.2-1). The Project CPF area overlaps with an existing disturbance that was cleared and stripped as part of the Whitesands Project (Petrobank 2012). The stripped soils from that area are currently stored at stockpiles (Stockpiles #12, #13 and #14; Petrobank 2012) that overlap with facilities planned for the Project CPF. The existing stockpiled materials will be relocated to stockpiles as shown on Figure ###. Any additional materials to be stripped for the CPF construction will be consolidated with existing stockpile materials (topsoil with topsoil, subsoil with subsoil). The existing “Mulch and Surface Organics” stockpile (Stockpile #14) will be relocated and stored separately from topsoil and subsoil. The other stockpiles for the Whitesands Project plant site are not expected to be relocated. Should these stockpiles need to be moved, additional storage area is available at Petrobank’s Observation Well 17, adjacent to the north edge of the CPF. Topsoil and subsoil have been
salvaged for soil disturbances within the Whitesands Project plant site. The movement of the existing stockpiles will be reported in the Soil Disturbance and Stockpile Summary Report.

- **Camp** – The camp access road will be expanded for the Project, from which topsoil and subsoil will be salvaged. No soil salvage will take place on the rest of the camp footprint as it is an existing soil disturbance. Newly salvaged materials will be combined with like materials in existing stockpiles at the camp (Stockpiles #22 and #23; Petrobank 2012).

- **Laydown Area** – the main portion of the Laydown Area is an existing soil disturbance where topsoil and subsoil have previously been salvaged. At the area to be expanded, topsoil and subsoil will be salvaged and stockpiled with like materials in existing stockpiles within the Laydown Area (Stockpiles #24 and #25; Petrobank 2012).

- **Borrow 1 and Access Road** – Within Borrow 1, topsoil and subsoil will be salvaged from the Kinosis SMU. Only topsoil will be salvaged from the Steepbank SMU. Salvaged topsoil and subsoil from the Borrow 1 access road (not including the well pad ROW) will be stockpiled within the Borrow 1 footprint. Topsoil will be salvaged along the access road and stored in a low profile windrow along the road and out of the working area.

Topsoil and subsoil stripping depths and volumes are presented on Figures 7.4-1 and 7.4-2. Conceptual drawings of construction and reclamation of the CPF, Laydown Area, Borrow 1 and associated Access Road are presented on Figures 7.4-3 to 7.4-6, respectively.

For the production well pads, Grizzly will use the following construction and soil salvage practices:

- **Well pads in upland areas** – Topsoil will be salvaged separately from subsoil using two-lift stripping. Topsoil and subsoil will be stockpiled separately within the footprint boundaries.

- **Well pads in peatlands** – No peat salvage will take place. After vegetation is cleared, geotextile will be placed on the peat surface. Borrow fill will be deposited over the geotextile in layers and compacted to the appropriate pad height.
7.4.2 Soils and Reclamation Material Balances

The anticipated soil material balances for peat, topsoil and subsoil is presented in Tables 7.4-1 and 7.4-2. Soil volumes were estimated using average SMU soil thicknesses from the data collected in 2013. The average topsoil depths were calculated using topsoil thicknesses of the inspection locations by soil series in each SMU, and are shown on Figure 7.4-1.

Actual volumes of existing stockpiles have been included in the Tables 7.4-1 and 7.4-2. These volumes were taken from the 2011 Annual C&R Report for the Whitesands Project (Petrobank 2012).

The actual volumes of topsoil and subsoil placed in stockpiles are expected to be less than the estimated in situ volumes, because of shrinkage of soil material upon drying and the inherent low bulk densities of LFH and peat. The low bulk density LFH and shallow peat (O horizon) of mineral soils will be salvaged and mixed with the salvaged A horizon material. Salvaged soil materials will be replaced during reclamation (Section 7.7.3).
## Table 7.4-1  Anticipated Topsoil Salvage and Reclamation Material Balance for the CPF and Associated Facilities

<table>
<thead>
<tr>
<th>Soil Map Unit</th>
<th>Area (ha)</th>
<th>Average Topsoil and Peat Salvage Thickness (m)</th>
<th>Topsoil and Peat Material Salvage Volume(^{(a)}) (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPF</td>
<td>Camp Laydown Area Borrow Pit 1 Access Road</td>
<td>CPF Camp Laydown Area Borrow Pit 1 Access Road CPF Camp Laydown Area Borrow Pit 1 Access Road</td>
</tr>
<tr>
<td>HLY(^{(b)})</td>
<td>1.2</td>
<td>0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.7 0.2 0.2 0.2 0.2 0.2</td>
<td>8,400 341 958 26,409 156</td>
</tr>
<tr>
<td>KNS</td>
<td>25.5</td>
<td>0.1 0.4 12.5 0.1 0.1 0.1 0.1 0.2 0.2 0.2 0.2 0.2 0.2</td>
<td>57,118 341 958 26,409 156</td>
</tr>
<tr>
<td>MILxt(^{(c)})</td>
<td>1.2</td>
<td>0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.4 - - 0.3 -</td>
<td>1,441 - - - -</td>
</tr>
<tr>
<td>STP</td>
<td>0.1</td>
<td>0.0 0.0 0.2 0.0 0.0 0.0 0.0 0.4 - - 0.3 -</td>
<td>580 - - 455 -</td>
</tr>
<tr>
<td>DIST(^{(d)})</td>
<td>30.3</td>
<td>3.1 0.8 0.6 0.0 0.0 0.0 0.0 0.0 0.0 0.3 - 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0</td>
<td>67,539(^{(f)}) 341 958 26,864 156</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total New Salvage(^{(e)})</th>
<th>70,219</th>
<th>4,741</th>
<th>2,608(^{(f)})</th>
<th>26,864</th>
<th>156</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing Topsoil Stockpiles (Petrobank 2012)</td>
<td>2,680</td>
<td>4,400</td>
<td>1,650</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total Replacement(^{(g)})</td>
<td>70,219</td>
<td>4,741</td>
<td>2,608(^{(f)})</td>
<td>26,864</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>Balance</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Volumes of materials were calculated using values for areas prior to rounding for presentation purposes.
\(^{(b)}\) Salvaged material will be peat.
\(^{(c)}\) Xt: Till present at 30 to 99 cm.
\(^{(d)}\) DIST: Disturbed
\(^{(e)}\) Values may not add up to total values due to rounding.
\(^{(f)}\) Topsoil salvage at CPF includes 8,400 m³ of peat and 61,075 m³ of topsoil.
\(^{(g)}\) Soil placement will be for the Laydown Area
Table 7.4-2  Anticipated Subsoil Salvage and Reclamation Material Balance for the CPF and Associated Facilities

<table>
<thead>
<tr>
<th>Soil Map Unit</th>
<th>Area (ha)</th>
<th>Average Subsoil Salvage Thickness (m)</th>
<th>Subsoil Material Salvage Volume&lt;sup&gt;(a)&lt;/sup&gt; (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPF Camp</td>
<td>Laydown Area</td>
<td>Borrow Pit 1</td>
</tr>
<tr>
<td>HLY</td>
<td>1.2 0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>KNS</td>
<td>25.5 0.1</td>
<td>0.4</td>
<td>12.5</td>
</tr>
<tr>
<td>MILxt&lt;sup&gt;(b)&lt;/sup&gt;</td>
<td>12 0.0 0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>STP</td>
<td>0.2 0.0</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>DIST&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>30.3 3.1 0.8</td>
<td>0.65</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total Salvage</strong>&lt;sup&gt;(d)&lt;/sup&gt;</td>
<td>70.025 427</td>
<td>1.197</td>
<td>30,481 0</td>
</tr>
<tr>
<td>Existing Subsoil Stockpiles (Petrobank 2012)</td>
<td>2,770 1,750</td>
<td>700 - -</td>
<td></td>
</tr>
<tr>
<td><strong>Total Replacement</strong>&lt;sup&gt;(d)&lt;/sup&gt;</td>
<td>72,795 2,177</td>
<td>1,897</td>
<td>30,481 0</td>
</tr>
<tr>
<td><strong>Balance</strong></td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

(a) Volumes of materials were calculated using values for areas prior to rounding for presentation purposes.
(b) xt: Till present at 30 to 99 cm.
(c) DIST: Disturbed
(d) Values may not add up to total values due to rounding.
7.4.3 Stripping of Surface Soil

Salvage of mineral soil materials may be conducted during frozen soil conditions. A soil cutter or similar attachment mounted on dozers may be required to loosen frozen mineral topsoil and facilitate stripping of topsoil. Loosening of upper subsoil with a ripper mounted on a dozer may be required if it is frozen at the time of salvage.

7.4.4 Stockpile Management

Stockpiles will be located outside the working/production areas and stored on stable surfaces, set back from standing trees. Recorded volumes and locations of stockpiled soil materials will be documented in a post-construction Disturbance and Stockpile Summary Report for the Project that will be submitted in accordance with the anticipated EPEA Approval. Mineral soil material will be stored on like materials (topsoil on topsoil and subsoil on subsoil). Geotextile may be placed under the “Peat” and “Mulch and Surface Organics” stockpiles at the CPF to ensure materials do not mix with underlying topsoil. Stockpiles will not be located near or in watercourses and will have appropriate signage. A minimum distance of 1 m will be maintained between individual stockpiles and other soil berms. Stockpiles will be contoured to a stable slope gradient (generally three units horizontal to one unit vertical [3H:1V]) to minimize erosion before being re-vegetated. They will be monitored, and if required, measures will be taken to protect soil from erosion or degradation. Measures for stabilizing stockpiles will be assessed on an as needed basis and might include re-contouring, seeding grasses and using controls such as silt fence, erosion control matting, or other cover.

If required, topsoil and subsoil stockpiles may be seeded with 30 kg/ha of a native species blend to establish an early protective cover. An example of a seed blend that can be used to re-vegetate reclaimed slopes and soil stockpiles is presented in Table 7.4-3. The seed mixes and application rates will be designed to minimize erosion without restricting growth of native species. Seed will be sourced primarily from Alberta and certificates of analysis for each seed component will be reviewed to reduce the potential introduction of weed species.

Table 7.4-3  Typical Native Seed Mix for Soil Stockpiles

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Percent Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awned wheat grass</td>
<td><em>Agropyron unilateral</em></td>
<td>20</td>
</tr>
<tr>
<td>Hairy wild rye</td>
<td><em>Leymus innovatus</em></td>
<td>20</td>
</tr>
<tr>
<td>Canada wild rye</td>
<td><em>Elymus canadensis</em></td>
<td>20</td>
</tr>
<tr>
<td>Tufted hair grass</td>
<td><em>Deschampsia caespitosa</em></td>
<td>20</td>
</tr>
<tr>
<td>Fowl bluegrass</td>
<td><em>Poa palustris</em></td>
<td>10</td>
</tr>
<tr>
<td>June grass</td>
<td><em>Koelaria macrantha</em></td>
<td>5</td>
</tr>
<tr>
<td>Tickle grass</td>
<td><em>Agrostis scabra</em></td>
<td>5</td>
</tr>
</tbody>
</table>
Disclaimer: Prepared solely for the use of Grizzly Oil Sands as
Date: 09 Dec 2013

May River SAGD Project

Subsoil Handling
Pre-Disturbance

2. Existing stockpiles consolidated in new stockpile area. Topsoil and subsoil salvaged and stored with like material in consolidated soil storage area (topsoil with topsoil, subsoil with subsoil).
3. Berm and ditch reconstructed using parent material (C Horizon) borrow material.
4. Gravel spread on top of pad.

Notes:
1. Not to scale.
2. Drawings are conceptual. Construction will be conducted according to engineering drawings.

Baseline Soil Map Unit
- KNS (Kinosis)
- HLY (Hartley)
- MILxt (Mildred)

Undisturbed Soil Layers
- Topsoil "A" Horizon
- Upper Subsoil "B" Horizon
- Parent Material "C" Horizon

Reclaimed Soil Layers/Map Units
- Reclaimed Upland
- Replaced Topsoil "A" Horizon
- Replaced Upper Subsoil "B" Horizon

Legend
- Aspen
- Balsam Poplar
- White Spruce

Reference

Conceptual Drawing of Construction and Reclamation of the CPF

Pre-Disturbance

Cross Section

Constructed

Cross Section

Reclaimed

Cross Section

Notes:
1. Not to scale.
2. Drawings are conceptual. Construction will be conducted according to engineering drawings.
Pre-Disturbance

1. Laydown ripped and recontoured.
2. Topsoil and subsoil salvaged separately and combined with like materials in existing stockpiles (topsoil with topsoil, subsoil with subsoil).
3. Laydown area graded.

Notes:
1. Not to scale.
2. Drawings are conceptual. Construction will be conducted according to engineering drawings.

Reference:
- Aspen
- White Spruce

Legend:
- Aspen
- White Spruce

Baseline Soil Map Unit
- Topsoil (A) Horizon
- Parent Material (C) Horizon

Reclaimed Soil Layers/Map Units
- Reclaimed Topsoil (A) Horizon
- Reclaimed Upper Subsoil (B) Horizon
- Reclaimed Upland

Conceptual Drawing of Construction and Reclamation of the Laydown Area

May River SAGD Project

K. Cheng
R. Labbe
S. Konecsni
October 2013
Disclaimer:
Prepared solely for the use of Grizzly Oil Sands as specified in the accompanying report. No representation of any kind is made to the other parties with which Grizzly Oil Sands has not entered into contract.
Notes:
1. Not to scale.
2. Drawings are conceptual. Construction will be conducted according to engineering drawings.
7.5 **WEED MANAGEMENT**

7.5.1 **Regulatory Requirements**

Grizzly will control weed species according to the Alberta *Weed Control Act, Weed Management on Industrial Sites* (ESRD 2012b) and other municipal weed control regulations as appropriate. The *Weed Control Regulation* provides a list of noxious and prohibited noxious species that must be controlled or eradicated. Grizzly will control or remove all listed weed species throughout the life of the Project.

7.5.2 **Weed and Non-Native Plant Control Methods**

The establishment of plant cover on soil stockpiles will reduce the potential for establishment of weeds. Light infestations will be controlled by mowing or hand-picking or in areas where herbicide application is not feasible. Non-residual herbicides will be applied to control any extensive weed infestation, where necessary. Preventing and controlling the spread of weeds within the Project footprint will be managed as per the following regulatory requirements and industry best practices:

- Personnel will be educated on weed control management.
- Equipment will be cleaned before arriving onsite (e.g. pressure washed and free of foreign soil and vegetative material).
- Soil disturbance will be limited where practical.
- Disturbed areas will be monitored for weeds during all stages of the Project.
- Weed control will be completed in a timely manner and records of weed control activities will be kept as required.
- Mechanical control of weeds (e.g., mowing, cultivating, hand-picking) is preferred, particularly near wetlands and riparian areas; chemical weed control will be used only when necessary, with required regulatory permissions.
- Herbicides applied will be appropriate for site conditions and weeds.
- Herbicides will be applied by a licensed industrial pesticide applicator will be contracted to select and apply herbicide(s).
- Herbicides applied will comply with the *Pesticide (Ministerial) Regulation* (Alberta Regulation 43/1997) and federal regulations.
- Herbicides will not be applied under windy or wet conditions that could cause offsite effects from herbicide movement off the intended treatment area.
- Herbicides will not be used where desired species would be harmed but if needed, may require spot spraying or mechanical control.
- Only Canada Certified Number 1, Varietal Blend Number 1 or Common Number 1 seed will be used. A certificate of analysis will be obtained and reviewed for any native seed component used in mixtures for reclamation (as directed by ESRD) to determine the quality of the seed being sourced and to mitigate any weed issues that may be identified.
- The use of straw bales for erosion control will be avoided where possible to minimize the spread of weeds and erosion control products containing straw will be evaluated for potential weed content.
- An annual cereal crop may be used for erosion control. The cover crop will be seeded at a reduced agronomic rate.
• Repeated fertilizer applications will not be conducted in order to prevent excessive growth of grasses that are highly competitive and detrimental to tree and shrub establishment.
• Where vegetation growth is poor or indications of nutrient deficiency appear, the need for additional fertilization will be determined by soil analytical fertility tests and the nutrient status of the offsite control soils.
• Soil sterilants will not be used.

7.6 RECLAMATION DURING OPERATIONS

Grizzly plans to progressively reclaim well pads and associated facilities (access roads, pipelines, power lines) when these are no longer needed for operations and after decommissioning is complete. Salvageable material, such as clean gravel and clean fill will be reused in construction where practical. Ongoing monitoring will begin after a site is reclaimed (Section 7.8).

7.7 RECLAMATION AFTER ABANDONMENT

Current guidelines and reclamation criteria referenced in developing this C&R plan are the 2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands, as updated (ESRD 2013c). Reclamation standards of the day will be employed during reclamation.

7.7.1 End Land Use Objectives

Reclamation objectives include achieving terrain, drainage and soil characteristics similar to pre-disturbance conditions in order to achieve equivalent land capability that will support plant communities compatible with the surrounding vegetation. Grizzly will consult with stakeholders and Aboriginal groups to review target end land uses before commencing final reclamation.

Pre-disturbance land capability ratings were determined based on the soil information collected for the Soil and Terrain Local Study Area, as summarized in Section 6.2. Through the use of appropriate reclamation, the properties of the replaced soils are expected to have equivalent or improved land capability as compared to baseline conditions. The class 3 and 5 areas within the CPF and associated facilities are predicted to be reclaimed to the same land capability classification (LCC; CEMA 2006a) classes for forestry as the pre-disturbance LCC classes. Class 4 areas within the CPF and associated facilities will be reclaimed to class 3 because class 3 and 4 reclamation materials will be salvaged and stockpiled together during construction.

Based on the end use objectives, the reclaimed CPF and associated facilities are anticipated to develop over time into self-sustaining ecosystems that can support land uses including forestry, recreation, trapping, traditional use and wildlife habitat.

7.7.2 Site Decommissioning and Remediation

A decommissioning and land reclamation plan will be submitted to the Director prior to ceasing operations of the Project, as designated in the anticipated EPEA approval. The plan will include details on decommissioning, abandonment and reclamation practices that comply with the applicable regulatory regime and the anticipated EPEA Approval. Diligence during the removal of surface equipment, structures and infrastructure is expected to prevent the release of contaminants. Concrete
or debris remaining after dismantling will be disposed of at a landfill. All geotechnical, groundwater monitoring and production wells will be abandoned to satisfy applicable guidelines and regulations.

After decommissioning, a Phase I Environmental Site Assessment (ESA) will be completed for the CPF and associated facilities (AENV 2013). Where necessary, soils will be assessed for potential contaminant impacts in a Phase II ESA, and remediation will be undertaken where required. The provincial guidelines used to assess soil for contaminants are contained in the Alberta Tier 1 Soil and Groundwater Remediation Guidelines - December 2010 (Tier 1; AENV 2010), as updated. Areas impacted by released contaminants, if any, will be reassessed following remediation to determine if specified endpoints (guideline criteria) for applicable parameters will have been achieved (AENV 2010b). Where undertaken, remediation will delay land reclamation activities.

### 7.7.3 Final Reclamation

Final reclamation activities are expected to last for approximately one to two years.

The general approach to reclamation of upland areas includes the following, where practicable:

- Surface gravel will be removed and reused, where practical.
- Erosion control structures and culverts will be removed before re-contouring begins.
- Subsoil material will be re-contoured to match the surrounding landform and drainage patterns (includes removal of berms and ditches), and leaving a stable surface.
- The majority of fill sourced from Borrow 1 used in site construction will be returned to Borrow 1.
- Soils will be de-compacted, where required, under appropriate moisture conditions.
- Salvaged reclamation materials will be replaced after de-compaction and re-contouring.
- Salvaged soils will be replaced in the same sequence as found in pre-disturbed areas by replacing all salvaged upper subsoil and then topsoil materials.
- Topsoil replacement will be suspended if wet soil conditions or high winds prevail.
- Topsoil materials will be replaced to leave small ridges and hollows, which may produce diverse microsites for moisture retention that are favorable for vegetation establishment (AENV 2009b).
- An experienced, trained environmental supervisor will determine when to suspend and resume soil handling activities.
- Salvaged woody debris will be spread over the reclaimed surface.
- Sites will be re-vegetated after consultation with ESRD.
- Approved native species or mixtures used will allow the establishment of native species in re-vegetation seed mixtures and woody seedlings compatible with the intended end land use (with consultation with ESRD).
- Reclamation will be monitored to determine the success.
- Remedial measures will be implemented (e.g., weed control, amelioration of drainage or erosion problems), as required.

### 7.7.4 Re-Vegetation

The objective for final reclamation will be to achieve a sustainable vegetation cover and species composition that is compatible with site conditions, so an equivalent land capability is achieved
following site closure. The re-vegetation objectives are consistent with the Guidelines for Reclamation to Forest and Vegetation in the Athabasca Oil Sands Region (AENV 2009b) and include the following:

- Utilization of native woody stemmed reclamation species common to the region.
- Establishment of a diverse range of plant species to re-create the level of biodiversity common to pre-development conditions.
- Establishment of a viable plant community capable of developing into a self-sustaining cover of species suitable for commercial forest, wildlife habitat and traditional land uses, with possibilities for recreation and other end uses.

Planting prescriptions were designed for the reclaimed CPF and associated facilities (Table 7.7-1). Based on current research, successful re-establishment to pre-disturbance ecosite phases at closure is uncertain. Therefore, the target reclaimed ecosite phases listed in Table 7.7-1 have been selected based on returning the site to target ecosites or establishing a successional trajectory towards similar species composition and structure. Forb and grass plant species are prescribed for the establishment on reclaimed upland sites suitable for the Central Mixedwood Natural Subregion (Table 7.7-2). The Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region (AENV 2009b), Field Guide to Ecosites of Northern Alberta (Beckingham and Archibald 1996) and the Native Plant Revegetation Guidelines for Alberta (NPWG 2001) were referenced in developing the planting prescriptions. A broader selection of understory shrubby and herbaceous species for each ecosite is provided in *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (AENV 2009b).

Final species selection, planting density and spacing distances to establish target ecosites will be determined at the time of reclamation, in consultation with ESRD, to ensure that the site will be re-vegetated appropriately, based on final site conditions and land use. Invasive and/or persistent agronomic species will not be used at reclamation.

**Table 7.7-1  Planting Prescriptions for Target Ecosite Phases in the CPF and Associated Facilities**

<table>
<thead>
<tr>
<th>Reclamation Target Ecosite</th>
<th>Tree Species(a)</th>
<th>Shrub Species(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b3 – blueberry Sw-Pj</td>
<td>white spruce+, aspen+, jack pine</td>
<td>blueberry, bearberry, Labrador tea, green alder, bog cranberry, twin-flower, prickly rose</td>
</tr>
<tr>
<td>d target*</td>
<td>white spruce+, aspen, balsam poplar, white birch</td>
<td>low-bush cranberry, Canada buffalo-berry, saskatoon, green alder, rose, raspberry</td>
</tr>
<tr>
<td>b regeneration</td>
<td>white spruce, aspen, jack pine</td>
<td>blueberry, bearberry, bog cranberry, Labrador tea, green alder, prickly rose, twin-flower</td>
</tr>
<tr>
<td>c regeneration</td>
<td>jack pine, black spruce</td>
<td>bog cranberry, blueberry, Labrador tea, prickly rose, twin-flower, willow</td>
</tr>
<tr>
<td>d regeneration</td>
<td>aspen, white spruce, black spruce, balsam poplar</td>
<td>low-bush cranberry, green alder, prickly rose, twin-flower, willow</td>
</tr>
<tr>
<td>e regeneration</td>
<td>aspen, balsam poplar, white spruce</td>
<td>alder, red-osier dogwood, prickly rose, wild red raspberry, willow</td>
</tr>
</tbody>
</table>

(a) assumed 2,000 stems/ha planting density; however total density may range from 1,800 to 2,200 stems/ha;
(b) assumed 600 stems/ha planting density; however total density may range from 500 to 700 stems/ha
+ Dominant species in the planting prescriptions
*originally a d3 ecosite phase
Vegetation deficiencies, including slow vegetation establishment, will be assessed and corrective measures will be undertaken, as required. The determining factor that would indicate slow vegetation establishment is the cover of desirable native species that are compatible with adjacent control areas. Adequate cover is assessed as having at least 25% cover of herbaceous species and 25% cover or 5 stems per 10m² of woody species (ESRD 2013c).

7.7.5 Well Pad Reclamation

For well pads in upland areas, reclamation will be consistent with the procedures presented in Section 7.7.3. For well pads in peatland areas, Grizzly will implement wetland reclamation principles and design, where practical. The reclamation goal in peatlands is to reclaim the padded sites to wetland conditions that will support the growth of native wetland species. After decommissioning, a portion of or all fill will be removed and the area will be reclaimed to a wetland reclamation area. This type of reclamation involves the removal of fill to a level that is slightly lower than the elevation of perched water in surrounding area while leaving wet mineral soil or peat substrate and shallow ponding but avoids leaving open water (Vitt et al. 2012). Complete removal of all pad materials, including geotextile, will take place if the water table is below the surface of the peat. Where the water table is at or near the surface in the surrounding undisturbed landscape, only a portion of the fill will be removed and the geotextile will be left in place. If all pad fill and geotextile is removed, peat will be de-compacted. If only partial removal of pad fill is practiced, the remaining pad fill will be de-compacted.

Reclamation of well pads in peatlands will be on a case-by-case basis but will include:

- salvaging surface gravel
- excavating pad fill to leave a poorly drained wetland substrate whether partial or complete removal of pad fill and geotextile
- reusing clean fill for construction or replacing it in nearby borrow areas
Figure 7.7-1a: Closure Land Capability Classification of the CPF and Associated Facilities

Project: May River SAGD Project

NAD 1983 UTM Zone 12N

Scale: 1:5,000

Reference: Data obtained from AltaLIS ©Government of Alberta used under license. GDM midstream and transportation infrastructure data provided by IHS© 2013 used under license. Imagery provided by Grizzly Oil Sands ULC (2013).
7.8  **MONITORING**

Monitoring for weed and erosion control, terrain conditions, and drainage and re-vegetation success will be conducted throughout the life of the Project. Culverts installed for roads in wetlands for the Project will be monitored for functionality. Problems identified with culverts will be addressed in a timely manner.

7.8.1  **Reclamation Monitoring and Reporting**

Monitoring will be carried out during construction and after reclamation to determine the progress and success of reclamation and mitigate any issues arising. Ongoing reclamation activities and procedures will be documented. Documents will include descriptions of the disturbance types and reclamation activities completed, with the dates of major activities. The monitoring schedule following reclamation will depend on additional measures applied to correct deficiencies, if any. Reclamation parameters assessed will document soil, landscape and vegetation conditions.

Stockpiled soil and any other temporary reclamation locations will be monitored until sufficient vegetation cover has established. Additional erosion control measures will be applied when necessary. Weeds will be controlled as discussed in Section 7.5.

Environmental monitoring will be done so that reclamation activities will achieve the applicable reclamation criteria and any conditions in the anticipated EPEA Approval. All reclamation activities will be documented and they will comply with the terms and conditions of the anticipated EPEA Approval for the Project.

7.9  **POST-RECLAMATION ASSESSMENTS**

The document, *2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands* (Updated June 2011; ESRD 2013c), indicates the goals and criteria for reclamation in forested areas. Final post-reclamation assessments will be completed using the reclamation criteria of the day for the intended land use category.

7.9.1  **Terrain and Drainage**

Drainage will be visually assessed for conformity to offsite drainage (i.e., no observable disruption of surface drainage or effects offsite from changes to subsurface drainage). Signs of erosion or slumping and reclaimed contours matching with the surroundings will be assessed. Gravel and rocks, bare areas and excess woody debris will be assessed according to reclamation criteria. Industrial debris that remains, if any, will be disposed of at an approved landfill.

7.9.2  **Soils**

Soils at reclaimed sites in mineral soil areas will be assessed for the following:

- Surface soil replacement as required by criteria (e.g., topsoil depth and distribution);
- Compaction (including soil structure/consistence) or other restricting layers; and
- Soil quality and chemical parameters as required by reclamation criteria.
Soils may be sampled and analyzed to confirm any potential soil quality issues that cannot be determined otherwise. Soil analytical parameters may include texture, structure, bulk density, soil reaction (pH), electrical conductivity (EC), sodium adsorption ratio (SAR) and macronutrient concentrations, as indicated in the criteria (ESRD 2013c).

Areas identified that contain substances that are Project related and exceed Tier 1 guidelines (AENV 2010), if any, will be reassessed following remediation to determine if specified endpoints for applicable parameters have been achieved (Section 7.7.2).

### 7.9.3 Vegetation

Vegetation monitoring will occur 2 years after reclamation of the Project disturbances. Vegetation deficiencies will be assessed and corrective measures will be undertaken, as required.

Vegetation establishment will be assessed according to regulatory requirements and the anticipated EPEA Approval conditions. Vegetation is currently assessed for the following characteristics and is compared to pre-disturbance and/or adjacent control ecosites:

- Presence of desired target species and layers of vegetation (woody and herbaceous forest species);
- Vegetation quantity (adequate density, distribution and growth); and
- Vegetation quality (plant health and vigour).

The reclaimed disturbances will also be assessed to confirm the re-establishment of the target vegetation communities or establishing a successional trajectory towards similar species composition and structure. Final assessments to document post-reclamation soil, terrain and vegetation conditions will be conducted and included in the reclamation certificates applications.