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10 VEGETATION

10.1 Introduction

This section presents the environmental setting and impact assessment for terrestrial vegetation, wetland and forestry resources to support the Project. The purpose is to provide a description of the composition and extent of these resources within the LSA and RSA, predict potential effects of the Project on these resources, assess the expected impacts, and outline available mitigation strategies if required. An assessment of cumulative effects is also presented.

10.2 Study Area

The LSA and RSA were delineated using a spatial approach (Figure 10.2-1). The LSA was used to evaluate areas directly impacted by Project development and operation, while the RSA was used to evaluate potential Project impacts that extend over larger geographical areas or ecosystems.

10.2.1 Spatial Boundaries

10.2.1.1 LSA

Site selection for the Project footprint began in 2005 and has continued as the Project design has evolved. Soil and vegetation sampling were initiated in 2005 based on preliminary geological results and the North American land holdings at the time. Preliminary facility placements were based on:

- Maximizing resource recovery;
- Terrain (i.e., upland locations were preferred as were locations with minimal change in topography, thereby reducing need for cut and fill); and
- Avoiding open water bodies and defined watercourse channels (having defined bed and bank material).

The 2006 vegetation study design and the vegetation LSA boundaries were refined using initial geological resource constraints mapping prepared in 2006 for the Leismer Demonstration Project Application. North American acquired over 50 townships of Alberta Vegetation Inventory/ Ecological Land Classification (AVI/ELC) data for the Project to map vegetation in all lease areas. As the LSA was being defined, the development of the Project footprint was still in preliminary stages. Plans for utility ROWs connecting North American's leases were conceptual; the precise location of the ROWs was not defined. Therefore, vegetation on lands between the leases was also mapped.

The lease boundaries and interconnecting lands encompass almost 16 townships of land. Consideration was given to reducing the LSA size to reduce the dilution effect on assessed impact of such a large LSA; however, insufficient engineering was available to eliminate any of these lands from potential development.

Since the initial selection of the vegetation LSA, North American has continued to refine the footprint layout based on a constraints mapping approach to avoid sensitive areas within the lease boundaries. North American made modifications to the footprint layout based on information acquired from the geological data collection, hydrogeological data, aquatics, soils and

vegetation surveys conducted in 2005 and 2006 combined with the AVI/ELC mapping and survey imagery (i.e., still photography images, aerial video, line scans and LiDAR, including topography).

As the Project footprint was further refined, several changes were made. North American examined each development area to determine the best SAGD well trajectories, giving consideration to variability in oil/water contact, reservoir quality, and character differences in the channels. Options for SAGD well pair placements in the channel trends considered non-reservoir shale plugs and various types of potential thief zones. Two SAGD pads were moved outside of the North American lease lands; however, well trajectories were designed to drain the resources from within the leases. The engineering and hydrogeologic assessments resulted in several source water and water disposal wells being located outside of the North American leases. In addition, the ROWs interconnecting the hubs were defined, some of which extended between North American leases. The refined Project footprint was used to assess impacts related to the Project.

The evolution of the Project footprint, following completion of the field programs, has resulted in small portions of the Project footprint occurring outside of the vegetation LSA boundary. The initial developments of Leismer Commercial, Leismer Expansion and Corner hubs are entirely within the vegetation LSA. The small portions of infrastructure that are outside of the LSA are more conceptual in nature and are associated with future development. The implications of the small portions of the footprint being outside of the vegetation LSA were not considered to affect the overall evaluation of vegetation impacts. In addition, it is anticipated that the overall Project footprint will be further refined, based on additional geological, biophysical and construction/reclamation information. Prior to construction, pre-development assessments (PDAs) will be conducted on the hub areas and SAGD pads to evaluate potential impacts and to develop C&R Plans for each site.

The LSA is 145,349 ha in area and has been established to assess effects of the Project at a local scale. The rationale used in deciding boundaries included consideration of vegetation, wildlife and biodiversity components of this EIA (Figure 10.2-1).

10.2.1.2 RSA

The RSA is 474,702 ha in area and has been delineated to evaluate potential effects of the Project that may extend or occur beyond the LSA (Figure 10.2-1). Its delineation incorporated considerations regarding:

- Regional industrial developments and ecological variables that have the potential to interact cumulatively;
- An 11 km buffer surrounding the LSA, representing one radius of the lateral extent of a typical moose home range; and
- Existing, approved and planned land uses such as forestry, industrial, and natural areas.

In some areas, the 11 km buffer was either expanded or reduced to follow existing lines of disturbance (i.e., along Highway 63), or to smooth the contour of the boundary.

Surrounding existing or approved projects incorporated within the 11 km boundary extension include Petrobank Whitesands Pilot Project, Petro-Canada Meadow Creek, JACOS Hangingstone Pilot Project and Connacher Great Divide Pilot. Portions of Al-Pac's proposed resource road in the south, linking Highway 881 to Highway 63, are included.

The RSA was selected to evaluate potential regional impacts related to air emission modelling for PAI and cumulative effects relating to physical disturbances associated with future announced projects.

Given the ecological interrelationships among vegetation, wildlife and biodiversity, this RSA will be used in the assessment process for all of these disciplines.

10.2.2 Temporal Boundaries

The temporal scope of the EIA reflects the timing and nature of Project phases as well as information available on other proposed projects. Project and cumulative project effects are assessed for the construction, operations, decommissioning and reclamation, and closure phases of the Project. Each phase is assessed at the peak of Project activity. The timing of phases for the Project is:

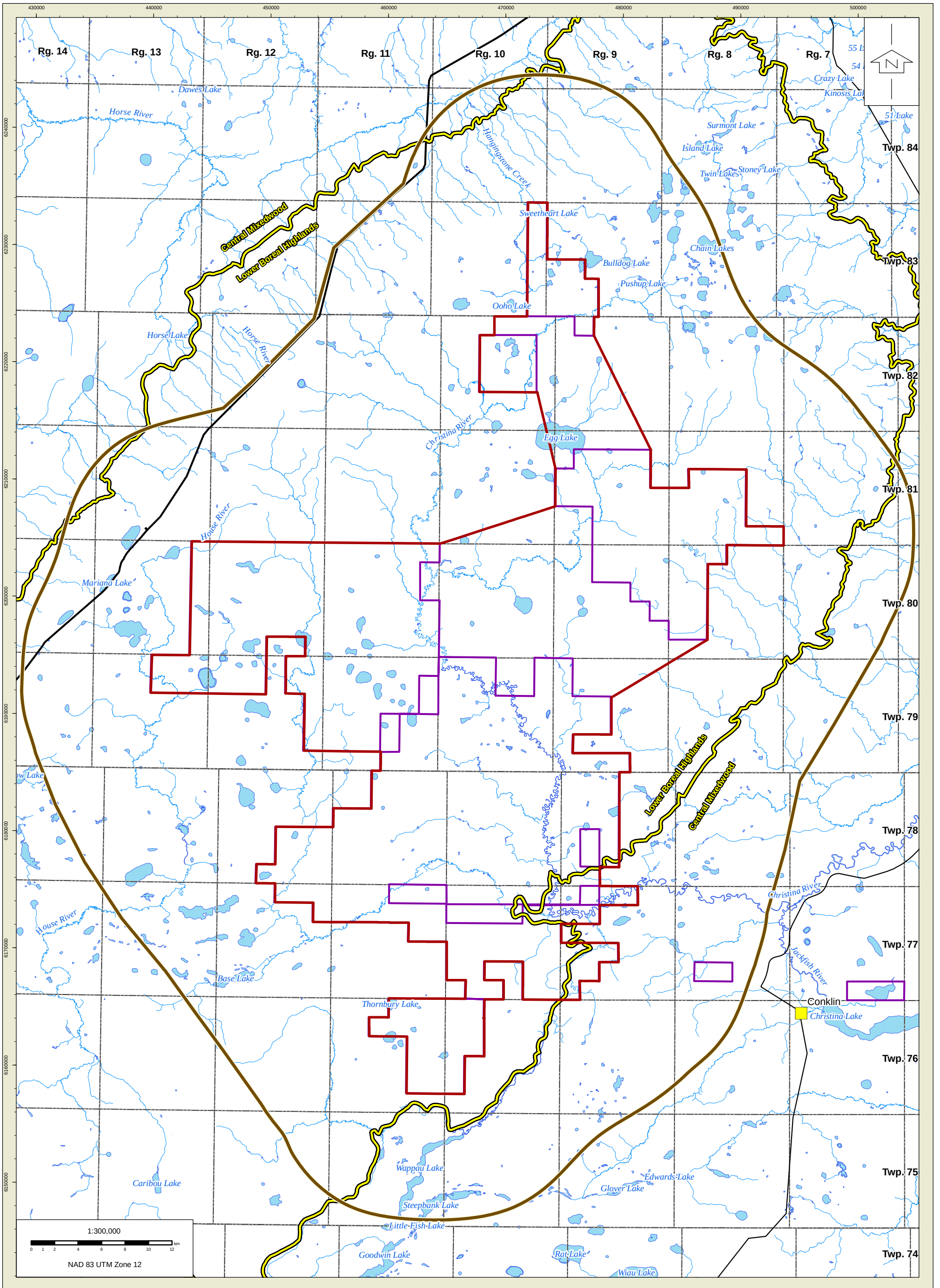
- Construction – 2008 through 2016
- Operations – 2010 through 2050
- Decommissioning and reclamation – progressive with final decommissioning in 2051 through 2053
- Closure – 2053

The overall Project schedule is outlined in Volume 2, Section 1.

The baseline scenario refers to the conditions (existing and approved projects) present in the LSA and RSA as of March 1, 2007. The application scenario uses a maximum disturbance case, which assumes that all components of the Project are fully developed and operational at the same time. This conservative, worst-case approach adds a safety margin to the assessment. Closure scenario assumes all facilities have been decommissioned and reclamation activities have been completed.

The temporal boundary for closure for the vegetation assessment extends 70 years beyond the life of the Project. This time frame is the anticipated time required to achieve merchantable timber after reclamation, assuming natural successional trajectories of the various ecosite phases. Reclamation of the facilities will utilize a progressive approach: as facilities are abandoned, they will be reclaimed. It is expected that, where appropriate, reclamation certificates will be issued prior to forest stands reaching merchantable criteria. As development is phased over many years, reclamation will be undertaken during the life of Project.

Cumulative effects include planned projects that have not yet received approval and those that were publicly disclosed as of March 1, 2007. The projects and developments included within the scope of this assessment are listed in Volume 2, Section 1, Table 1.5-1.



Title:

LOCAL STUDY AREA
AND
REGIONAL STUDY AREA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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10.3 Issues and Assessment Criteria

Assessment criteria were used to describe and evaluate the predicted significance of Project effects and the cumulative effects for various indicators. The criteria and their descriptions are in Volume 2, Section 1.

The criteria are modified and further defined relevant to the Vegetation section for this EIA as follows:

Magnitude describes the size and severity of the effect. Magnitude for assessing impacts due to removal of vegetation is classified as negligible (no discernible contribution, less than 1% measurable change), low (1% or greater but less than 10% measurable change), medium (10% or greater but less than 20% measurable change) or high (20% or greater, measurable change to the resource).

Duration describes how long the effect will occur. Duration for assessing impacts due to removal of vegetation is classified as short-term (less than 5 years), medium-term (5 years to 70 years) or long-term (greater than 70 years).

Permanence describes the potential for the recovery or reversibility of an effect. Permanence is classified as effects that are reversible in the short-term (less than 5 years), reversible in the medium-term (5 years or more but less than 70), and reversible in the long-term (70 years or more) or irreversible (permanent).

Conclusions for the Project effects criteria are based on quantitative and qualitative assessments. Quantitative assessments include the results of measurable predictions such as area of vegetation removed in ecosite phases. Qualitative assessments are subjective and take into account conclusions based on best professional judgment. This is important when environmental objectives are not available or quantitative predictions are not feasible, such as uncertainties in predicting future vegetation community structure and succession.

The integration of the various effects criteria ratings result in a final impact rating for each potential Project effect. The possible final impact ratings are: no impact, low impact, medium impact or high impact. The result of combining objective and quantitative assessments with subjective evaluations and best professional judgment provides a conclusion for each predicted Project effect.

Key indicators identified for vegetation, wetlands and forest resources include: vegetation communities, rare plants as listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and on Alberta Natural Heritage Information Centre (ANHIC) Tracking Lists, vegetation communities with limited distribution, wetlands, economic forests, old-growth forests, and traditional and medicinal plants. Potential impacts to the stated indicators are assessed with respect to removal of vegetation and alteration or changes in hydrology.

Cumulative effects assessments (CEAs) are required under the *Alberta Environmental Protection and Enhancement Act* and the *Canadian Environmental Assessment Act*.

Key potential cumulative effects issues were identified for the Project during early Project notification and consultation with the public, government representatives and the Project team. The identified key issues were:

- Water use;
- Air emissions; and

- Land disturbance.

Cumulative effects likely to result from the combination of the Project, other existing and proposed projects in the area, and reasonably foreseeable environmental changes were considered and evaluated. Project effects in the LSA with a predicted magnitude of medium or higher that could act cumulatively with other environmental pressures were included in the CEA.

10.4 Methods

10.4.1 Ecological Land Classification Mapping

Dynamic interactions between biotic (plant and animal) communities and their associated abiotic influences (climate, topography, drainage, soils) create complex groupings or ecosystems across the landscape. Various systems have been developed to classify ecosystems so that they may ultimately be represented, delineated and mapped as ecologically-based landscape units. In Alberta, ecosystems have been classified into Natural Regions and Subregions. These classifications have recently been reviewed and revised by the Alberta Government Natural Regions Committee (Natural Regions Committee, 2006). Beckingham and Archibald (1996) have incorporated the Natural Regions and Subregions classification system into their hierarchical classification system in *Field Guide to Ecosites of Northern Alberta.* Both classification systems are recognized and used in Alberta for ecological land classification and land management purposes. In this assessment both classification systems are used to describe vegetation communities and ecosystems in the LSA.

The Beckingham and Archibald (1996) classification system (using ecological areas, ecosites, ecosite phases and community types) was applied to terrestrial areas, and the Alberta Wetland Inventory (AWI) (Halsey et al., 2003) system was used to describe wetlands. Although Beckingham and Archibald's classification does include wetland ecosite phases, the AWI system was considered to provide a more complete representation of wetland types. A concordance table comparing the two systems is included in Appendix 10A.

10.4.1.1 LSA Vegetation Mapping

Ecological Land Classification (ELC) mapping for the LSA and surrounding area was based on Alberta Vegetation Inventory (AVI) polygon data, approved and current as of May 2004, as acquired from Al-Pac. Map polygons were initially delineated based on AVI attributes including canopy cover, canopy height, canopy composition, stand age, and moisture regime and then assigned an equivalent ecosite phase classification.

ELC mapping was refined using data collected during vegetation field surveys. Ecosite phase polygons were subsequently analyzed using GIS to calculate the extent of current and future vegetation types in the study areas.

10.4.1.2 RSA Vegetation Mapping

ELC mapping for the RSA was based on interpretation of spatial Alberta Ground Cover Characterization (AGCC) data (Sleep, 2003). Ground cover classes within the AGCC system were delineated based on digital interpretation of satellite imagery. Ground cover classes for the RSA are mapped at a coarser scale than ecosite phases used for the LSA.

Table 10.4-1 outlines the correlation between the AGCC land cover classes used to describe the RSA and ecosite phases and wetland types used to describe the LSA.

Table 10.4-1 Correlation of Ground Cover Classes in the RSA with Ecosite Phases and Wetland Classes in the LSA

Type	Ground Cover Classes (AGCC)	Central Mixedwood Ecosite Phase	Boreal Highlands Ecosite Phase
Upland	Open Pine	a1	a1
	Closed Pine	c1	c1
	Closed Se/Sw	b4, d3, e3, f3,g1	b3, d3, e1, f1,g1
	Closed Aspen, Balsam poplar and/or Birch	b2,d1,e1,f1	d1
	Closed Coniferous and Deciduous Cover (40%-60%)	b1,b3,d2,e2,f2	b1,b2,d2
	Closed Upland Shrub	shrubland	shrubland
	Mixed Grassland	meadow	meadow
Wetlands	Graminoid Wetlands (sedges/grasses/forbs) (less than 6% tree cover) (less than 25% shrub)	k3,l1	j3
	Shrubby Wetlands (Willow and Birch)	j2,k1,k2	i2,j1,j2
	Black Spruce Bog (sphagnum understorey) (6% - 100 % tree cover)	h1,i1,i2,j1,j2	h1,h2,i1,i2
	Lake, pond, reservoir, river and stream	Water (NWR, NWL, NWF)	Water (NWR, NWL, NWF)
Other	Rock, Talus, and/or Avalanche Chute	NMR	NMR
	Exposed Soil	NMS/NMC	NMS/NMC
	Cloud / Haze	n/a	n/a
	Shadow	n/a	n/a
Disturbance	Major roads, highway and railways	AIH	AIH
	Graminoid (grasses/sedges/forbs) dominated clear-cut	CC	CC
	Undifferentiated burn	BU	BU
	Graminoid (grasses/sedges/forbs) dominated burn	BU_Regen	BU_Regen
	Tree/shrub dominated burn	BU_Regen	BU_Regen
	New Burn	BU	BU

10.4.2 Field Program

The vegetation field program began in 2005. At the time, Project development was still conceptual in nature and a footprint had not been established. Vegetation survey sampling sites were chosen to verify ELC mapping and conduct baseline sampling for each ecosite phase. Site-specific data were collected during visual checks and vegetation survey sample plots. Rare plant meanders were completed at vegetation sampling sites and in areas between sampling sites that were thought to have high potential for rare plants to be present.

Vegetation and early rare plant surveys were completed concurrently from July 6 to 11, 2005. Vegetation and late rare plant surveys were conducted from August 9 to 13, 2005.

With the development of a proposed Project footprint in 2006, a field sampling program was designed that took into account the number, size and type of ecosite phases and wetland classes present and previously sampled. Vegetation and rare plant surveys were conducted concurrently from June 22 to 27, 2006, and July 17 to 22, 2006.

10.4.2.1 Vegetation Survey Sample Plots

Vegetation survey sample plots were detailed plots with quantitative and qualitative data that reflected vegetation and ecological factors. A nested sample plot scheme was used to capture community diversity and structural attributes. Circular plots 1 m in radius were established to measure percent cover of graminoid, herb (forb), moss and lichen species; 2.5 m radius plots were used to measure shrub species cover; and 10 m radius plots were used to assess tree canopy and subcanopy strata.

Data collected at each site included abiotic (slope, aspect, moisture and nutrient regimes), biotic (species composition) and community structure parameters. At each sample site, a rare plant meander was also conducted and species composition was recorded in a 50 m walkout that was outside of the sample plot but within the same ecosite phase.

10.4.2.2 Visual Checks

Visual checks were completed to verify the accuracy of ELC mapping. They were done both on the ground and via helicopter surveys. For each visual check dominant vegetation characteristics were recorded and/or ELC mapping was verified. Locations were recorded using handheld GPS units.

10.4.2.3 Rare Plant Surveys

Procedures and recommendations given in *Guidelines for Rare Plant Surveys* (Lancaster, 2000) were implemented for rare plant surveys. A search of ANHIC databases was first conducted to determine rare plant and rare community occurrences within the Project area and immediately surrounding townships. A list of known rare plant and rare community occurrences for the area was subsequently generated. The ANHIC database was also searched for rare plant occurrences in the Central Mixedwood and Lower Boreal Highlands Subregions to create a list of rare plants that may potentially occur within the area. ELC maps that had been coded to ecosite phase mapping units were reviewed for uncommon plant communities and communities with high potential for rare plant occurrences, based on the ANHIC searches.

Available ecological and phenological information was reviewed to determine appropriate timing of field work. Diagnostic characteristics of species were reviewed in order to identify those species that would necessitate the collection of voucher specimens (i.e., those that would require a microscope for determination of species).

Rare plant meanders were conducted during the 2005 and 2006 field seasons to identify the presence of rare species. GPS locations and species lists were recorded on datasheets and in field notebooks. Meanders were conducted at each sample plot site during vegetation surveys, as well as at several proposed well pad locations and hubs. When rare species were found (exclusive of vegetation survey sample plots), a floristic inventory and site description was recorded.

10.4.3 Terrestrial Vegetation and Wetland Resources

10.4.3.1 Vegetation Communities of Limited Distribution

Vegetation communities of limited distribution have been defined as ecosite phases that represent less than one percent of the LSA. Communities of limited distribution were not assessed for the RSA. Communities of limited distribution in the Central Mixedwood portion of the LSA were not included because of the overall low percentage of this natural subregion represented in the LSA. Appendix 10B presents detailed descriptions of ecosite phases.

10.4.3.2 Economic Forests

The LSA for the Project is located on crown land, portions of which fall within Forestry Management Units (FMU) L11, A14 and L3. FMUs are areas in which the Government of Alberta has granted forestry companies the right to harvest, remove and grow timber (Al-Pac, 2006). In these FMUs Al-Pac has the right to harvest deciduous trees and Millar Western is entitled to harvest coniferous trees (Al-Pac, 2006).

Forested and Non-Forested Areas

To identify forested and non-forested areas in the LSA, AVI data were used in conjunction with base vegetation mapping. Non-forested areas were defined as having less than 6% total tree cover and were therefore not assigned canopy attributes in the AVI data set. Mapping polygons having 6% tree cover or greater were defined as forested and assigned canopy attributes in the AVI dataset.

Productive Forests

To determine the impact of the Project on forest resources, forested areas in the LSA were differentiated as either productive or unproductive using GIS. The area of productive forests was determined by assigning Timber Productivity Ratings (TPR) to AVI polygons within the LSA. A TPR is an estimate of the "potential productivity of a stand based on height and age of dominant and co-dominant trees of the leading species" (AEP, 1997). The TPR for any given stand can be good, medium, fair or unproductive.

For the purposes of assessing TPR, ecosite phases were correlated with particular forest types (coniferous, deciduous or mixedwood) based on dominant tree species. A correlation table of ecosite phases and forest types is presented in Table 10.4-2.

Table 10.4-2 Correlation between Ecosite Phases and Forest Types by Natural Subregion in the LSA

Ecosite phase	Forest type	
	Central Mixedwood	Lower Boreal Highlands
a1	coniferous	coniferous
b1	mixedwood	mixedwood
b2	deciduous	mixedwood
b3	mixedwood	coniferous
b4	coniferous	N/A
c1	coniferous	coniferous
d1	deciduous	deciduous
d2	mixedwood	mixedwood
d3	coniferous	coniferous
e1	deciduous	mixedwood
e2	mixedwood	N/A
e3	coniferous	N/A
f1	deciduous	coniferous
f2	mixedwood	N/A
f3	coniferous	N/A
g1	coniferous	coniferous
h1	coniferous	coniferous
h2	N/A	coniferous
i1	coniferous	coniferous
i2	non-forested	non-forested
j1	coniferous	coniferous
j2	non-forested	non-forested
j3	N/A	non-forested
k1	coniferous	N/A
k2	non-forested	N/A
k3	non-forested	N/A
l1	non-forested	N/A

N/A – ecosite does not occur in this subregion

Forest Merchantability

Thomae (2003) described forest merchantability as "a tool for describing the relative economics of timber harvesting opportunities throughout a forested land base." Although some forest stands may have the potential to be productive, not all locations may produce merchantable timber. For example, stands in which black spruce (*Picea mariana*) and tamarack (*Larix laricina*) are dominant may be highly productive, but because these species are not harvested in the LSA, they are not merchantable. Furthermore, stands that are inaccessible, or either juvenile (less than 20 years old) or immature (approximately 21 to 60 years old), are not considered merchantable by forestry standards (Timberline Forest Inventory Consultants, 2004).

The amount of merchantable forest available on the land base influences the annual allowable cut (AAC). The AAC is defined in the Alberta Timber Harvest Planning and Operating Ground

Rules as the volume of timber that can be harvested under sustained-yield management in any one year (ASRD, 2006). A reduction in the area of merchantable timber as a result of disturbance could lead to a reduction in AAC.

10.4.3.3 Old-Growth Forests

Old-growth status for a particular forest type can be defined according to two approaches (NCASI, 2005; Schneider, 2002). The first is based on stand age while the second considers the structural characteristics of a stand (Lee et al., 2000). Although the two approaches are complementary, the age-based definition has been used most extensively by forest managers because data are readily available (NCASI, 2005). Forest structure is more difficult to measure and assessment criteria for old-growth stands in Alberta have not been widely documented.

To estimate the distribution of old-growth forest in the LSA, age-based assessment criteria were developed for each dominant canopy species based on current literature: white and black spruce forests, 120 years; jack pine forests, 120 years; deciduous and mixedwood forests, 100 years (Schneider, 2002; Timoney, 2001). ELC mapping polygons were assigned to a particular forest type based on dominant tree species (Table 10.4-2) and AVI stand origin data were used to identify those forests meeting the relevant old-growth age criteria.

10.4.3.4 Traditional and Medicinal Plants

Plant species of traditional or medicinal importance to Aboriginal peoples in the study area were determined from those identified in previous EIAs in close proximity to the Project. Traditional and medicinal plants that are well known and of high importance include blueberry *(Vaccinium* spp), low-bush cranberry (*Viburnum edule*), Labrador tea (*Ledum groenlandicum*), Saskatoon (*Amelanchier alnifolia*), wild red raspberry (*Rubus idaeus*), wild strawberry (*Fragaria virginiana*), white spruce (*Picea glauca*), white birch or paper birch (*Betula papryifera*), willow (*Salix* spp.), balsam poplar (*Populus balsamifera*), wild mint (*Mentha arvensis*) and sweet flag (*Acorus calamus*). Because traditional and medicinal plant species are found in all ecosite phases and wetland types, only those identified in the Land and Resource Use section (Volume 5, Section 13) have been selected as assessment indicators. The assessment indicators chosen are blueberry, low-bush cranberry and wild strawberry.

10.4.3.5 Wetlands and Peatlands

Wetlands are composed of both peat forming and non-peat forming communities. Peatlands are defined by AWI as those wetlands having greater than 40 cm of accumulated organics. Generally bogs and fens are considered peatlands. Non-peat forming wetlands include marshes, swamps and shallow open water.

Both ecosite phases and AWI wetland types have been used to describe and assess wetlands and peatlands in the LSA. At the RSA level, AGCC categories are used to describe wetland categories.

10.4.3.6 Rare Plants and Rare Communities

Rare Plant Potential

Information and data from a number of vegetation resources were extracted and compiled to develop a ranking system for vegetation communities that potentially support rare vascular plants. A list of rare vascular plant species for north-central Alberta was generated incorporating those species in COSEWIC and ANHIC (Tracking List) databases. COSEWIC is an independent body

of experts responsible for identifying and assessing species considered to be at risk (COSEWIC, 2006). ANHIC ranks species based on their global and provincial status using a system developed by The Nature Conservancy (ANHIC, 2004). Status is determined primarily by the number of occurrences and is assigned using a scale of one (very rare) to five (secure). Species ranked G1 are very rare globally, and those ranked S1 are very rare provincially. The ranks in Alberta are as follows:

- G1/S1: <5 occurrences or only a few remaining individuals;
- G2/S2: 6-20 occurrences or with many individuals in fewer occurrences;
- G3/S3: 21-100 occurrences may be rare and local throughout its range, or in a restricted range (may be abundant in some locations or may be vulnerable to extirpation because of some factor of its biology);
- G4/S4: apparently secure under present conditions, typically >100 occurrences but may be fewer with many large populations; may be rare in parts of its range, especially peripherally;
- G5/S5: demonstrably secure under present conditions, >100 occurrences, may be rare in parts of its range, especially peripherally;
- GNR/SNR: unranked or under review;
- GH/SH: historically known, may be relocated in the future; and'
- GNA/SNA: conservation status not applicable (includes exotic species).

The preferred habitats for species on the generated list were researched using habitat descriptions from *Flora of Alberta* (Moss, 1983), the ANHIC database, Flora of North America (on line), and *Rare Vascular Plants of Alberta* (Kershaw et al., 2001). They were subsequently correlated with ecosite phases as described by Beckingham and Archibald (1996).

Known occurrences and locations of rare plants in north central Alberta were compiled using distribution maps in *Flora of Alberta* (Moss, 1983), information contained in the ANHIC databases, and rare plant occurrences listed in previous EIAs in the oil sands region.

The number of species per ecosite phase was determined using the list of potential rare plants, their preferred habitat as ecosite phases, and their known occurrences and locations. Rare plant potential rankings for ecosite phases were then assigned.

Table 10.4-3 summarizes rankings of ecosite phases according to their potential to support rare plants.

Table 10.4-3 Rare Plant Habitat Potential Ranking by Ecosite Phase and Land Classes

Central Mixedwood	
High Potential	**Ephase**
	(j1) Treed Poor Fen
	(j2) Shrubby Poor Fen
	(k1) Treed Rich Fen
	(k2) Shrubby Rich Fen
Moderate	**(d3)** Low bush cranberry (Aspen-White spruce)
	(i1) Treed bog
	(k3) Graminoid Fen
	(l1) Marsh
	NWL Lake
	Burn Regeneration
	Disturbed
Low	**(b1)** Blueberry (Jack pine/Aspen)
	(d1) Low bush cranberry (Aspen)
	(d2) Low bush cranberry (Aspen/White spruce)
	(e1) Dogwood (Balsam poplar/Aspen)
	(e3) Dogwood (White spruce)
	(g1) Labrador tea (Black spruce/Jack pine)
	(i2) Shrubby bog
	Deciduous Regeneration
	Shrubland
	NWF Flooded areas
Very Low	**(a1)** Lichen (Jack pine)
	(b2) Blueberry (Aspen/Paper birch)
	(b3) Blueberry (Aspen/White spruce)
	(b4) Blueberry (White spruce/Jack pine)
	(c1) Labrador tea (Jack pine/Black spruce)
	(e2) Dogwood (Balsam poplar/White spruce)
	(f1) Horsetail (Balsam poplar/Aspen)
	(f2) Horsetail (Balsam poplar/White spruce)
	(f3) Horsetail (White spruce)
	(h1) Labrador tea (White spruce/Black spruce)

Lower Boreal Highlands	
High Potential	**Ephase**
	(i1) Treed Poor Fen
	(i2) Shrubby Poor Fen
	(j1) Treed Rich Fen
	(j2) Shrubby Rich Fen
Moderate	**(d3)** Low bush cranberry (White spruce)
	(h1) Treed bog
	(j3) Graminoid Fen & Marsh
	NWL Lake
	Burn Regeneration
	Disturbed
Low	**(b1)** Blueberry (Jack pine/Aspen)
	(d1) Low bush cranberry (Aspen)
	(d2) Low bush cranberry (Aspen/White spruce/Black spruce)
	(e1) Fern (White spruce)
	(g1) Labrador tea (Black spruce/Jack pine)
	(h2) Shrubby bog
	Deciduous Regeneration
	Shrubland
	NWF Flooded areas
Very Low	**(a1)** Bearberry (Jack pine)
	(b2) Blueberry (Aspen)
	(b3) Blueberry (White spruce/Jack pine)
	(c1) Labrador Tea (Jack pine/Black spruce)
	(f1) Horsetail (White spruce)

Rare Communities

Rare communities are defined by ANHIC as unusual, uncommon, of limited extent, or encountered infrequently. Vegetation types that have been described (by vegetation experts) as in decline or threatened are also included as rare communities. Rare communities may or may not have rare plants associated with them. It is the assemblage of species within a community that determines rarity, rather than presence or absence of rare plant species. Only natural communities are considered for ANHIC's tracking and watch lists. Rare communities cannot be identified at ELC mapping scales by ecosite phases or wetland types alone; they must be observed in the field. Appendix C describes Provincial Community Conservations Ranks.

10.4.4 Assessment Approach

The assessment approach included defining issues and resources for evaluation, and conducting impact analyses relating to terrestrial vegetation, wetlands, and forest resources. Mitigation strategies were reviewed to determine possible and appropriate measures that would reduce potential Project impacts. Impacts were assessed at the LSA level for ecological units and all selected indicators; however, only those that had an environmental impact rating of medium or high were assessed at the RSA level.

The baseline scenario for impact analyses included existing and approved projects and activities that were judged to have a potential influence within the Project study area. A list of projects and activities included in the baseline scenario, application scenario and CEA scenario is found in Volume 2, Section 1, Table 1.5-1. Baseline information was mapped and quantified (using GIS) for terrestrial vegetation, wetlands, and forest resources in the LSA and RSA. The application scenario included the baseline scenario plus potential impacts from development and operation of the Project (Project footprint). Mapping was undertaken for resources specifically affected by the Project in the LSA and RSA.

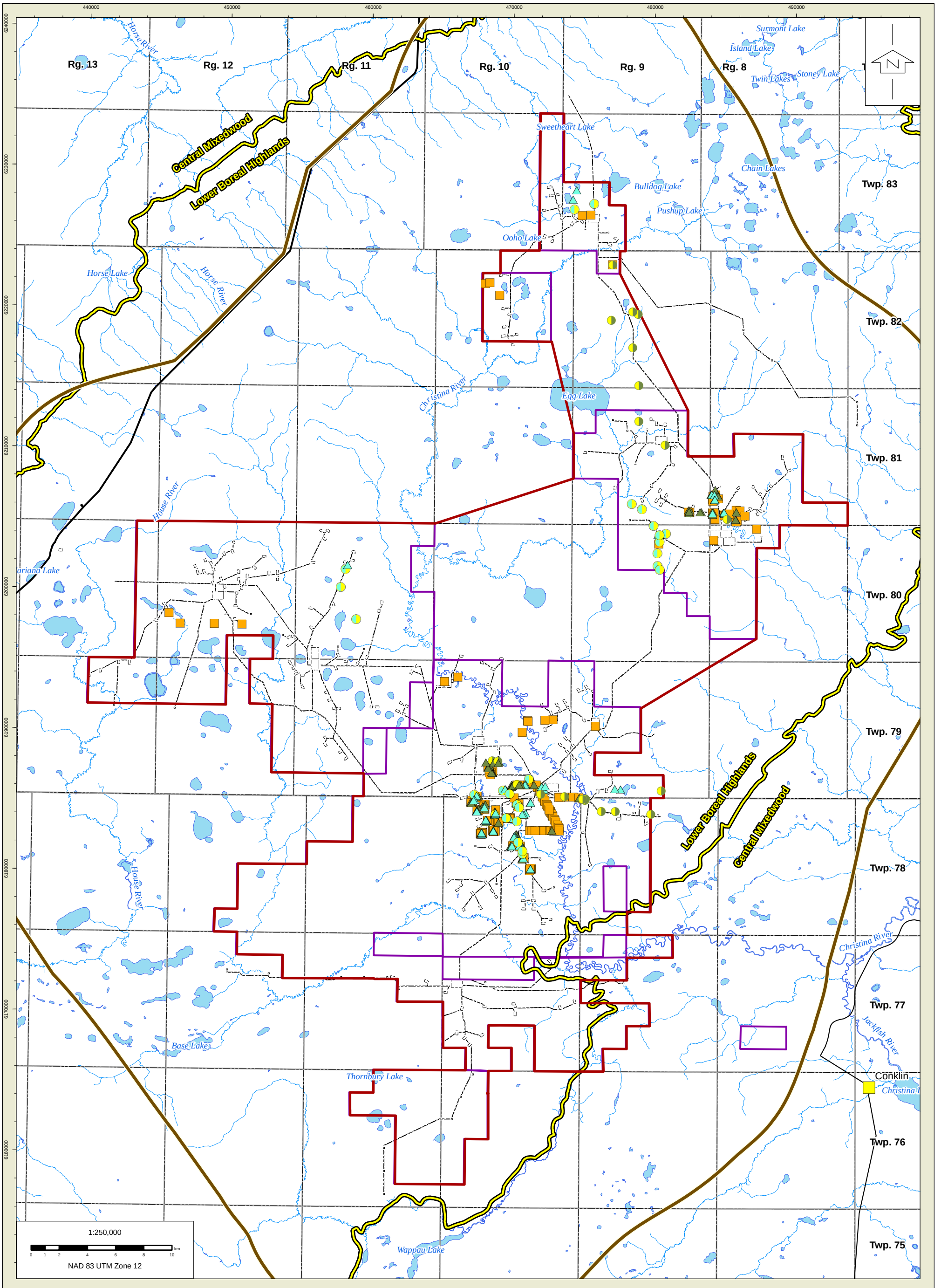
The final step of the impact analysis was a cumulative effects assessment. Incorporated in the cumulative effects assessment are residual effects following reclamation and closure of the Project, foreseeable future projects, and surrounding activities that are likely to contribute additional impacts.

10.4.5 Scoping of Indicators

A scoping exercise was undertaken to determine indicators representative of broader groups of parameters because measuring and assimilating every environmental or ecological parameter into an EIA is impractical. The following indicators have been selected to focus this assessment for terrestrial vegetation, wetlands and forest resources:

- vegetation communities with limited distribution;
- economic forests;
- old-growth forests;
- traditional and medicinal plants;
- wetlands and peatlands;
- potential rare plant habitat; rare plants; rare plant communities;
- acid deposition; and
- non-native and invasive species.

These indicators, as well as ecological units in the study areas, are assessed with regard to vegetation removal and alterations to hydrology. Potential impacts from air emissions are discussed and assessed separately.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Rg. 11
Rg. 10
Rg. 9
Rg. 8
Twp. 83
Twp. 82
Twp. 81
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
Twp. 75
Central Mixedwood
Lower Boreal Highlands
Horse River
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
ariana Lake
Base Lake
Thornbury Lake
Wappau Lake
Jackfish River
Conklin
N
1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Project Footprint
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Sampling Sites
Late Rare Meander
Early Rare Meander
Sample Plot
Sample Plot / Late Rare Meander
Sample Plot / Early Rare Meander
Visual Check
Title:
SAMPLING SITES IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: June 11, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Sampling_Sites_LSA.mxd
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Checked: LM
Fig. No.: 10.4-1

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6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Christina River

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

a b c

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Project Footprint
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Sampling Sites

- Late Rare Meander
- Early Rare Meander
- Sample Plot
- Sample Plot / Late Rare Meander
- Sample Plot / Early Rare Meander
- Visual Check

Title:

SAMPLING SITES IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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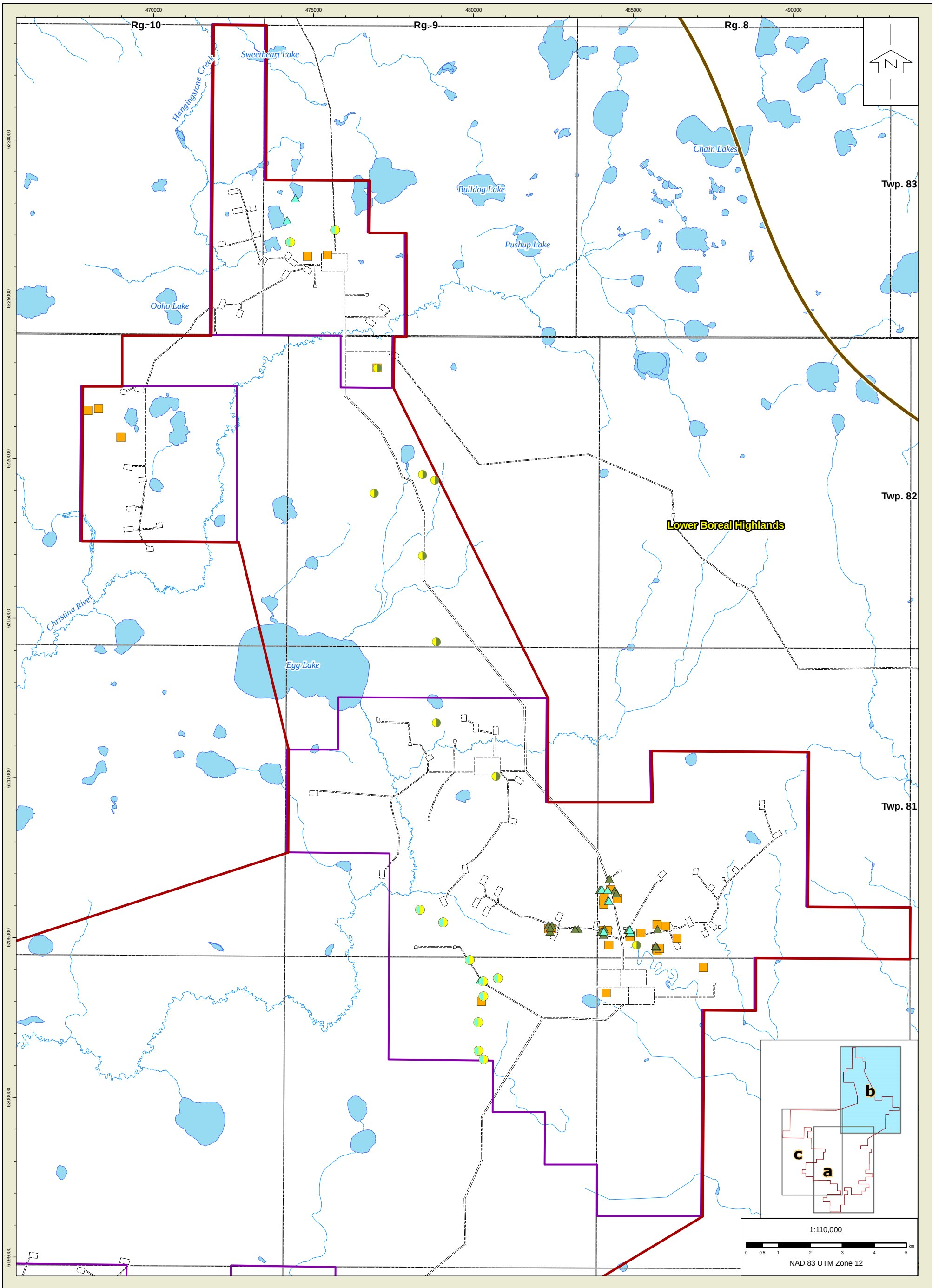

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Sampling Sites

- Late Rare Meander
- Early Rare Meander
- Sample Plot
- Sample Plot / Late Rare Meander
- Sample Plot / Early Rare Meander
- Visual Check

Title:

SAMPLING SITES IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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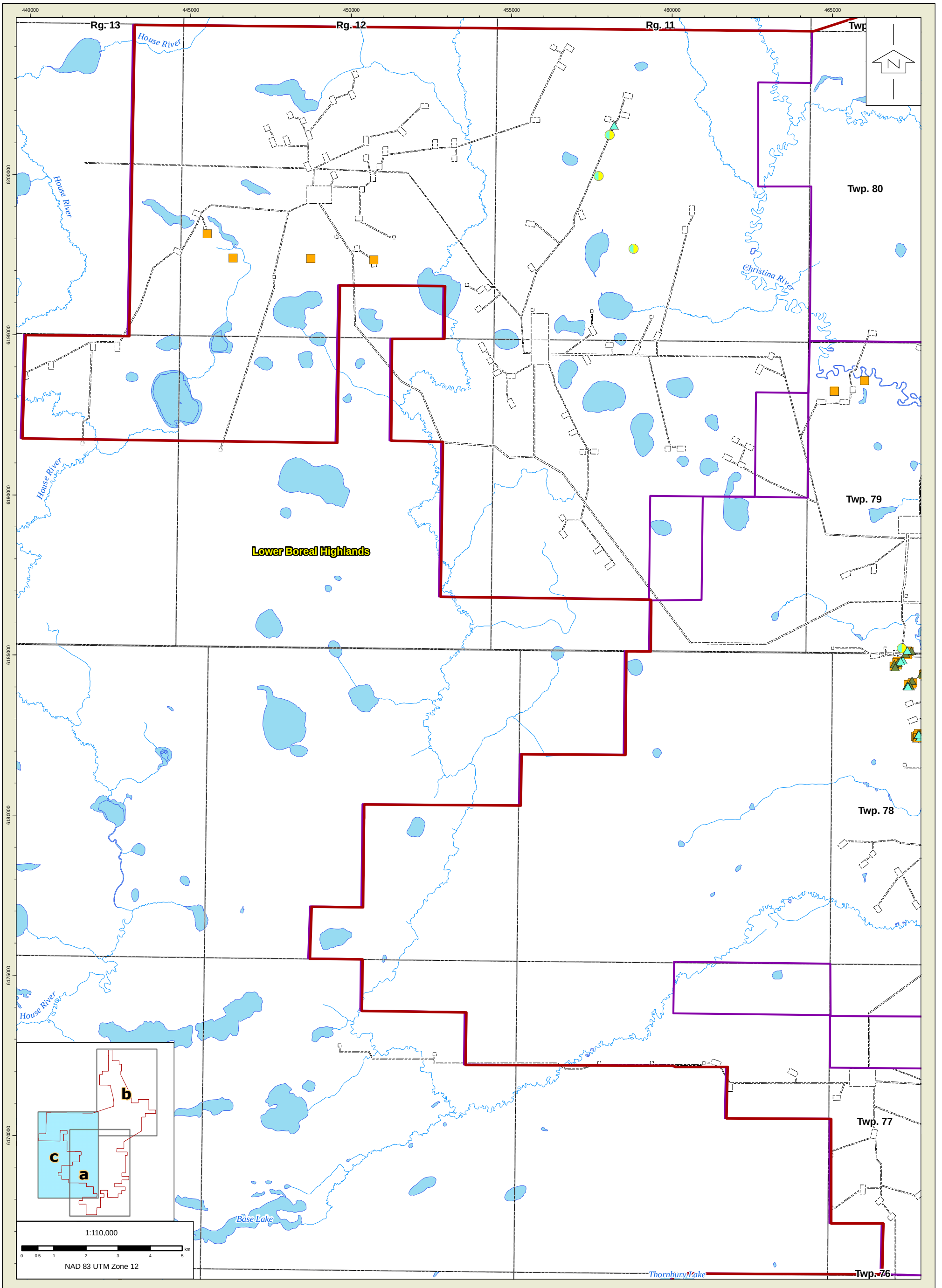

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Sampling Sites

- Late Rare Meander
- Early Rare Meander
- Sample Plot
- Sample Plot / Late Rare Meander
- Sample Plot / Early Rare Meander
- Visual Check

Title:

SAMPLING SITES IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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10.5 Existing Conditions

A major portion of the LSA is located within the Lower Boreal Highland Subregion of the Boreal Forest Natural Region (Natural Regions Committee, 2006). A smaller portion in the southeast section of the LSA is located within the Central Mixedwood Subregion (Natural Regions Committee, 2006) (Figure 10.2-1). Generally, the Central Mixedwood is characterized by short, warm summers and long, cold winters. Climatic conditions for the Lower Boreal Highlands Subregion are moist and cool when compared to the Central Mixedwood Subregion. Soils of both subregions are dominated by: Gray Luvisols in upland areas; Gleysols and Organic soils in lowland areas and wetlands; Brunisols in pine-dominated, sandy areas; and occasionally, discontinuous permafrost is associated with bogs (Beckingham and Archibald, 1996).

Forests and landscape features of the Central Mixedwood and Lower Boreal Highlands form a mosaic of upland forests, lowlands and wetlands with numerous interspersed rivers and lakes. In the Central Mixedwood Subregion, upland forested areas are typically vegetated with deciduous forests of pure or mixed stands of aspen (*Populus tremuloides)* and balsam poplar; mixed stands of aspen and white spruce with balsam fir (*Abies balsamea*) in older stands; and coniferous forests dominated by white spruce with jack pine (*Pinus banksiana*) dominating dry sandy areas. Black spruce, tamarack and white birch are typical tree species in lowland forests and wetlands.

Forests of the Lower Boreal Highlands Subregion are more diverse than those of the Central Mixedwood Subregion. Pure white birch stands are found on upper elevations. White birch and balsam poplar are often the dominant tree species in pure and mixed stands where aspen would be dominant in the Central Mixedwood Subregion (Natural Regions Committee, 2006). Lodgepole pine (*Pinus contorta*) typically replaces jack pine at higher elevations throughout the province, and, in the Lower Boreal Highland Natural Subregion where elevations are increasing relative to the adjacent Central Mixedwood Natural Subregion, hybrids of jack pine and lodgepole pine can be found (Natural Regions Committee 2006).

Geomorphology of the Lower Boreal Highland Natural Subregion is also more diverse than the Central Mixedwood Natural Subregion. The Lower Boreal Highland Natural Subregion has gently to strongly sloping lower elevations and undulating to hummocky upland areas. The Central Mixedwood Natural Subregion has gently undulating plains with minor hummocky upland areas (Natural Regions Committee 2006). Both regions are studded with numerous shallow waterbodies and have extensive wetland areas of bogs and fens.

10.5.1 Terrestrial Vegetation and Wetlands of the LSA

10.5.1.1 Ecological Units

Results of the ecosite phase mapping (Table 10.5-1) indicate that the Lower Boreal Highlands Subregion accounted for 97.7% of the LSA, while the remaining 2.3% was located within the Central Mixedwood Subregion. All 18 possible Lower Boreal Highland ecosite phases occurred within the LSA (Figures 10.5-1 and 10.5-1a to 10.5-1c). Eleven of these ecosite phases were upland types, while seven were lowland (wetland) types. In total, 48 detailed vegetation survey sample plots, and 183 rare meanders were completed (Figures 10.4-1 and 10.4-1a to 10.4-1c). In addition, visual checks were completed during helicopter reconnaissance fights and while traversing on the ground between sample sites. A summary of plot type and frequency by ecosite phase and wetland type is included in Appendix 10D.

The total area of upland ecosite phases in the Lower Boreal Highland Subregion was 47,358 ha (32.6% of the LSA). The total area of wetland ecosite phases in the Lower Boreal Highland Subregion was 76,927 ha (52.9% of the LSA).

Twenty three of the 25 ecosite phases defined for the Central Mixedwood were found in the LSA. Sixteen ecosite phases were upland types and seven were wetland types. Total upland area in the Central Mixedwood Subregion was 1701 ha (1.2% of the LSA), and 1015 ha (0.7% of the LSA) were wetland areas.

The total area of upland ecosite phases in the LSA was 49,060 ha (33.8% of the LSA). Total wetland area was 77,942 ha (53.6% of the LSA).

The most abundant upland ecosite phase in the LSA was g1 (Labrador tea-hygric, black spruce, jack pine), with an area of 14,151 ha. This ecosite phase accounted for 9.7% of the LSA. The h1 Treed (Black spruce) bog was the most abundant wetland ecosite phase, comprising 37,516 ha or 25.8% of the LSA. Ecosite phase descriptions for the Lower Boreal Highlands and Central Mixedwood Natural Subregions are found in Appendix 10B.

Table 10.5-1 Summary of Ecosite Phases and Disturbance Areas by Natural Subregion in the LSA

	Baseline Scenario					
	Central Mixedwood Subregion		**Lower Boreal Highlands Subregion**		**LSA (Baseline Scenario)**	
	Area (ha)	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**
Upland Ecosite Phase						
a1	9	0.0	2477	1.7	N/A	
b1	109	0.1	3994	2.7		
b2	0	0.0	962	0.7		
b3	27	0.0	626	0.4		
b4	24	0.0	N/A	N/A		
c1	58	0.0	11540	7.9		
d1	477	0.3	7852	5.4		
d2	287	0.2	3185	2.2		
d3	111	0.1	1142	0.8		
e1	311	0.2	1343	0.9		
e2	77	0.1	N/A	N/A		
e3	19	0.0	N/A	N/A		
f1	4	0.0	86	0.1		
f2	8	0.0	N/A	N/A		
f3	2	0.0	N/A	N/A		
g1	83	0.1	14151	9.7		
h1	96	0.1	N/A	N/A		
Terrestrial Subtotal	***1701***	***1.2***	***47358***	***32.6***	***49060***	***33.8***

	Baseline Scenario					
	Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA (Baseline Scenario)	
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA
Wetland/Peatland Ecosite Phase						
h1	N/A	N/A	37516	25.8	N/A	
h2	N/A	N/A	6198	4.3		
i1	548	0.4	7308	5.0		
i2	36	0.0	7210	5.0		
j1	41	0.0	10688	7.4		
j2	109	0.1	4360	3.0		
j3	N/A	N/A	3647	2.5		
k1	15	0.0	N/A	N/A		
k2	204	0.1	N/A	N/A		
k3	62	0.0	N/A	N/A		
l1	0	0.0	N/A	N/A		
Wetland Subtotal	***1015***	***0.7***	***76927***	***52.9***	***77942***	***53.6***
Other						
Burn	0	0.0	8388	5.8	8388	5.8
Burn Clearcut	0	0.0	38	0.0	38	0.0
Burn Regen	0	0.0	1100	0.8	1100	0.8
Meadow	1	0.0	35	0.0	36	0.0
NMC (Cutbank)	1	0.0	0	0.0	1	0.0
Shrubland	1	0.0	41	0.0	42	0.0
Other Subtotal	***2***	***0.0***	***9602***	***6.6***	***9604***	***6.6***
Water						
NWF (Flooded)	10	0.0	276	0.2	287	0.2
NWL (Lake)	25	0.0	2991	2.1	3016	2.1
NWR (River)	72	0.0	320	0.2	392	0.3
Water Subtotal	***107***	***0.1***	***3588***	***2.5***	***3694***	***2.5***
Disturbance						
AIG (Gravel/Borrow Pit)	26	0.0	5	0.0	31	0.0
AIH (Roads)	0	0.0	1608	1.1	1608	1.1
AII (Industrial Sites)	0	0.0	19	0.0	19	0.0
CC (Clearcut)	392	0.3	1149	0.8	1541	1.1
CIP (Pipelines)	27	0.0	1481	1.0	1507	1.0
CIW (Wellsites)	9	0.0	284	0.2	293	0.2
CL (Clearing)	0	0.0	49	0.0	49	0.0
CP (Reclaimed to grass)	0	0.0	0	0.0	0	0.0
Disturbance Subtotal	***454***	***0.3***	***4594***	***3.2***	***5049***	***3.5***
Total	**3280**	**2.3**	**142069**	**97.7**	***145349***	**100.0**

Notes:

Summed totals may differ due to rounding conventions.

N/A - not applicable

10.5.1.2 Vegetation Communities of Limited Distribution

Vegetation communities of limited distribution are those ecosite phases that represent less than 1% in area of the LSA (Table 10.5-1). Their importance is their contribution to the biodiversity of an area. Communities of limited distribution in the Lower Boreal Highland subregion of the LSA included the b2 (blueberry, aspen), b3 (blueberry, white spruce, jack pine), d3 (low-bush cranberry, white spruce), e1 (fern, white spruce), and f1 (horsetail, white spruce) ecosite phases. Table 10.5-1 shows total areas for each of these ecosite phases and their corresponding percent representation in the LSA. Figures 10.5-2 and 10.5-2a to 10.5-2c illustrate the distribution of these locally uncommon ecosite phases within the LSA.

10.5.1.3 Forested and Non-Forested Areas

Forested land comprises 79.7% of the LSA (115,862 ha) at baseline. The area classified as non-forested covers 20.3% (29,487 ha).

Of the area classified as forested land, 98.0% (113,521 ha) is in the Lower Boreal Highlands subregion and 2.0% (2,341 ha) is in the Central Mixedwood subregion. The majority of forested land (57.7%, 66,803 ha) is comprised of wetland ecosite phases. Terrestrial ecosite phases comprise the remaining forested land (42.3%, 49,059 ha). Table 10.5-2 provides a summary of the distribution of forested land in the LSA at baseline.

Table 10.5-2 Summary of Forested and Non-Forested lands in the LSA at Baseline

Landscape category	Central Mixedwood				Lower Boreal Highlands			
	Forested area (ha)	% LSA	Non-forested area (ha)	% LSA	Forested area (ha)	% LSA	Non-forested area (ha)	% LSA
Terrestrial	1701	1.2	0	0.0	47358	32.6	1	0.0
Wetlands	639	0.4	376	0.3	66164	45.5	10763	7.4
Other[1]	0	0.0	2	0.0	0	0.0	9602	6.6
Waterbodies	0	0.0	107	0.1	0	0.0	3588	2.5
Disturbances	0	0.0	454	0.3	0	0.0	4594	3.2
Total	**2341**	**1.6**	**940**	**0.6**	**113521**	**78.1**	**28547**	**19.6**

1 Burns, meadows, shrublands and cutbanks

Summed Totals may differ due to rounding of original GIS values in columns

10.5.1.4 Productive Forests

Table 10.5-3 shows the amount of productive and non-productive forest in each forest type category. Due to the low amount of area in the Central Mixedwood subregion, data have been combined for the subregions. In the LSA at baseline 92,921 ha of forested land is classified as productive (63.9% of the LSA). Forests with a TPR rating of good cover 22,915 ha (15.8% of the LSA), those with a rating of medium cover 54,249 ha (37.3%) and those rated fair cover 15,757 ha (10.8%). The majority of productive forests, regardless of rating, are coniferous (74,299 ha; 80.0% of productive forests). Unproductive forests cover 12,254 ha (8.4% of the LSA) at baseline.

Table 10.5-3 Summary of Productive and Non-productive Forests by Forest Type in the LSA at Baseline

TPR Rating	Coniferous Forest Area (ha)	% LSA	Deciduous Forest Area (ha)	% LSA	Mixedwood Forest Area (ha)	% LSA	Total Forested Area (ha)	% LSA	Non-forested Area (ha)	% LSA	Total	% LSA
Good	9836	6.8	7619	5.2	5461	3.8	22915	15.8	193	0.1	23109	15.9
Medium	48980	33.7	1018	0.7	4250	2.9	54249	37.3	6681	4.6	60930	41.9
Fair	15483	10.7	6	0.0	268	0.2	15757	10.8	3462	2.4	19219	13.2
Total Productive	**74299**	**51.1**	**8643**	**5.9**	**9979**	**6.9**	**92921**	**63.9**	**10337**	**7.1**	**103257**	**71.0**
Unproductive	12239	8.4	2	0.0	14	0.0	12254	8.4	21397	14.7	33651	23.2
All	**86538**	**59.5**	**8644**	**5.9**	**9993**	**6.9**	**105175**	**72.4**	**31734**	**21.8**	**136909**	**94.2**

Summed Totals may differ due to rounding of original GIS values in columns

10.5.1.5 Forest Merchantability

At baseline there are 33,960 ha of merchantable timber in the LSA (23.4% of the LSA). Ecosite phase c1 (Labrador tea-mesic Pj-Sb) in the Lower Boreal Highlands contributes the largest amount of area (10,980 ha; 7.6% of the LSA) to the total area of merchantable timber in the LSA. Table 10.5-4 summarizes the distribution of merchantable timber by ecosite phase.

Table 10.5-4 Summary of Merchantable Timber in the LSA by Ecosite Phase

Ecosite Phase	Central Mixedwood Subregion		Lower Boreal Highlands Subregion	
	Area (ha)	% of LSA	Area (ha)	% of LSA
a1	9	0.0	2477	1.7
b1	109	0.1	3994	2.7
b2	0	0.0	962	0.7
b3	27	0.0	626	0.4
b4	24	0.0	N/A	N/A
c1	58	0.0	10980	7.6
d1	477	0.3	7852	5.4
d2	287	0.2	3136	2.2
d3	111	0.1	1094	0.8
e1	311	0.2	347	0.2
e2	77	0.1	N/A	N/A
e3	19	0.0	N/A	N/A
f1	4	0.0	86	0.1
f2	8	0.0	N/A	N/A
f3	2	0.0	N/A	N/A
g1	0	0.0	808	0.6
h1	47	0.0	0	0.0
h2	N/A	N/A	0	0.0
i1	0	0.0	0	0.0
i2	0	0.0	0	0.0
j1	0	0.0	28	0.0
j2	0	0.0	0	0.0
j3	N/A	N/A	0	0.0
k1	0	0.0	N/A	N/A
k2	0	0.0	N/A	N/A
k3	0	0.0	N/A	N/A
l1	0	0.0	N/A	N/A
Total	**1570**	**1.1**	**32389**	**22.3**

N/A – ecosite does not occur in this subregion

Summed Totals may differ due to rounding of original GIS values in columns

10.5.1.6 Old-Growth Forests

Old-growth forests have unique structure and function relative to younger stands. They are characterized by a heterogeneous age structure, large canopy trees, an accumulation of snags and downed woody material, and high species diversity. In addition to providing habitat for wildlife, older forests tend to support increased genetic diversity. Therefore, they act as reservoirs that enable plant reproduction and adaptation across fragmented landscapes (Mosseler et al., 2003).

Table 10.5-5 shows the amount of old growth forest in each ecosite phase in the Lower Boreal Highlands and Central Mixedwood subregions. At baseline there are 7,718 ha of forest in the LSA that are regarded as old growth (5.3% of the LSA). The ecosite phase with the largest amount of old growth is the Lower Boreal Highlands ecosite phase h1 (treed bog), which contains 1,756 ha of old growth (1.2% of the LSA).

Table 10.5-5 Summary of Old-Growth Forest in Ecosite Phases in the LSA at Baseline

Ecosite Phase	Baseline			
	Central Mixedwood		Lower Boreal Highlands	
	Area (ha)	% of LSA	Area (ha)	% of LSA
a1	0	0.0	0	0.0
b1	53	0.0	322	0.2
b2	0	0.0	210	0.1
b3	13	0.0	85	0.1
b4	0	0.0	N/A	N/A
c1	0	0.0	109	0.1
d1	52	0.0	829	0.6
d2	48	0.0	1158	0.8
d3	92	0.1	445	0.3
e1	69	0.0	544	0.4
e2	43	0.0	N/A	N/A
e3	19	0.0	N/A	N/A
f1	0	0.0	19	0.0
f2	0	0.0	N/A	N/A
f3	0	0.0	N/A	N/A
g1	7	0.0	1170	0.8
h1	30	0.0	1756	1.2
h2	N/A	N/A	0	0.0
i1	0	0.0	229	0.2
i2	0	0.0	0	0.0
j1	0	0.0	416	0.3
j2	0	0.0	0	0.0
j3	N/A	N/A	0	0.0
k1	0	0.0	N/A	N/A
k2	0	0.0	N/A	N/A
k3	0	0.0	N/A	N/A
l1	0	0.0	N/A	N/A
Total	**425**	**0.3**	**7293**	**5.0**

Summed Totals may differ due to rounding of original GIS values

N/A – ecosite does not occur in this subregion

Most of the old growth forest in the LSA is in ecosite phases that have been classified as coniferous or mixedwood (Table 10.5-6). Coniferous forest accounts for 51.3% (3,962 ha) of all old growth forest in the LSA and 41.7% (3,220 ha) is mixedwood. The distribution of old-growth forest among coniferous, deciduous and mixedwood forest ecosite phases is summarized and displayed in Figures 10.5-3 and 10.5-3a to 10.5-3c. The classification of ecosite phases according to forest type is given in Table 10.4-2.

Table 10.5-6 Distribution of Old-Growth Forest among Forest Types in the LSA at Baseline

Old-Growth Forest Type	Baseline					
	Central Mixedwood		Lower Boreal Highlands		Total (ha)	Total % of LSA
	Area (ha)	% of LSA	Area (ha)	% of LSA		
Coniferous	148	0.1	3813	2.6	3962	2.7
Deciduous	121	0.1	416	0.3	537	0.4
Mixedwood	156	0.1	3063	2.1	3220	2.2
Total	**425**	**0.3**	**7293**	**5.0**	**7718**	**5.3**

Summed Totals may differ due to rounding of original GIS values in columns

10.5.1.7 Traditional and Medicinal Plants

All of the most common and well known traditional medicinal plants as mentioned in the Methods section (Section 10.4.3.4) were observed in the LSA. In the LSA, there are 37,245 ha (25.6%) of potential blueberry habitat (ecosite phases a1, b1, b2, b3, b4, c1, and g1 in the Central Mixedwood subregion and ecosite phases a1, b1, b2, b3, c1, d2, g1 in the Lower Boreal Highlands subregion). Potential cranberry habitat (ecosite phases d1, d2, d3, e1, e2, e3, f1, f2 and f3 in the Central Mixedwood subregion and ecosite phases b1, d1, d2, d3, e1 and f1 in the Lower Boreal Highlands subregion) comprised 18,898 ha (13%) of the LSA. There are 914 ha (0.6% of the LSA) of potential strawberry habitat (ecosite phase d2 in the Central Mixedwood subregion and ecosite phase b3 in the Lower Boreal Highlands subregion). A species list per ecosite phase is found in Appendix E.

10.5.1.8 Wetlands and Peatlands

Based on the AWI classification system, 14 wetland classes were identified in the LSA (Table 10.5-7, Figures 10.5-4 and 10.5-4a to 10.5-4c). The total area for AWI classified wetlands was 79,570 ha or 54.7% of the LSA. Of the wetland classes, 10 were peatlands that accounted for a total of 71,396 ha or 49.1% of the LSA. The most abundant wetland class was BTNN (treed bog), with an area of 35,734 ha or 24.6% of the LSA.

Area calculations of wetlands using ecosite phase and AWI classification systems vary slightly. This is largely due to treed (SFNN, STNN) and shrubby (SONS) swamps of the AWI classification not being recognized in Beckingham and Archibald's (1996) ecosite phase classification system (Figures 10.5-5 and 10.5-5a to 10.5-5c). Ecosite phases that Beckingham and Archibald (1996) code as e1 and f1 in the Lower Boreal Highlands Subregion and h1 in the Central Mixedwood Subregion, which have wet moisture regimes, are coded as treed swamps (STNN) in the AWI classification system.

Table 10.5-7 Summary of AWI Wetland Classes by Natural Subregion within the LSA at Baseline

AWI Wetland Class	Wetland Description	Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA (Baseline)	
		Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA
Wetland							
BFNN (Peatland)	Forested bog	4	0.0	1554	1.1	1558	1.1
BONS (Peatland)	Open shrubby bog	36	0.0	6153	4.2	6189	4.3
BTNI (Peatland)	Treed bog with internal laws	1	0.0	771	0.5	771	0.5
BTNN (Peatland)	Treed bog	543	0.4	35191	24.2	35734	24.6
FONG (Peatland)	Open graminoid fen	0	0.0	518	0.4	518	0.4
FONS (Peatland)	Open shrubby fen	28	0.0	8601	5.9	8629	5.9
FOPN (Peatland)	Open shrubby patterned fen	0	0.0	28	0.0	28	0.0
FTNI (Peatland)	Treed fen with internal lawns	3	0.0	1377	0.9	1380	0.9
FTNN (Peatland)	Treed fen	53	0.0	16483	11.3	16536	11.4
FTPN (Peatland)	Treed patterned fen	0	0.0	52	0.0	52	0.0
MONG	Marsh, graminoid	59	0.0	1804	1.2	1863	1.3
SONS	Open shrubby swamp	288	0.2	4432	3.0	4721	3.2
STNN	Treed swamp	57	0.0	1357	0.9	1414	1.0
WONN	Shallow open water	0	0.0	175	0.1	175	0.1
Wetland Total		**1072**	**0.7**	**78498**	**54.0**	**79570**	**54.7**

Summed totals may differ due to rounding of original GIS values in columns.

10.5.2 Terrestrial Vegetation and Wetlands of the RSA

The RSA covered an area of 474,702 ha (Table 10.5-8). Coniferous, deciduous, and mixedwood forests accounted for 56.2% (266,609 ha) of this area, while wetland and water cover classes represented 39.2% (186,228 ha) of the RSA. The closed spruce class comprised the largest portion of the RSA, accounting for 146,573 ha (30.9%). Disturbance represented 3.7% (17,610 ha) of the RSA. Of the disturbance categories, new burn comprised the largest portion of disturbance, accounting for 14,409 ha or 3.0 % of the RSA. Figures 10.5-6 and 10.5-6a to 10.5-6c illustrates the distribution and extent of land cover classes in the RSA.

Table 10.5-8 Summary of Land Cover Classes by Natural Subregion in the RSA at Baseline

Type	Ground Cover Classes (AGCC)	Area (ha)	Percentage of RSA
Upland	Open Pine	48219	10.2
	Closed Pine	31679	6.7
	Closed Se/Sw	146573	30.9
	Closed Aspen, Balsam Poplar and/or Birch	31722	6.7
	Closed Coniferous and Deciduous Cover (40-60%)	8417	1.8
	Closed Upland Shrub	651	0.1
	Mixed Grassland	721	0.2
Wetlands & Water	Graminoid Wetlands (sedges/grasses/forbs) (less than 6% tree cover) (less than 25% shrub)	56706	11.9
	Shrubby Wetlands (Willow and Birch)	16674	3.5
	Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)	100406	21.2
	Lake, pond, reservoir, river and stream	12443	2.6
Other	Rock, Talus, and/or Avalanche Chute	3	0.0
	Exposed Soil	1350	0.3
	Cloud / Haze	526	0.1
	Shadow	1004	0.2
Disturbance	Major roads, highway and railways	386	0.1
	Graminoid (grasses/sedges/forbs) dominated clear-cut	2041	0.4
	Undifferentiated burn	121	0.0
	Graminoid (grasses/sedges/forbs) dominated burn	64	0.0
	Tree/shrub dominated burn	590	0.1
	New Burn	14409	3.0
	Total	**474702**	**100.0**

Summed totals may differ due to rounding.

10.5.3 Rare Plants and Rare Communities

10.5.3.1 Potential Rare Plant Habitat in the LSA

Vegetation communities in the LSA were ranked according to their potential to support rare plants. Table 10.5-9 summarizes the extent of potential rare plant habitat for each natural subregion occurring in the LSA. The distribution of vegetation communities within the LSA by rare plant habitat potential ranking is illustrated in Figures 10.5-7 and 10.5-7a to 10.5-7c. Adding areas of Boreal Mixedwood and Lower Boreal Highland Subregions together, 20.6% of the LSA (29,936 ha) has a high potential for rare plants to be present, 35.9% (52,141 ha) has a moderate potential, 26.8% (38,886 ha) has a low potential and 11% (15,995 ha) has a very low potential to support rare plants.

Table 10.5-9 Rare Plant Potential Habitat in the LSA of the Kai Kos Dehseh SAGD Project at Baseline

Central Mixedwood			
High Potential	**Ephase**	**Area (ha)**	**% LSA**
	(j1) Treed Poor Fen	41	0.0
	(j2) Shrubby Poor Fen	109	0.1
	(k1) Treed Rich Fen	15	0.0
	(k2) Shrubby Rich Fen	204	0.1
	Total High Potential	**370**	**0.3**
Moderate			
	(d3) Low bush cranberry (Aspen-White spruce)	111	0.1
	(il) Treed bog	548	0.4
	(k3) Graminoid Fen	62	0.0
	(l1) Marsh	0	0.0
	NWL Lake	25	0.0
	Burn Regeneration	0	0.0
	Disturbed	455	0.3
	Total Moderate Potential	**1200**	**0.8**
Low			
	(b1) Blueberry (Jack pine/Aspen)	109	0.1
	(d1) Low bush cranberry (Aspen)	477	0.3
	(d2) Low bush cranberry (Aspen/White spruce)	287	0.2
	(e1) Dogwood (Balsam poplar/Aspen)	311	0.2
	(e3) Dogwood (White spruce)	19	0.0
	(g1) Labrador tea (Black spruce/Jack pine)	83	0.1
	(i2) Shrubby bog	548	0.4
	Deciduous Regeneration	0	0.0
	Shrubland	1	0.0
	NWF Flooded areas	10	0.0
	Total Low Potential	**1845**	**1.3**
Very Low			
	(a1) Lichen (Jack pine)	9	0.0
	(b2) Blueberry (Aspen/Paper birch)	0	0.0
	(b3) Blueberry (Aspen/White spruce)	27	0.0
	(b4) Blueberry (White spruce/Jack pine)	24	0.0
	(c1) Labrador tea (Jack pine/Black spruce)	58	0.0
	(e2) Dogwood (Balsam poplar/White spruce)	77	0.1
	(f1) Horsetail (Balsam poplar/Aspen)	4	0.0
	(f2) Horsetail (Balsam poplar/White spruce)	8	0.0
	(f3) Horsetail (White spruce)	2	0.0
	(h1) Labrador tea (White spruce/Black spruce)	96	0.1
	Total Very Low Potential	**305**	**0.2**

Lower Boreal Highlands			
High Potential	**Ephase**	**Area (ha)**	**% LSA**
	(i1) Treed Poor Fen	7308	5.0
	(i2) Shrubby Poor Fen	7210	5.0
	(j1) Treed Rich Fen	10688	7.4
	(j2) Shrubby Rich Fen	4360	3.0
	Total High Potential	**29566**	**20.3**
Moderate	**(d3)** Low bush cranberry (White spruce)	1142	0.8
	(hl) Treed bog	37516	25.8
	(j3) Graminoid Fen & Marsh	3647	2.5
	NWL Lake	2991	2.1
	Burn Regeneration	1100	0.8
	Disturbed	4545	3.1
	Total Moderate Potential	**50941**	**35.0**
Low	**(b1)** Blueberry (Jack pine/Aspen)	3994	2.7
	(d1) Low bush cranberry (Aspen)	7852	5.4
	(d2) Low bush cranberry (Aspen/White spruce/Black spruce)	3185	2.2
	(e1) Fern (White spruce)	1343	0.9
	(g1) Labrador tea (Black spruce/Jack pine)	14151	9.7
	(h2) Shrubby bog	6198	4.3
	Deciduous Regeneration	0	0.0
	Shrubland	41	0.0
	NWF Flooded areas	276	0.2
	Total Low Potential	**37041**	**25.5**
Very Low	**(a1)** Bearberry (Jack pine)	2477	1.7
	(b2) Blueberry (Aspen)	962	0.7
	(b3) Blueberry (White spruce/Jack pine)	626	0.4
	(c1) Labrador tea (Jack pine/Black spruce)	11540	7.9
	(f1) Horsetail (White spruce)	86	0.1
	Total Very Low Potential	**15691**	**10.8**

	Area (ha)	% of LSA
Total High Potential	**29936**	**20.6**
Total Moderate Potential	**52141**	**35.9**
Total Low Potential	**38886**	**26.8**
Total Very Low Potential	**15995**	**11.0**

Percent numbers do not add to 100 because all landscape areas are not included in rare plant potential calculations (i.e., rivers, roads)

Summed totals may differ due to rounding conventions.

10.5.3.2 Rare Plants

Thirteen rare plant species were observed during the 2005 and 2006 field programs: ten rare vascular plants; *Cardamine pratensis* spp *paludosa, Carex rostrata, Carex heleonastes, Chrysosplenium tetrandrum, Diphasiastrum sitchense, Euphrasia hudsoniana, Juncus stygius* var *americanus, Potamogeton natans, Potamogeton praelongus, Sarracenia purpurea,* and three rare moss species, *Splachnum luteum, Splachnum rubrum* and *Pseudobryum cinclidiodes*. *Carex rostrata, Potamogeton natans* and *Potamogeton praelongus* were removed from ANHIC's revised tracking and watch lists in July 2006. Table 10.5-10 provides a summary of the rare plant species, their ranking and the ecosite phases in which they were observed. Rankings are explained in Section 10.4.3.6. Figures 10.5-8 and 10.5-8a to 10.5-8c show the distribution of rare plants observed.

Table 10.5-10 Rare Plants Observed in the Kai Kos Dehseh LSA

Scientific Name	Common Name	Ecosite Phase*/Wetland	Status Provincial/Global
Cardamine pratensis spp *paludosa*	meadow bitter cress	j1, j2, i1/FTNI	SU (New listing for Alberta)
Carex rostrata	beaked sedge	i2, j1, j2, j3,/ FONS, FTNI, MONG	removed from ANHIC list July 2006
Carex heleonastes	Hudson Bay sedge	j2/FONS	S2/G4
Chrysosplenium tetrandrum	green saxifrage	e1, j2/SONS	S3/G5
Diphasiastrum sitchense	ground-fir	c1	S2/G5
Euphrasia hudsoniana	Hudson Bay eyebright	Disturbance (i1, h1, d1, c1/BTNN, FTNI)	SU (New listing for Alberta)
Juncus stygius var americanus	Stygian rush	j2/FONS	S2/G5T5
Potamogeton natans	floating-leaf pondweed	NWL/WONN	removed from ANHIC list July 2006
Potamogeton praelongus	white-stem pondweed	NWL/WONN	removed from ANHIC list July 2006
Pseudobryum cinclidiodes		d2	S2/G5
Sarracenia purpurea	pitcher plant	j2/FONS	S2/G5
Splachnum luteum	yellow collar moss	c1, h1, h2/BTNN, BONS	S3/G3
Splachnum rubrum	red collar moss	c1, h1, h2/BTNN, BONS	S3/G3

* All rare plants for the Project were found within the Boreal Highlands Natural Subregion, therefore all ecosite phases listed above represent those of the Boreal Highlands Natural Subregion.

10.5.3.3 Rare Communities

One rare community, *Andromeda polifolia* / *Sarracenia purpurea* / *Sphagnum angustifolium*, was observed. This community is listed as S1S2 in ANHIC's database.

10.5.4 Natural and Anthropogenic Disturbances

Parts of the LSA have been affected by natural or anthropogenic disturbances. The principal form of natural disturbance has been forest fire. The main anthropogenic disturbances have included road construction, land clearance for pipelines and forest harvesting.

The total area affected by forest fire is 9,526 ha or 6.6% of the LSA. Burned areas were classified using attributes in the AVI dataset. AVI includes attribute information for the 1995 burn that occurred in the north-central portion of the LSA. However it does not incorporate the House River Fire of 2002 that spans southern portions of the LSA. The House River Fire, being more recent, was not incorporated in the current audited AVI used in this impact assessment. Since AVI includes pre-burn vegetation information, the total burn disturbance in the LSA is an underestimate. According to GIS calculations of ASRD's Spatial Wildfire data (ASRD, 2006), total burn area within the LSA is 26,527 ha for the House River Fire of 2002 and 10,318 ha for the 1995 fire. Figures 10.5-9 and 10.5-9a to 10.5-9c illustrate the distribution and extent of burns within and surrounding the RSA.

Total anthropogenic disturbance accounted for 5,049 ha or 3.5% of the LSA. Roads comprised a total of 1608 ha or 1.1% of the LSA; pipelines comprised a total of 1,507 ha or 1.0% of the LSA; and clear cuts accounted for 1,541 ha or 1.1% of the LSA.

10.5.5 Non-native and Invasive Species

There was one observed occurrence of scentless chamomile (*Matricaria perforata)* located along an access route (UTM 480303/ 6203634, NAD 83: Section 34, Twp 80, Range 09, W4M).

440000 450000 460000 470000 480000 490000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000

Rg. 13 Rg. 12 Rg. 11 Rg. 10 Rg. 9 Rg. 8

Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75

Central Mixedwood
Lower Boreal Highlands

Horse River
Horse Lake
Christina River
Jackfish River
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Thornbury Lake
Wappau Lake
Conklin

N

1:250,000

0 1 2 4 6 8 10 km

NAD 83 UTM Zone 12

Legend

Ecophase

- a1
- b1
- b2
- b3
- b4
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- f2
- f3
- g1
- h1
- h2
- i1
- i2
- j1
- j2
- j3
- k1
- k2
- k3

Other

- Burn Regeneration
- NMC - cutbank
- NMB - burn recent
- BU_CC - burned clearcut
- BU - Burn
- Shrubland
- CL - clearing
- Meadow
- NWF - Flooded
- NWL - Lake
- NWR - River

Disturbance

- AII - industrial / plant site
- CIW - well pad
- AIG - borrow pit
- CIP - pipeline
- CC - clearcut
- AIH - road/cutline/trail

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

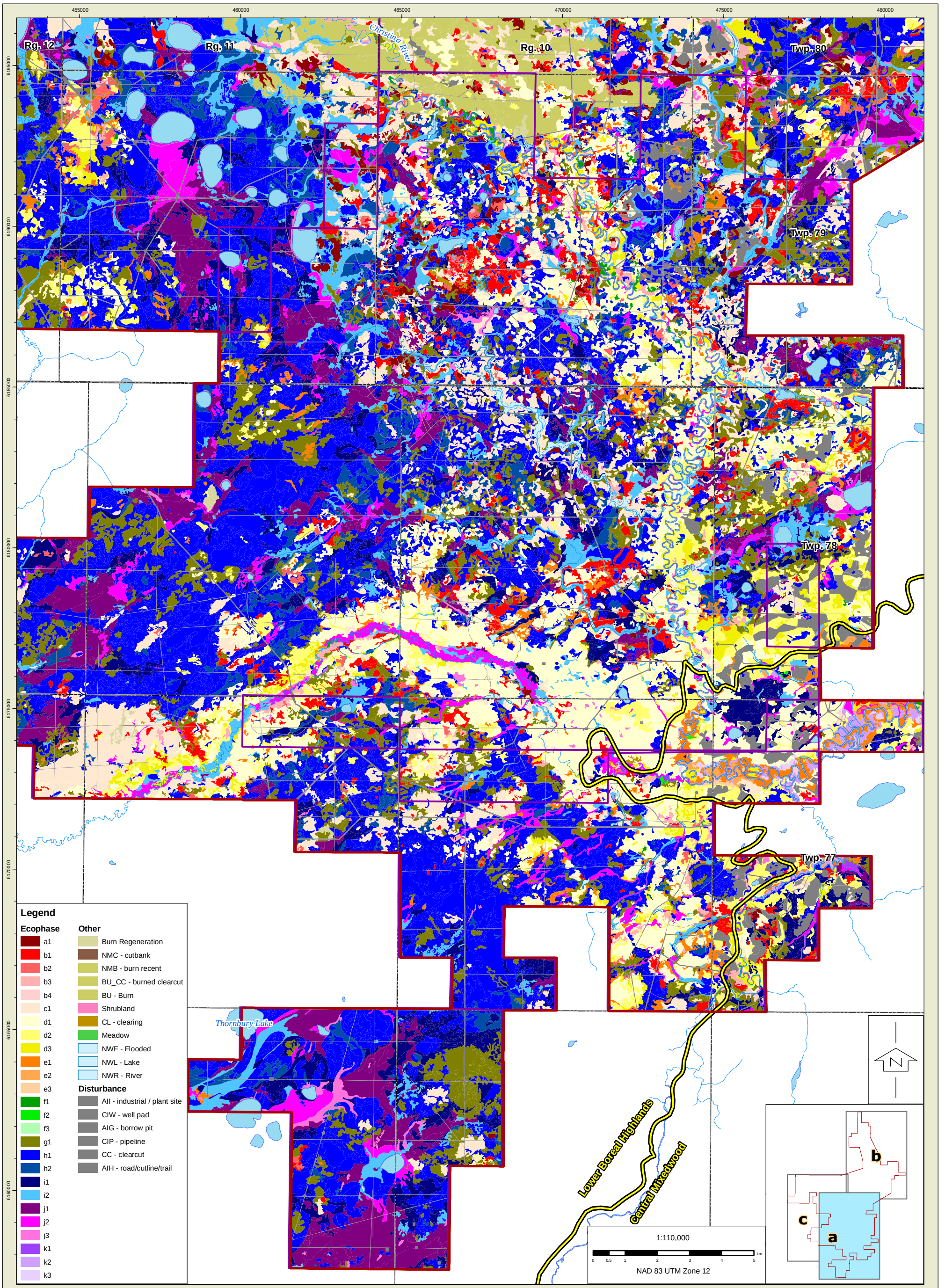
ECOSITE PHASES
IN THE LOCAL STUDY AREA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Phases_LSA.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-1



Title:

ECOSITE PHASES
IN THE LOCAL STUDY AREA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Phases_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-1a

470000 475000 480000 485000 490000

6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000

Rg. 10 Rg. 9

Sweetheart Lake
Bulldog Lake
Christina River
Pushup Lake
Hangingstone Creek
Ooho Lake
Egg Lake

Twp. 83
Twp. 82
Twp. 81

Lower Boreal Highlands

Legend

Ecophase

- a1
- b1
- b2
- b3
- b4
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- f2
- f3
- g1
- h1
- h2
- i1
- i2
- j1
- j2
- j3
- k1
- k2
- k3

Other

- Burn Regeneration
- NMC - cutbank
- NMB - burn recent
- BU_CC - burned clearcut
- BU - Burn
- Shrubland
- CL - clearing
- Meadow
- NWF - Flooded
- NWL - Lake
- NWR - River

Disturbance

- AII - industrial / plant site
- CIW - well pad
- AIG - borrow pit
- CIP - pipeline
- CC - clearcut
- AIH - road/cutline/trail

N

a b c

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

ECOSITE PHASES IN THE LOCAL STUDY AREA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Phases_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-1b

440000 445000 450000 455000 460000 465000

6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

Twp. 80

Twp. 79

Lower Boreal Highlands

Twp. 78

Twp. 77

Base Lake

Thornbury Lake

Twp. 76

Legend

Ecophase

- a1
- b1
- b2
- b3
- b4
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- f2
- f3
- g1
- h1
- h2
- i1
- i2
- j1
- j2
- j3
- k1
- k2
- k3

Other

- Burn Regeneration
- NMC - cutbank
- NMB - burn recent
- BU_CC - burned clearcut
- BU - Burn
- Shrubland
- CL - clearing
- Meadow
- NWF - Flooded
- NWL - Lake
- NWR - River

Disturbance

- AII - industrial / plant site
- CIW - well pad
- AIG - borrow pit
- CIP - pipeline
- CC - clearcut
- AIH - road/cutline/trail

b c a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

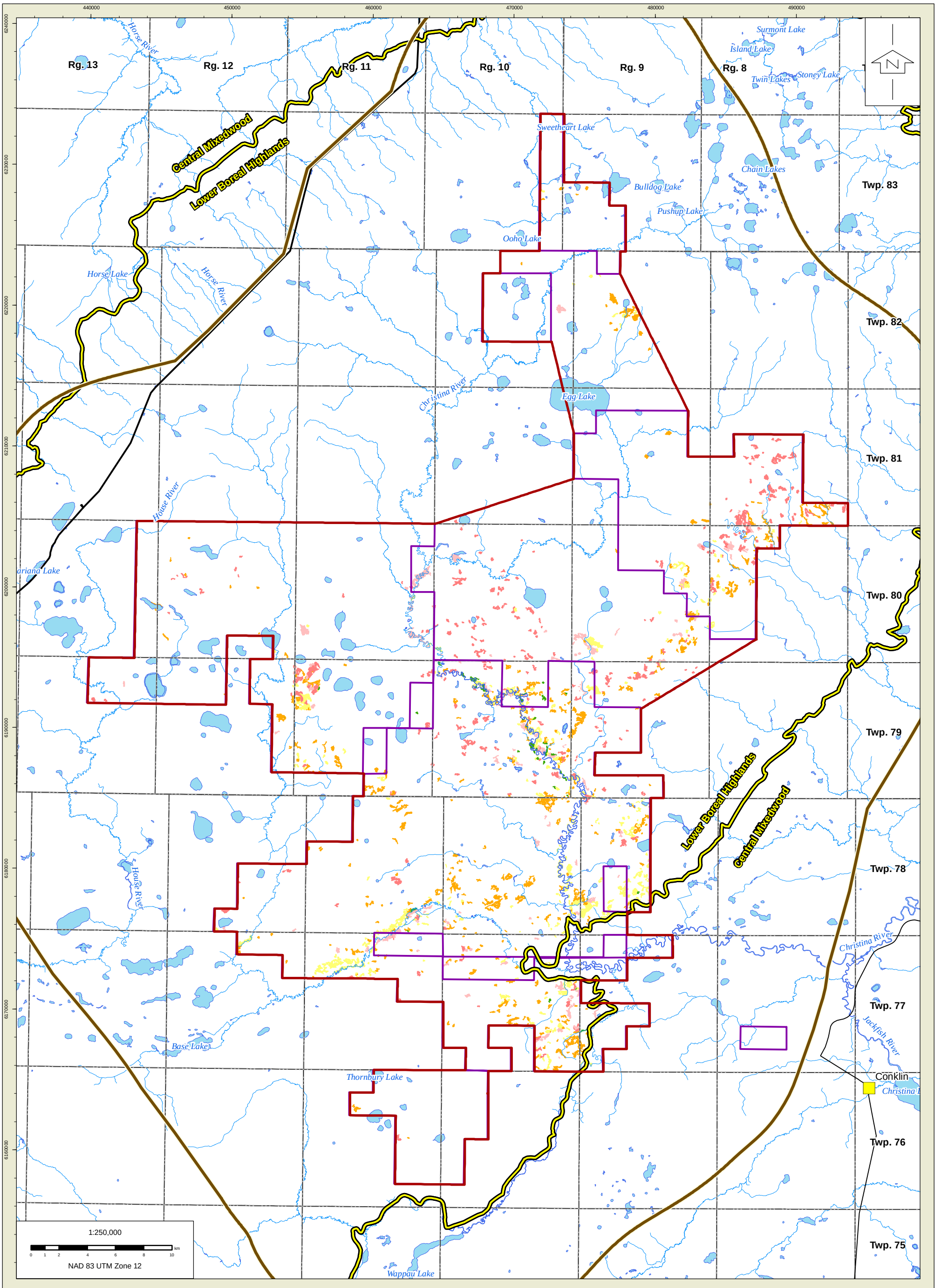
ECOSITE PHASES
IN THE LOCAL STUDY AREA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Phases_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-1c



Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosites of Limited Distribution

- b2, Lower Boreal Highlands
- b3, Lower Boreal Highlands
- d3, Lower Boreal Highlands
- e1, Lower Boreal Highlands
- f1, Lower Boreal Highlands

Title:

ECOSITE PHASES OF LIMITED DISTRIBUTION IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosites_Limited_LSA.mxd

Drawn by:	Checked:	Fig. No.:
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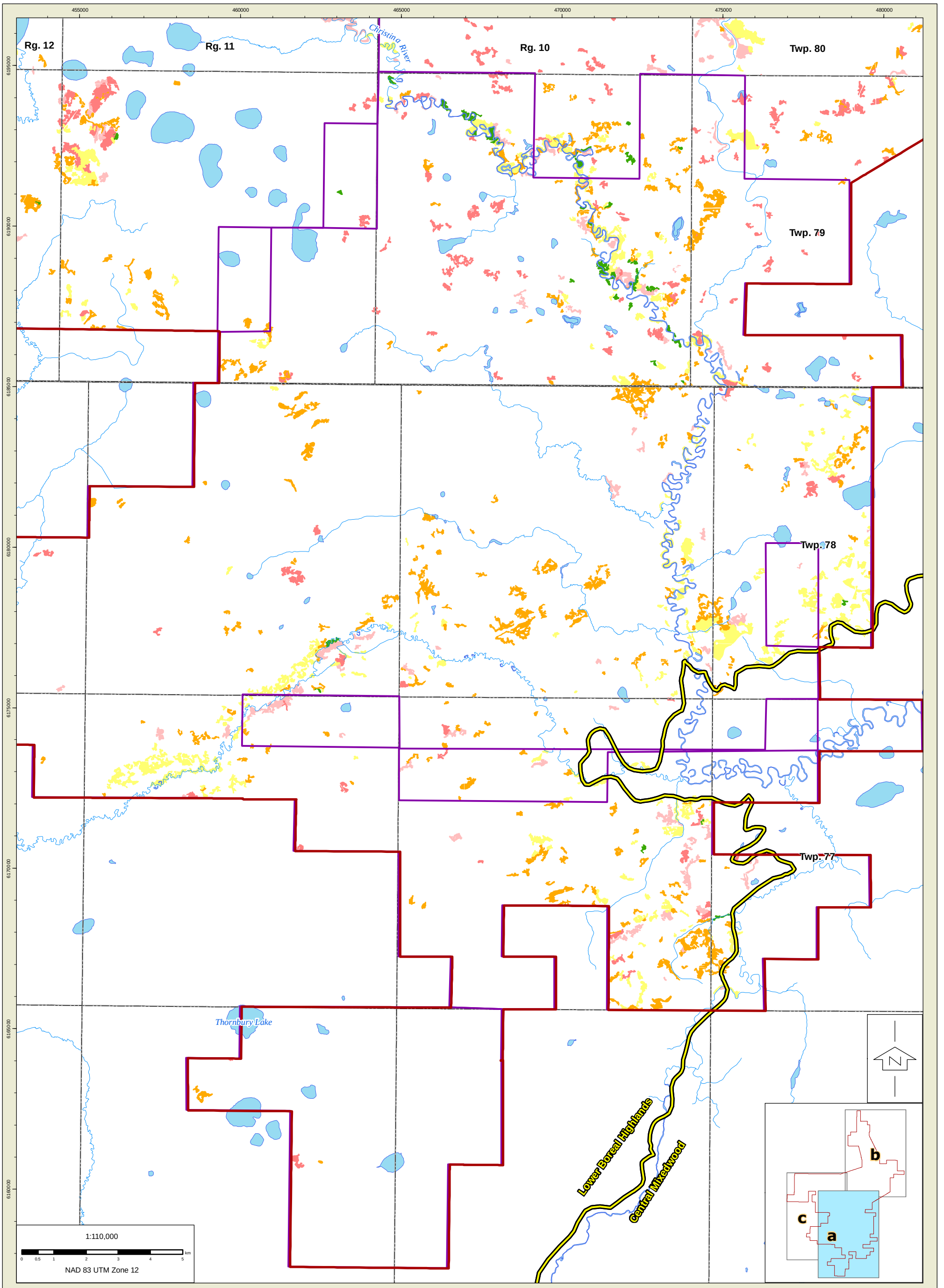

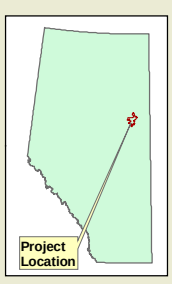

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosites of Limited Distribution

- b2, Lower Boreal Highlands
- b3, Lower Boreal Highlands
- d3, Lower Boreal Highlands
- e1, Lower Boreal Highlands
- f1, Lower Boreal Highlands

Title:

ECOSITE PHASES OF LIMITED DISTRIBUTION IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosites_Limited_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-2a

470000 475000 480000 485000 490000

6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000

Rg. 10 Rg. 9 Rg. 8

Twp. 83

Twp. 82

Twp. 81

Sweetheart Lake

Bulldog Lake

Chain Lakes

Christina River

Pushup Lake

Hangingstone Creek

Ooho Lake

Egg Lake

Lower Boreal Highlands

b

c

a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosites of Limited Distribution

- b2, Lower Boreal Highlands
- b3, Lower Boreal Highlands
- d3, Lower Boreal Highlands
- e1, Lower Boreal Highlands
- f1, Lower Boreal Highlands

Title:

ECOSITE PHASES OF LIMITED DISTRIBUTION IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosites_Limited_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-2b

440000 445000 450000 455000 460000 465000

6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

Twp. 80

Twp. 79

Twp. 78

Twp. 77

Twp. 76

House River

House River

House River

House River

Christina River

Base Lake

Thornbury Lake

Lower Boreal Highlands

N

b

c

a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

North American Vegetation RSA

North American Vegetation LSA

North American Lease

Major Road (Hwy. 63)

Road (881)

Rivers

Lake

Twp. Rg. Lines

Ecosites of Limited Distribution

b2, Lower Boreal Highlands

b3, Lower Boreal Highlands

d3, Lower Boreal Highlands

e1, Lower Boreal Highlands

f1, Lower Boreal Highlands

Title:

ECOSITE PHASES OF LIMITED DISTRIBUTION IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosites_Limited_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
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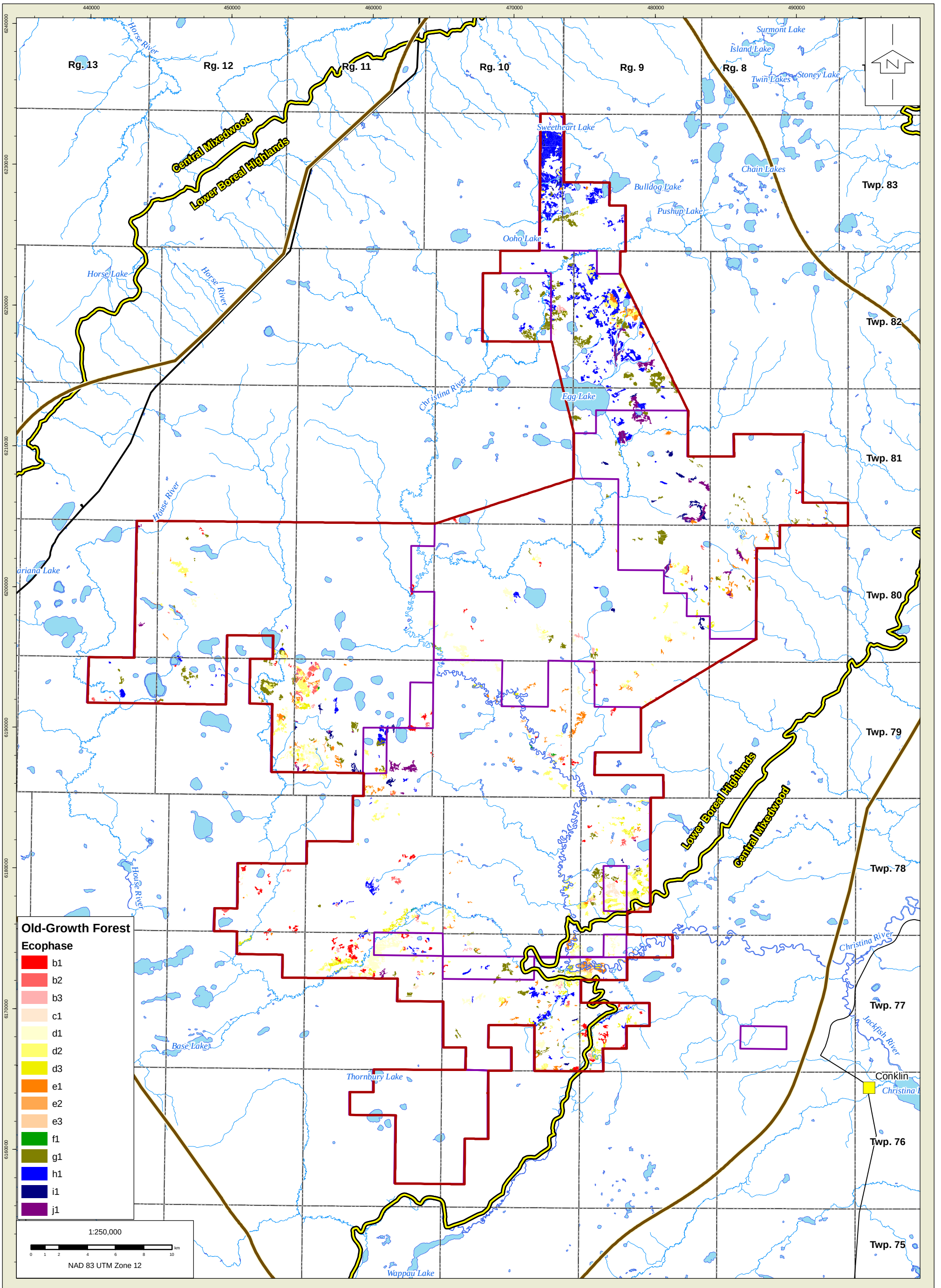
440000
450000
460000
470000
480000
490000
6240000
6230000
6220000
6210000
6200000
6190000
6180000
6170000
6160000
Rg. 13
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Twp. 83
Twp. 82
Twp. 81
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
Twp. 75
Central Mixedwood
Lower Boreal Highlands
Horse River
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
Jackfish River
Base Lake
Thornbury Lake
Wappau Lake
Conklin
N
Old-Growth Forest
Ecophase
b1
b2
b3
c1
d1
d2
d3
e1
e2
e3
f1
g1
h1
i1
j1
1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Title:
OLD-GROWTH FOREST IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: June 11, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Old-Growth_LSA.mxd
Drawn by: TG
Checked: LM
Fig. No.: 10.5-3

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

Old-Growth Forest

Ecophase

- b1
- b2
- b3
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- g1
- h1
- i1
- j1

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

N

b c a

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

OLD-GROWTH FOREST IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Old-Growth_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
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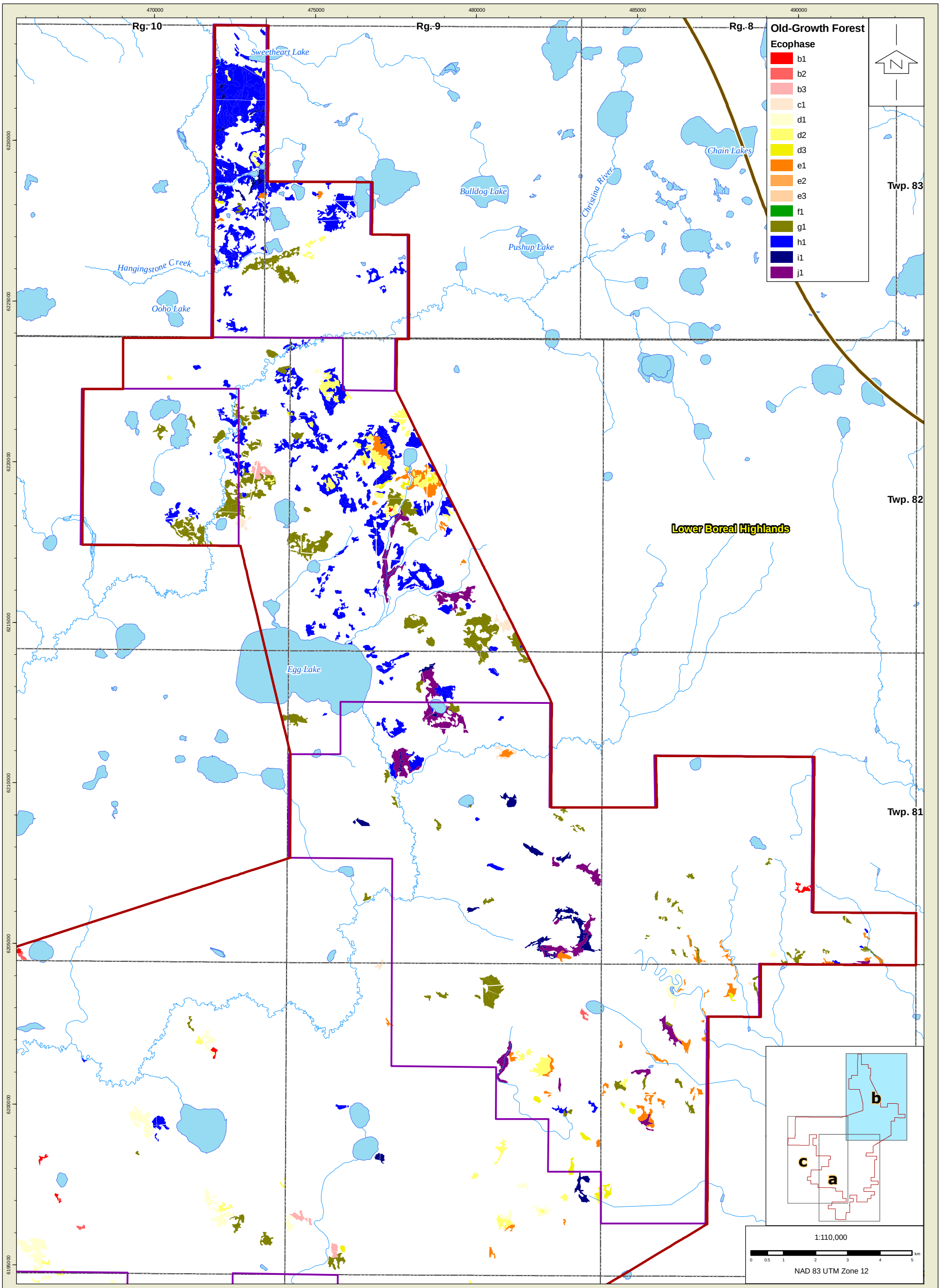


Title:

OLD-GROWTH FOREST IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Old-Growth_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-3b

Rg. 13
Rg. 12
Rg. 11
Twp
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
House River
Christina River
Lower Boreal Highlands
Base Lake
Thornbury Lake
440000
445000
450000
455000
460000
465000
6200000
6195000
6190000
6185000
6180000
6175000
6170000

Old-Growth Forest
Ecophase
- b1
- b2
- b3
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- g1
- h1
- i1
- j1

b
c
a

1:110,000
0 0.5 1 2 3 4 5 km
NAD 83 UTM Zone 12

Project Location

Legend
- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

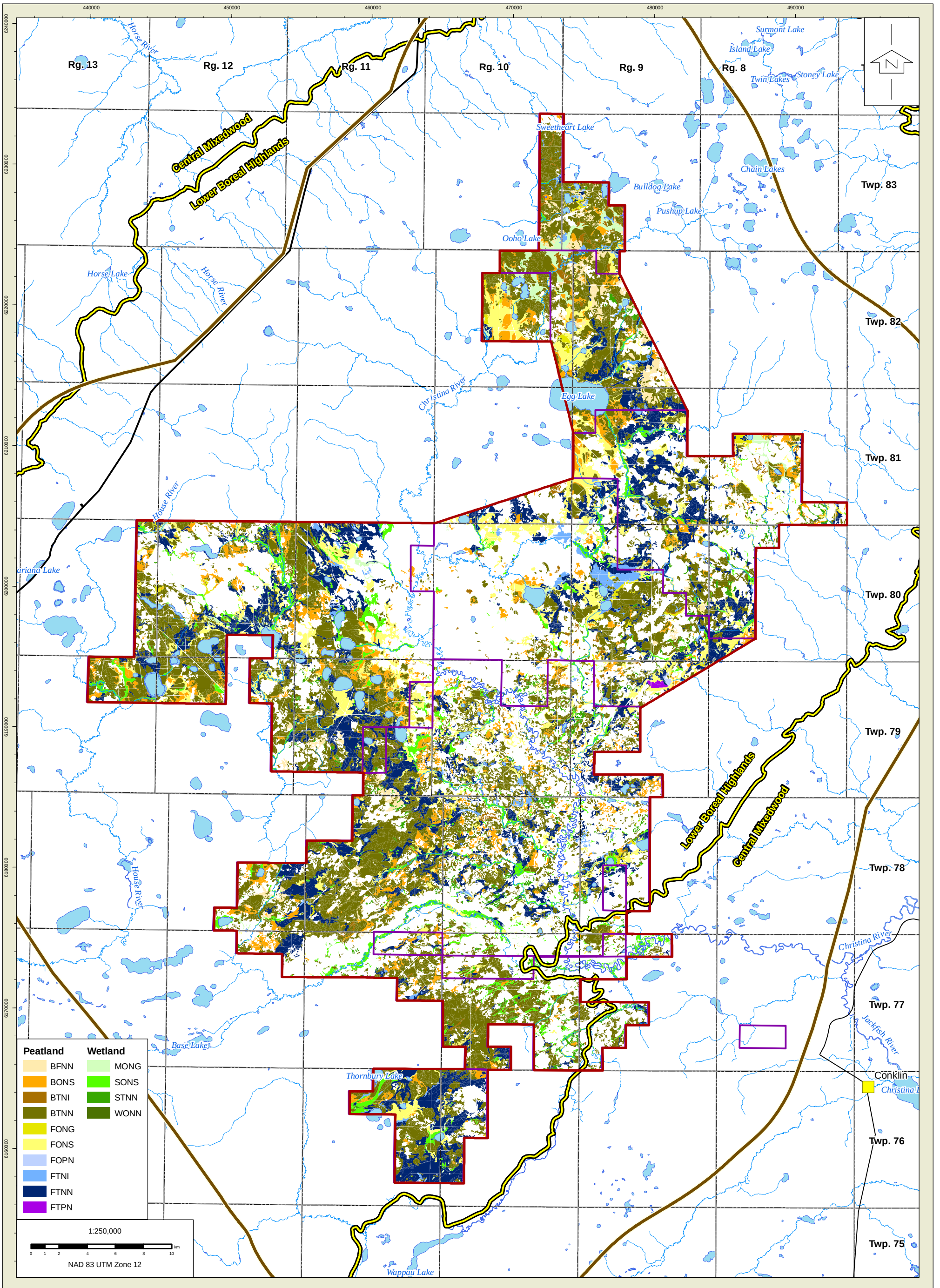
OLD-GROWTH FOREST IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Old-Growth_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-3c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470000
480000
490000
6240000
6230000
6220000
6210000
6200000
6190000
6180000
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6160000
Rg. 13
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Twp. 83
Twp. 82
Twp. 81
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
Twp. 75
Central Mixedwood
Lower Boreal Highlands
Horse River
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
Jackfish River
Conklin
Base Lake
Thornbury Lake
Wappau Lake
Peatland
BFNN
BONS
BTNI
BTNN
FONG
FONS
FOPN
FTNI
FTNN
FTPN
Wetland
MONG
SONS
STNN
WONN
1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Title:
ALBERTA WETLAND INVENTORY CLASSES AND PEATLANDS IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: June 11, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\AWI_WL_PL_LSA.mxd
Drawn by: TG
Checked: LM
Fig. No.: 10.5-4

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

Peatland

- BFNN
- BONS
- BTNI
- BTNN
- FONG
- FONS
- FOPN
- FTNI
- FTNN
- FTPN

Wetland

- MONG
- SONS
- STNN
- WONN

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

N

a b c

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

ALBERTA WETLAND INVENTORY CLASSES AND PEATLANDS IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\AWI_WL_PL_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
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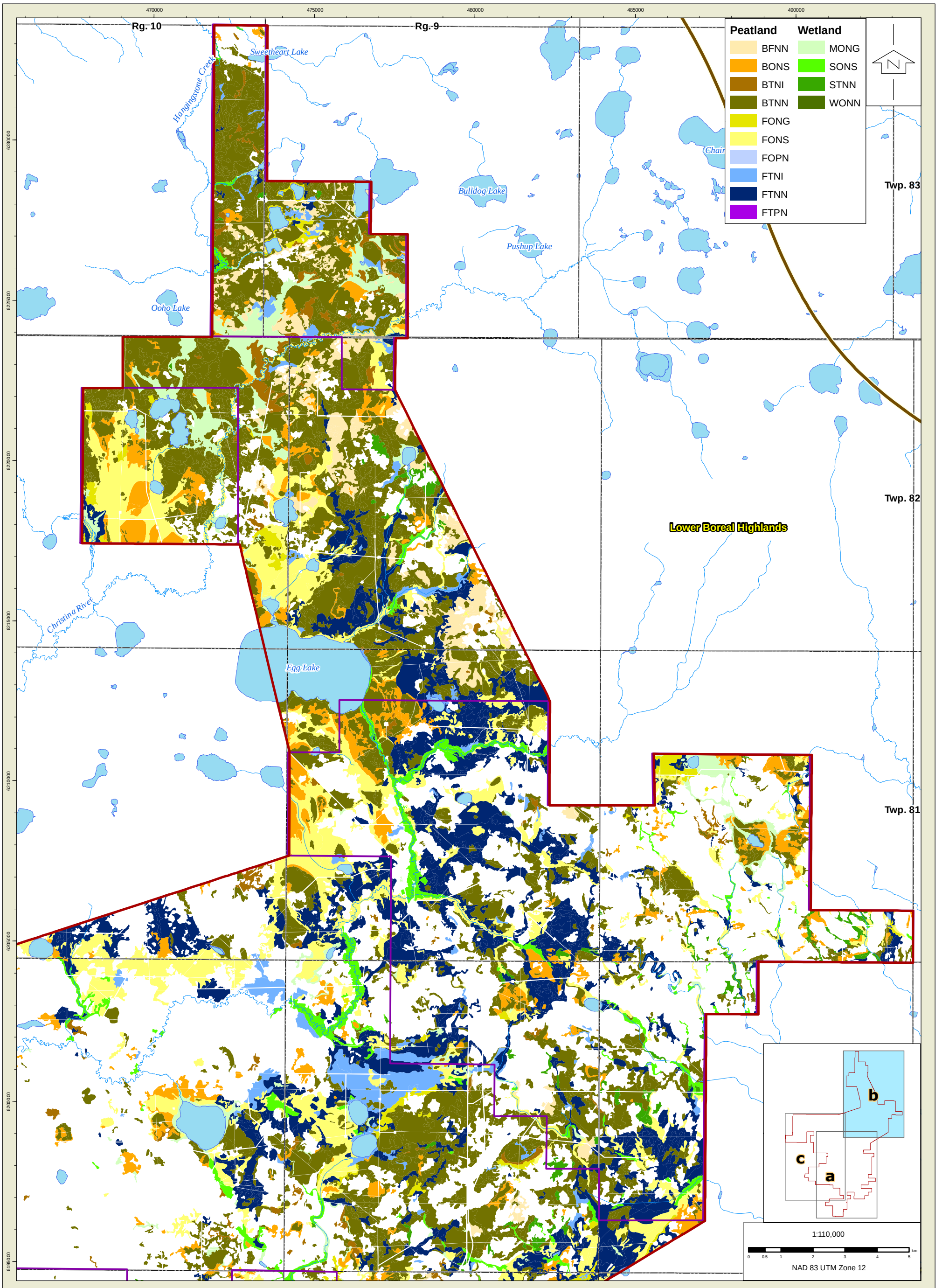

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

ALBERTA WETLAND INVENTORY CLASSES AND PEATLANDS IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\AWI_WL_PL_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-4b

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6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

Twp. 80

Twp. 79

Twp. 78

Twp. 77

Twp. 76

House River

House River

House River

Christina River

Lower Boreal Highlands

Base Lake

Thornbury Lake

N

Peatland

- BFNN
- BONS
- BTNI
- BTNN
- FONG
- FONS
- FOPN
- FTNI
- FTNN
- FTPN

Wetland

- MONG
- SONS
- STNN
- WONN

a b c

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

ALBERTA WETLAND INVENTORY CLASSES AND PEATLANDS IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\AWI_WL_PL_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-4c

440000 450000 460000 470000 480000 490000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000

Rg. 13 Rg. 12 Rg. 11 Rg. 10 Rg. 9 Rg. 8

Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75

Central Mixedwood
Lower Boreal Highlands

Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Christina River
Pushup Lake
Ooho Lake
Horse River
Horse Lake
Egg Lake
House River
ariana Lake
Base Lake
Thornbury Lake
Jackfish River
Conklin
Christina L
Wappau Lake

1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosite Phase Wetlands

h1 h2 i1 i2 j1 j2 j3 k1 k2 k3

Title:

ECOSITE PHASE WETLANDS IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Wetlands_LSA

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-5

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

a b c

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosite Phase Wetlands

h1 h2 i1 i2 j1 j2 j3 k1 k2 k3

Title:

ECOSITE PHASE WETLANDS IN THE LSA

North American Oil Sands Corporation

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Wetlands_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
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6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000

Rg. 10 Rg. 9 Rg. 8

Twp. 83 Twp. 82 Twp. 81

Sweetheart Lake
Bulldog Lake
Chain Lakes
Christina River
Pushup Lake
Hangingstone Creek
Ooho Lake
Egg Lake
Lower Boreal Highlands

N

b c a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Ecosite Phase Wetlands

h1 h2 i1 i2 j1 j2 j3 k1 k2 k3

Title:

ECOSITE PHASE WETLANDS IN THE LSA

North American Oil Sands Corporation

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Wetlands_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
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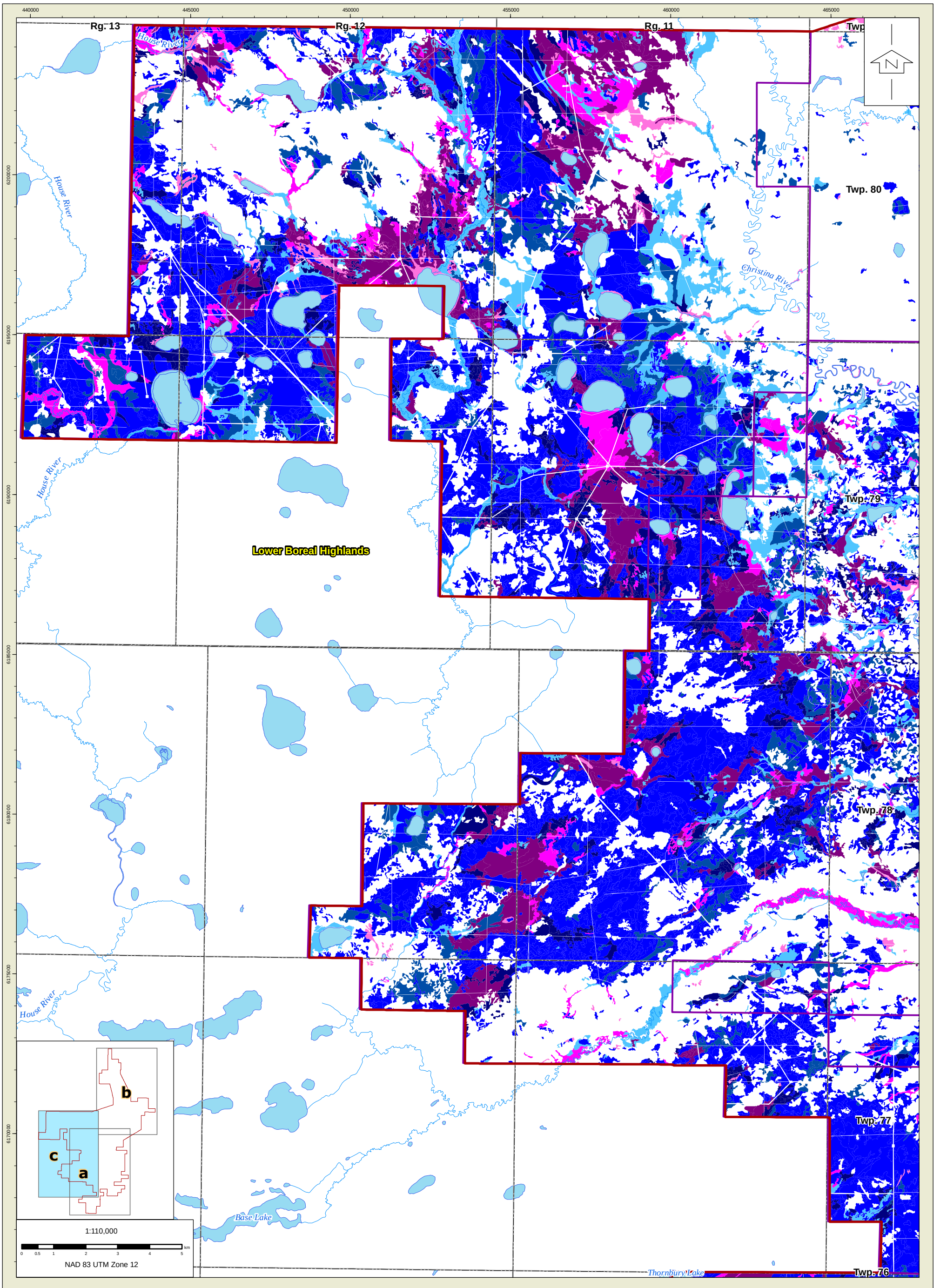


Title:

ECOSITE PHASE WETLANDS IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ecosite_Wetlands_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-5c

Ground Cover Classes

- Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)
- Closed Aspen, Balsam Poplar and/or Birch
- Closed Coniferous and Deciduous Cover (40-60%)
- Closed Pine
- Closed Se/Sw
- Closed Upland Shrub
- Cloud / Haze
- Exposed Soil
- Graminoid (grasses/sedges/forbs) dominated burn
- Graminoid (grasses/sedges/forbs) dominated clear-cut
- Graminoid Wetlands (sedges/grasses/forbs) (<6% tree cover) (<25% shrub)
- Lake, pond, reservoir, river and stream
- Major roads, highway and railways
- Mixed Grassland
- New Burn
- Open Pine
- Rock, Talus, and/or Avalanche Chute
- Shadow
- Shrubby Wetlands (willow and birch)
- Tree/shrub dominated burn
- Undifferentiated burn

430000 440000 450000 460000 470000 480000 490000 500000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000 6150000

Rg. 11 Rg. 10 Rg. 9 Rg. 8 Rg. 7

Twp. 84 Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75 Twp. 74

Central Mixedwood
Lower Boreal Highlands
Lower Boreal Highlands
Central Mixedwood

Hangingstone Creek
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Horse River
Christina River
Egg Lake
House River
Mariana Lake
House River
Base Lake
Thornbury Lake
Christina River
Jackfish River
Conklin
Christina Lake
Caribou Lake
Wappau Lake
Steepbank Lake
Little Fish Lake
Goodwin Lake
Rat Lake
Wiau Lake
Edwards Lake
Glover Lake

Crazy Lake
Kinosis La
51 Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake

1:300,000

0 1 2 4 6 8 10 12 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

DISTRIBUTION OF GROUND COVER CLASSES IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ground_Cover_RSA.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-6

430000 435000 440000 445000 450000 455000 460000 465000 470000 475000 480000 485000 490000 495000

6180000 6175000 6170000 6165000 6160000 6155000 6150000

Rg. 14 Rg. 13 Rg. 12 Rg. 11 Rg. 10 Rg. 9 Rg. 8

Twp. 78 Twp. 77 Twp. 76

Base Lake Thornbury Lake Wappau Lake Steepbank Lake Little Fish Lake Edwards Lake Glover Lake Christina Lak

Conklin

Lower Boreal Highlands Central Mixedwood

a b c

Ground Cover Classes

- Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)
- Closed Aspen, Balsam Poplar and/or Birch
- Closed Coniferous and Deciduous Cover (40-60%)
- Closed Pine
- Closed Se/Sw
- Closed Upland Shrub
- Cloud / Haze
- Exposed Soil
- Graminoid (grasses/sedges/forbs) dominated burn
- Graminoid (grasses/sedges/forbs) dominated clear-cut
- Graminoid Wetlands (sedges/grasses/forbs) (<6% tree cover) (<25% shrub)
- Lake, pond, reservoir, river and stream
- Major roads, highway and railways
- Mixed Grassland
- New Burn
- Open Pine
- Rock, Talus, and/or Avalanche Chute
- Shadow
- Shrubby Wetlands (willow and birch)
- Tree/shrub dominated burn
- Undifferentiated burn

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

1:175,000

0 1 2 4 6 8 km

NAD 83 UTM Zone 12

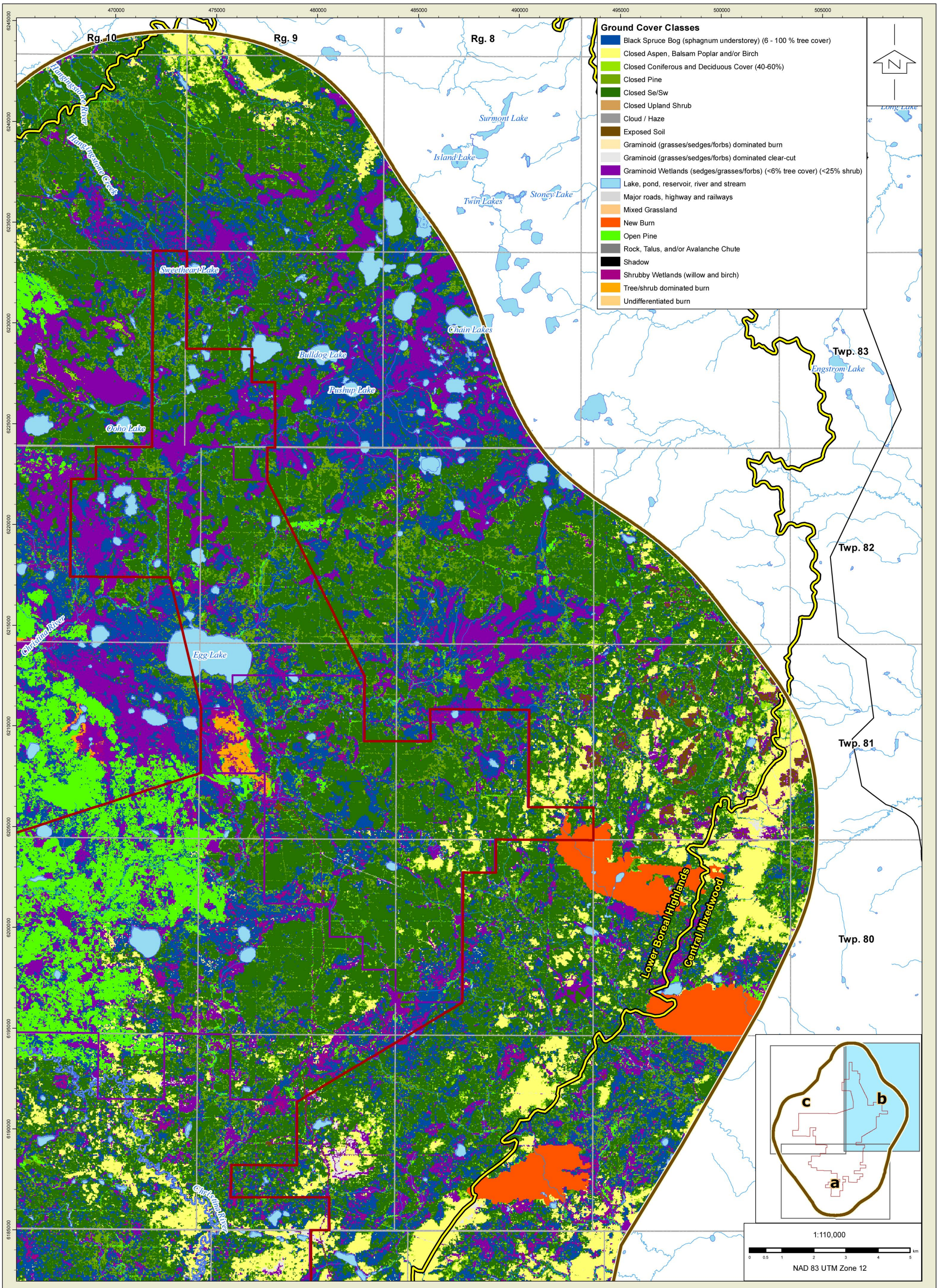
N

Title:

DISTRIBUTION OF GROUND COVER CLASSES IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved: LM/PB	Revision Date: June 11, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ground_Cover_RSA_A.mxd	
Drawn by: TG	Checked: LM
	Fig. No.: 10.5-6a



Title:

DISTRIBUTION OF GROUND COVER CLASSES IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ground_Cover_RSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-6b

Ground Cover Classes

- Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)
- Closed Aspen, Balsam Poplar and/or Birch
- Closed Coniferous and Deciduous Cover (40-60%)
- Closed Pine
- Closed Se/Sw
- Closed Upland Shrub
- Cloud / Haze
- Exposed Soil
- Graminoid (grasses/sedges/forbs) dominated burn
- Graminoid (grasses/sedges/forbs) dominated clear-cut
- Graminoid Wetlands (sedges/grasses/forbs) (<6% tree cover) (<25% shrub)
- Lake, pond, reservoir, river and stream
- Major roads, highway and railways
- Mixed Grassland
- New Burn
- Open Pine
- Rock, Talus, and/or Avalanche Chute
- Shadow
- Shrubby Wetlands (willow and birch)
- Tree/shrub dominated burn
- Undifferentiated burn

430000 435000 440000 445000 450000 455000 460000 465000 470000

6245000 6240000 6235000 6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000 6190000 6185000

Rg. 12 Rg. 11

Twp. 85 Twp. 84 Twp. 83 Twp. 82 Twp. 81 Twp. 80

Hanging stone River Hanging stone Creek

Central Mixedwood Lower Boreal Highlands

Ooho Lake Horse Lake Horse River Christina River Egg L Mariana Lake House River Crow Lake

N

c b a

1:175,000

0 1 2 4 6 8 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

DISTRIBUTION OF GROUND COVER CLASSES IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Ground_Cover_RSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-6c

Rare Plant Habitat Potential

Very Low	Low	Moderate	High
a1, BM	b1, BM	d3, BM	j1, BM
b4, BM	b3, BM	i1, BM	j2, BM
c1, BM	d1, BM	k3, BM	k1, BM
e2, BM	d2, BM	d3, LBH	k2, BM
f1, BM	e1, BM	h1, LBH	i1, LBH
f2, BM	e3, BM	j1, LBH	i2, LBH
f3, BM	g1, BM	j3, LBH	j2, LBH
h1, BM	i2, BM	NWL, BM	
a1, LBH	Shrubland, BM	AIH, BM	
b2, LBH	b1, LBH	CIW, BM	
b3, LBH	d1, LBH	BU_Regen, LBH	
c1, LBH	d2, LBH	NWL, LBH	
e1, LBH	g1, LBH	AIG, LBH	
f1, LBH	h2, LBH	AIH, LBH	
	Shrubland, LBH	AII, LBH	
		CIP, LBH	
		CIW, LBH	

440000 450000 460000 470000 480000 490000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000

Rg. 10 Rg. 9 Rg. 8

Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75

Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
House River
ariana Lake
House River
Base Lake
Thornbury Lake
Wappau Lake
Jackfish River
Christina River
Conklin

Lower Boreal Highlands
Central Mixedwood

1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

POTENTIAL RARE PLANT HABITAT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Potential_RarePlant_Habitat_LSA.mxd

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TG	LM	10.5-7

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Christina River

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

Rare Plant Habitat Potential

Very Low	Moderate	Moderate	High
a1, BM	d3, BM	AIG, LBH	j1, BM
b4, BM	i1, BM	AIH, LBH	j2, BM
c1, BM	k3, BM	AII, LBH	k1, BM
e2, BM	d3, LBH	CIP, LBH	k2, BM
f1, BM	h1, LBH	CIW, LBH	i1, LBH
f2, BM	j1, LBH		i2, LBH
f3, BM	j3, LBH		j2, LBH
h1, BM	NWL, BM		
a1, LBH	AIH, BM		
b2, LBH	CIW, BM		
b3, LBH	BU_Regen, LBH		
c1, LBH	NWL, LBH		
e1, LBH	AIG, LBH		
f1, LBH	AIH, LBH		
Low	AII, LBH		
b1, BM	CIP, LBH		
b3, BM	CIW, LBH		
d1, BM	**High**		
d2, BM	j1, BM		
e1, BM	j2, BM		
e3, BM	k1, BM		
g1, BM	k2, BM		
i2, BM	i1, LBH		
Shrubland, BM	i2, LBH		
b1, LBH	j2, LBH		
d1, LBH			
d2, LBH			
g1, LBH			
h2, LBH			
Shrubland, LBH			

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

a b c

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

POTENTIAL RARE PLANT HABITAT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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Drawn by:	Checked:	Fig. No.:
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470000 475000 480000 485000 490000

6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000

Rg. 10 Rg. 9

Sweetheart Lake

Bulldog Lake

Pushup L

Hangingstone Creek

Ooho Lake

Egg Lake

Twp. 83

Twp. 82

Twp. 81

Lower Boreal Highlands

Rare Plant Habitat Potential

Very Low	Low	Moderate	High
a1, BM	b1, BM	d3, BM	j1, BM
b4, BM	b3, BM	i1, BM	j2, BM
c1, BM	d1, BM	k3, BM	k1, BM
e2, BM	d2, BM	d3, LBH	k2, BM
f1, BM	e1, BM	h1, LBH	i1, LBH
f2, BM	e3, BM	j1, LBH	i2, LBH
f3, BM	g1, BM	j3, LBH	j2, LBH
h1, BM	i2, BM	NWL, BM	
a1, LBH	Shrubland, BM	AIH, BM	
b2, LBH	b1, LBH	CIW, BM	
b3, LBH	d1, LBH	BU_Regen, LBH	
c1, LBH	d2, LBH	NWL, LBH	
e1, LBH	g1, LBH	AIG, LBH	
f1, LBH	h2, LBH	AIH, LBH	
	Shrubland, LBH	AII, LBH	
		CIP, LBH	
		CIW, LBH	

b c a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

POTENTIAL RARE PLANT HABITAT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

House River

House River

House River

Christina River

Twp. 80

Twp. 79

Twp. 78

Twp. 77

Twp. 76

Lower Boreal Highlands

Base Lake

Thornbury Lake

N

Rare Plant Habitat Potential

Very Low
- a1, BM
- b4, BM
- c1, BM
- e2, BM
- f1, BM
- f2, BM
- f3, BM
- h1, BM
- a1, LBH
- b2, LBH
- b3, LBH
- c1, LBH
- e1, LBH
- f1, LBH

Low
- b1, BM
- b3, BM
- d1, BM
- d2, BM
- e1, BM
- e3, BM
- g1, BM
- i2, BM
- Shrubland, BM
- b1, LBH
- d1, LBH
- d2, LBH
- g1, LBH
- h2, LBH
- Shrubland, LBH

Moderate
- d3, BM
- i1, BM
- k3, BM
- d3, LBH
- h1, LBH
- j1, LBH
- j3, LBH
- NWL, BM
- AIH, BM
- CIW, BM
- BU_Regen, LBH
- NWL, LBH
- AIG, LBH
- AIH, LBH
- AII, LBH
- CIP, LBH
- CIW, LBH

High
- j1, BM
- j2, BM
- k1, BM
- k2, BM
- i1, LBH
- i2, LBH
- j2, LBH

b

c

a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

POTENTIAL RARE PLANT HABITAT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

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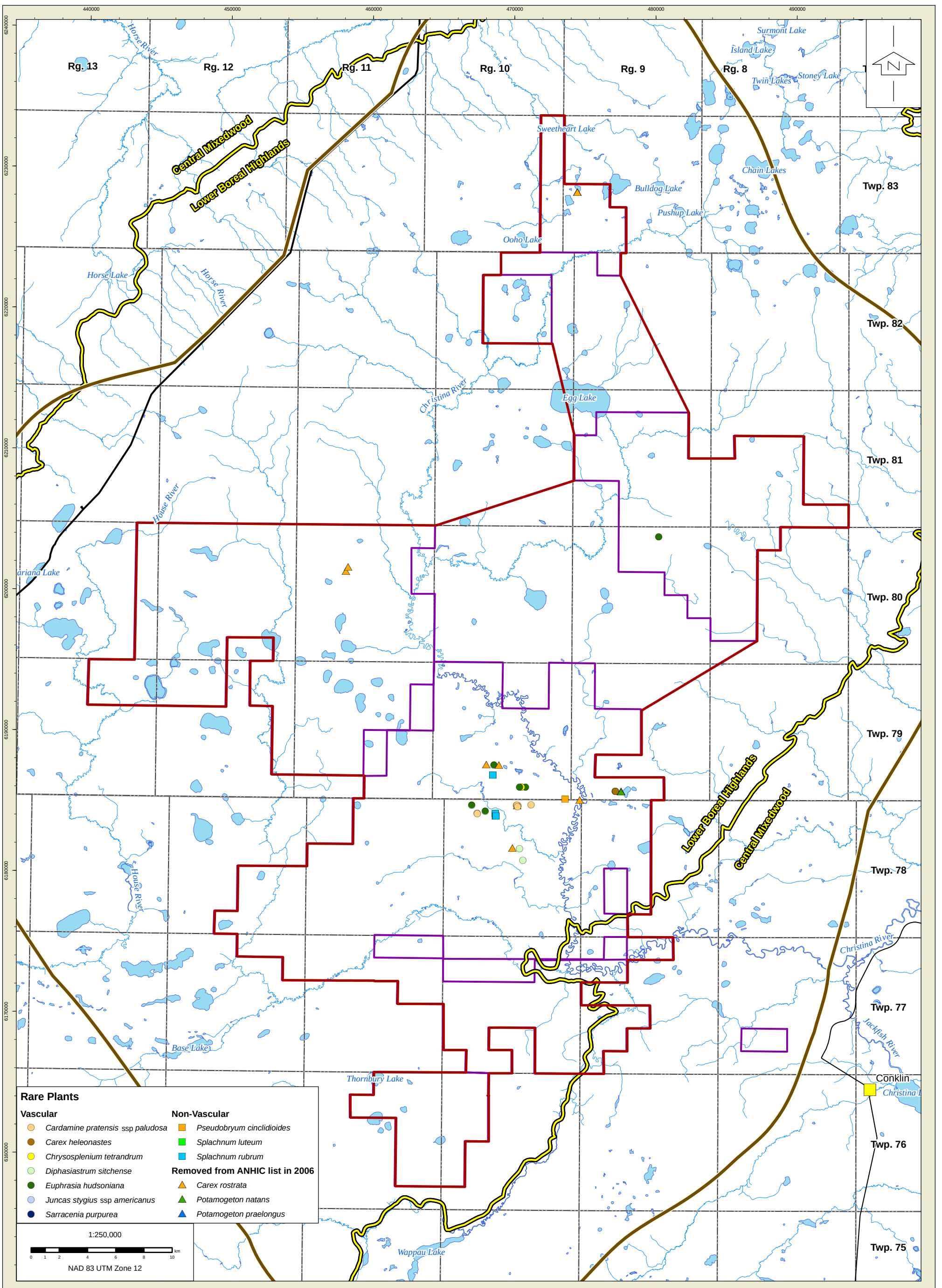
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6160000
Rg. 13
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Twp. 83
Twp. 82
Twp. 81
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
Twp. 75
Central Mixedwood
Lower Boreal Highlands
Horse River
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
Jackfish River
Base Lake
Thornbury Lake
Wappau Lake
Conklin
N
Rare Plants
Vascular
Cardamine pratensis ssp paludosa
Carex heleonastes
Chrysosplenium tetrandrum
Diphasiastrum sitchense
Euphrasia hudsoniana
Juncas stygius ssp americanus
Sarracenia purpurea
Non-Vascular
Pseudobryum cinclidioides
Splachnum luteum
Splachnum rubrum
Removed from ANHIC list in 2006
Carex rostrata
Potamogeton natans
Potamogeton praelongus
1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Title:
RARE PLANTS OBSERVED IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: July 3, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Rare_Plants_LSA.mxd
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Checked: LM
Fig. No.: 10.5-8

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10 Twp. 80 Twp. 79 Twp. 78 Twp. 77

Christina River

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

Rare Plants

Vascular

- *Cardamine pratensis* ssp *paludosa*
- *Carex heleonastes*
- *Chrysosplenium tetrandrum*
- *Diphasiastrum sitchense*
- *Euphrasia hudsoniana*
- *Juncas stygius* ssp *americanus*
- *Sarracenia purpurea*

Non-Vascular

- *Pseudobryum cinclidioides*
- *Splachnum luteum*
- *Splachnum rubrum*

Removed from ANHIC list in 2006

- *Carex rostrata*
- *Potamogeton natans*
- *Potamogeton praelongus*

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

N

a b c

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

RAREPLANTS OBSERVED IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 3, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Rare_Plants_LSA_A.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-8a

470000 475000 480000 485000 490000

Rg. 10 Rg. 9

Twp. 83 Twp. 82 Twp. 81

Lower Boreal Highlands

Sweetheart Lake
Hangingstone Creek
Bulldog Lake
Pushup Lake
Ooho Lake
Christina River
Egg Lake

6230000 6225000 6220000 6215000 6210000 6205000 6200000 6195000

Rare Plants

Vascular

- *Cardamine pratensis* ssp *paludosa*
- *Carex heleonastes*
- *Chrysosplenium tetrandrum*
- *Diphasiastrum sitchense*
- *Euphrasia hudsoniana*
- *Juncas stygius* ssp *americanus*
- *Sarracenia purpurea*

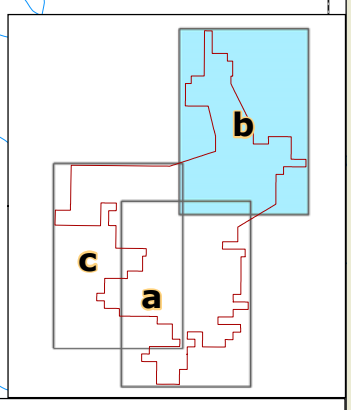
Non-Vascular

- *Pseudobryum cinclidioides*
- *Splachnum luteum*
- *Splachnum rubrum*

Removed from ANHIC list in 2006

- *Carex rostrata*
- *Potamogeton natans*
- *Potamogeton praelongus*

N



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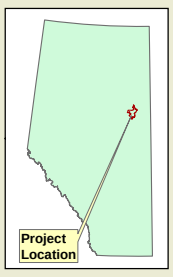
0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12



Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

RAREPLANTS OBSERVED IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 3, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Rare_Plants_LSA_B.mxd

Drawn by:	Checked:	Fig. No.:
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6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

N

Twp. 80

Twp. 79

Twp. 78

Twp. 77

Twp. 76

House River

House River

House River

House River

Christina River

Thornbury Lake

Lower Boreal Highlands

b

c

a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Rare Plants

Vascular

- *Cardamine pratensis* ssp *paludosa*
- *Carex heleonastes*
- *Chrysosplenium tetrandrum*
- *Diphasiastrum sitchense*
- *Euphrasia hudsoniana*
- *Juncas stygius* ssp *americanus*
- *Sarracenia purpurea*

Non-Vascular

- *Pseudobryum cinclidioides*
- *Splachnum luteum*
- *Splachnum rubrum*

Removed from ANHIC list in 2006

- *Carex rostrata*
- *Potamogeton natans*
- *Potamogeton praelongus*

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

RAREPLANTS OBSERVED IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 3, 2007

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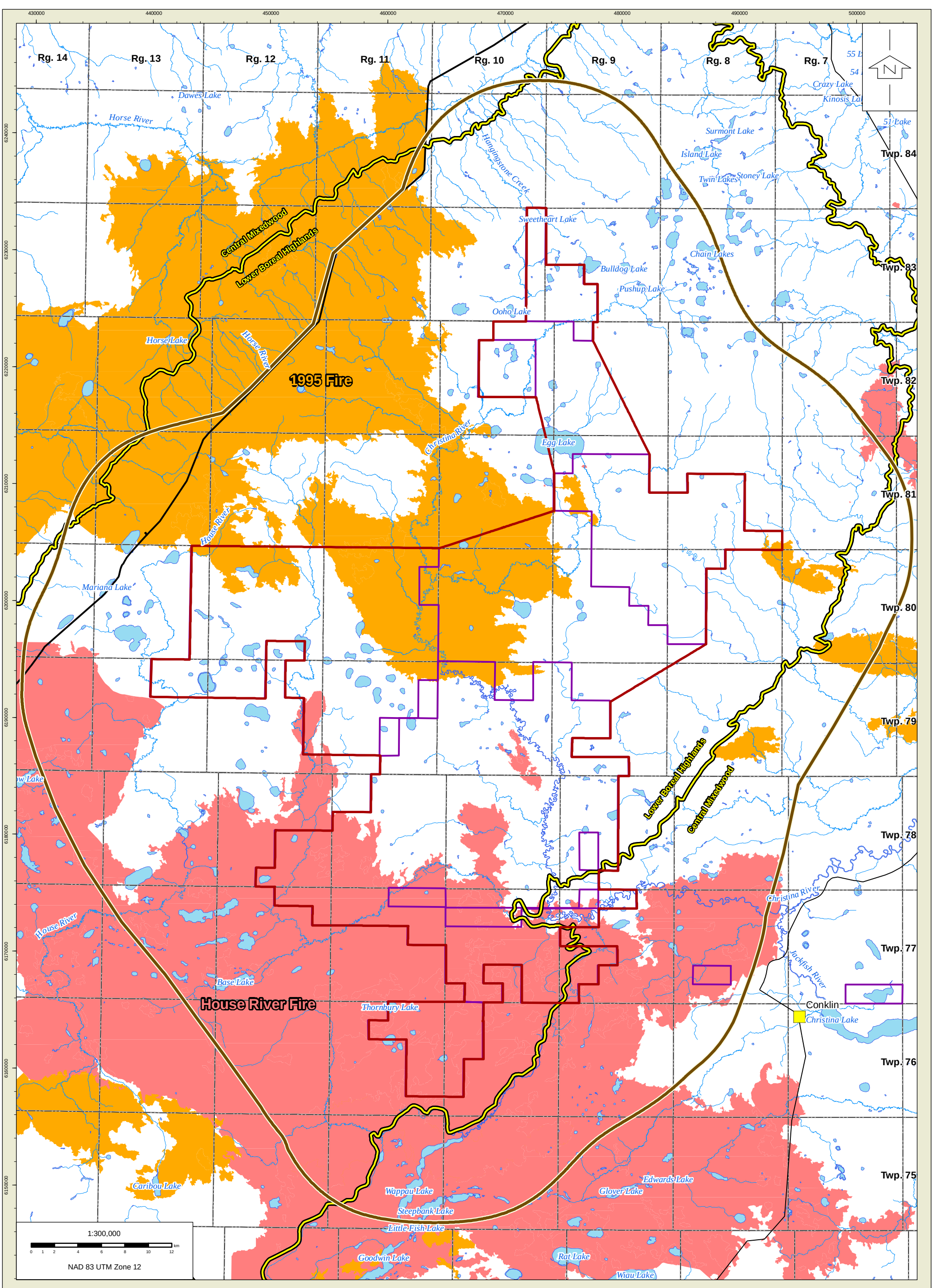

Title:

RECENT BURNS IN THE LSA AND RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\RecentBurns_LSA_RSA.mxd

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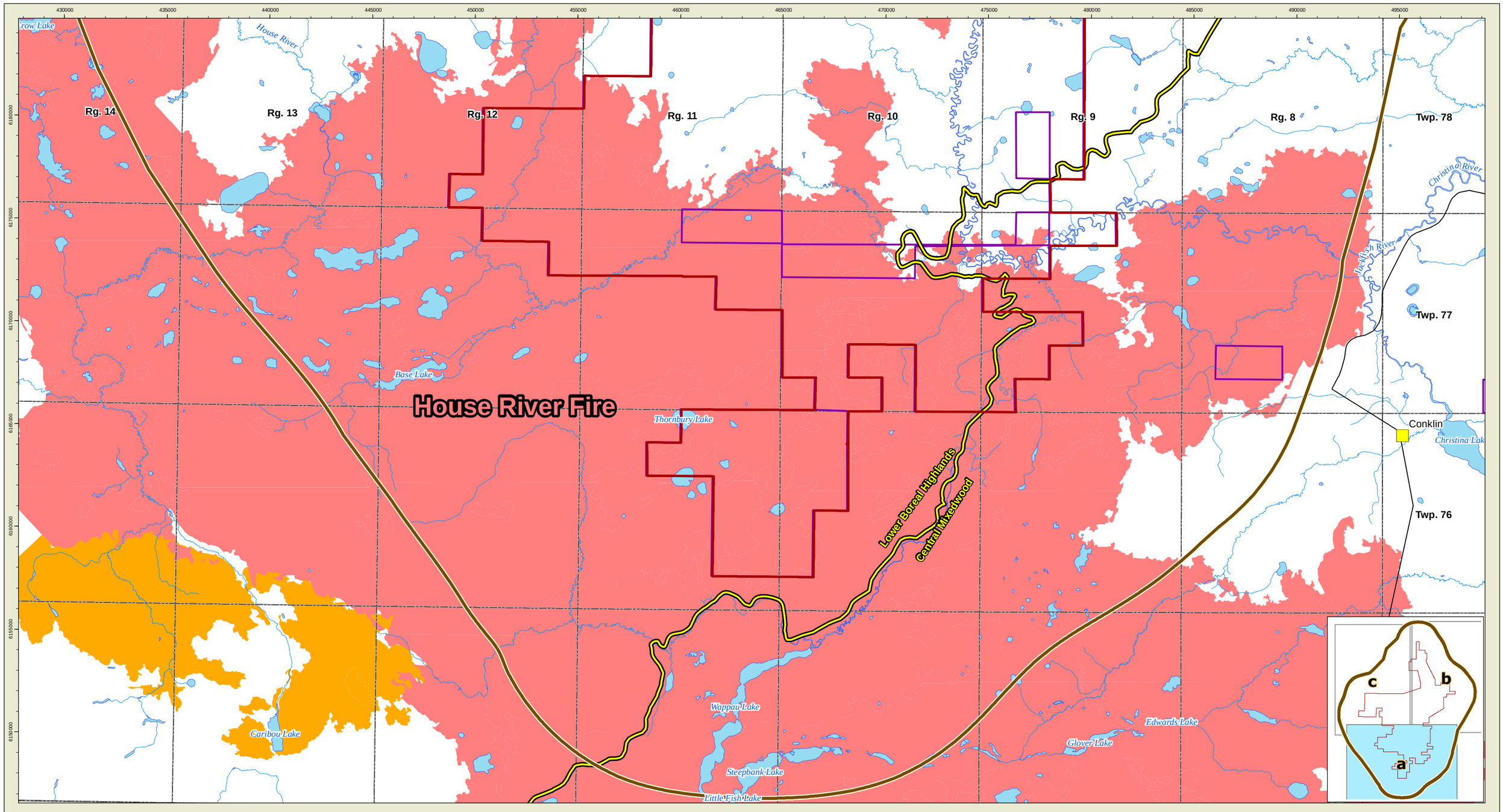

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines
- Historical Fires 1990 to 1999
- Historical Fires 2000 to 2005

1:175,000

0 1 2 4 6 8 km

NAD 83 UTM Zone 12

N

Title:

RECENT BURNS IN THE LSA AND RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\RecentBurns_LSA_RSA_A.mxd

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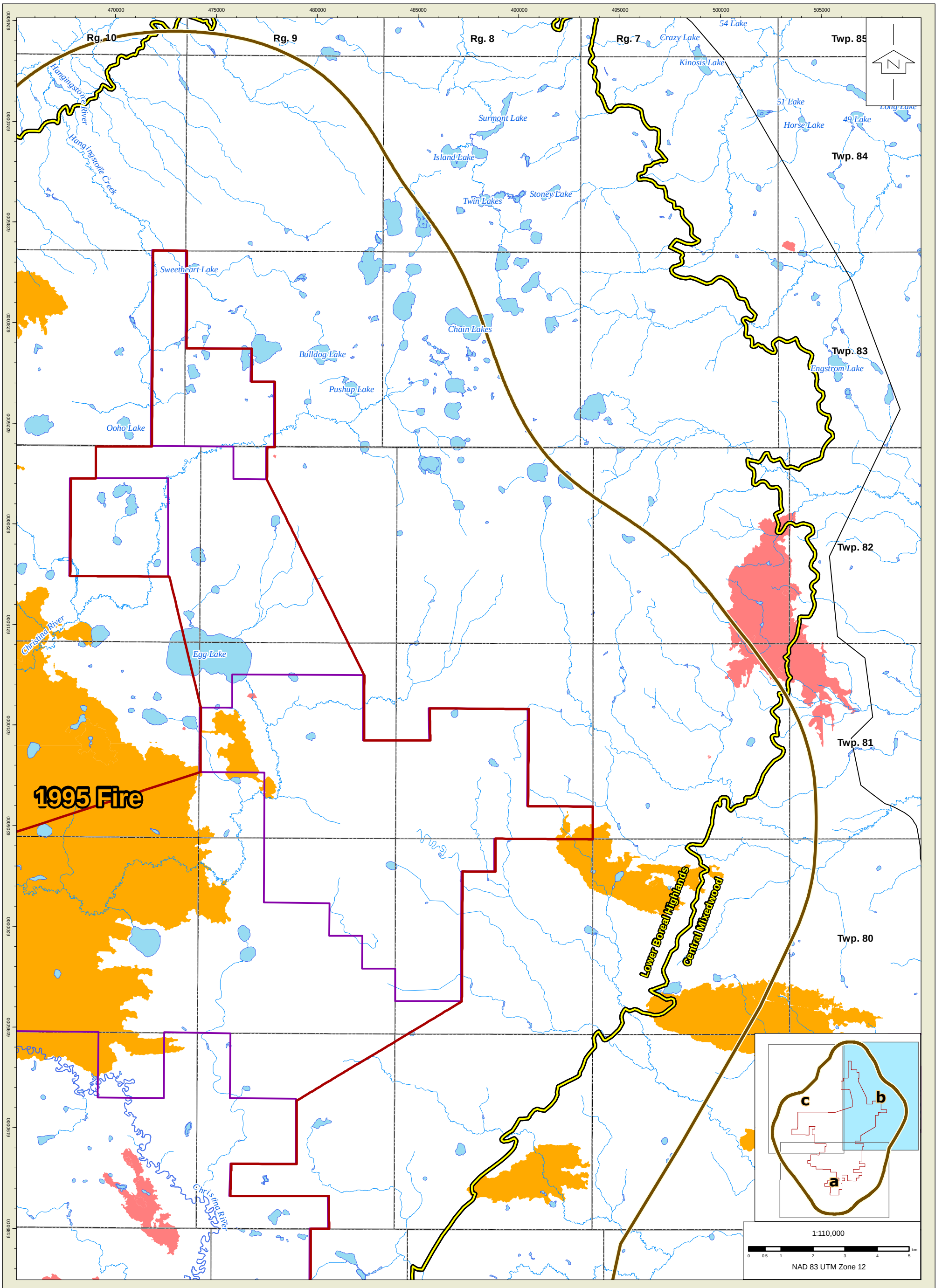
Rg. 10
Rg. 9
Rg. 8
Rg. 7
Twp. 85
Twp. 84
Twp. 83
Twp. 82
Twp. 81
Twp. 80
54 Lake
Crazy Lake
Kinosis Lake
51 Lake
Long Lake
Horse Lake
49 Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Hangingstone River
Hangingstone Creek
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Engstrom Lake
Christina River
Egg Lake
1995 Fire
Lower Boreal Highlands
Central Mixedwood
a
b
c
1:110,000
0 0.5 1 2 3 4 5 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Historical Fires 1990 to 1999
Historical Fires 2000 to 2005
Title:
RECENT BURNS IN THE LSA AND RSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: June 11, 2007
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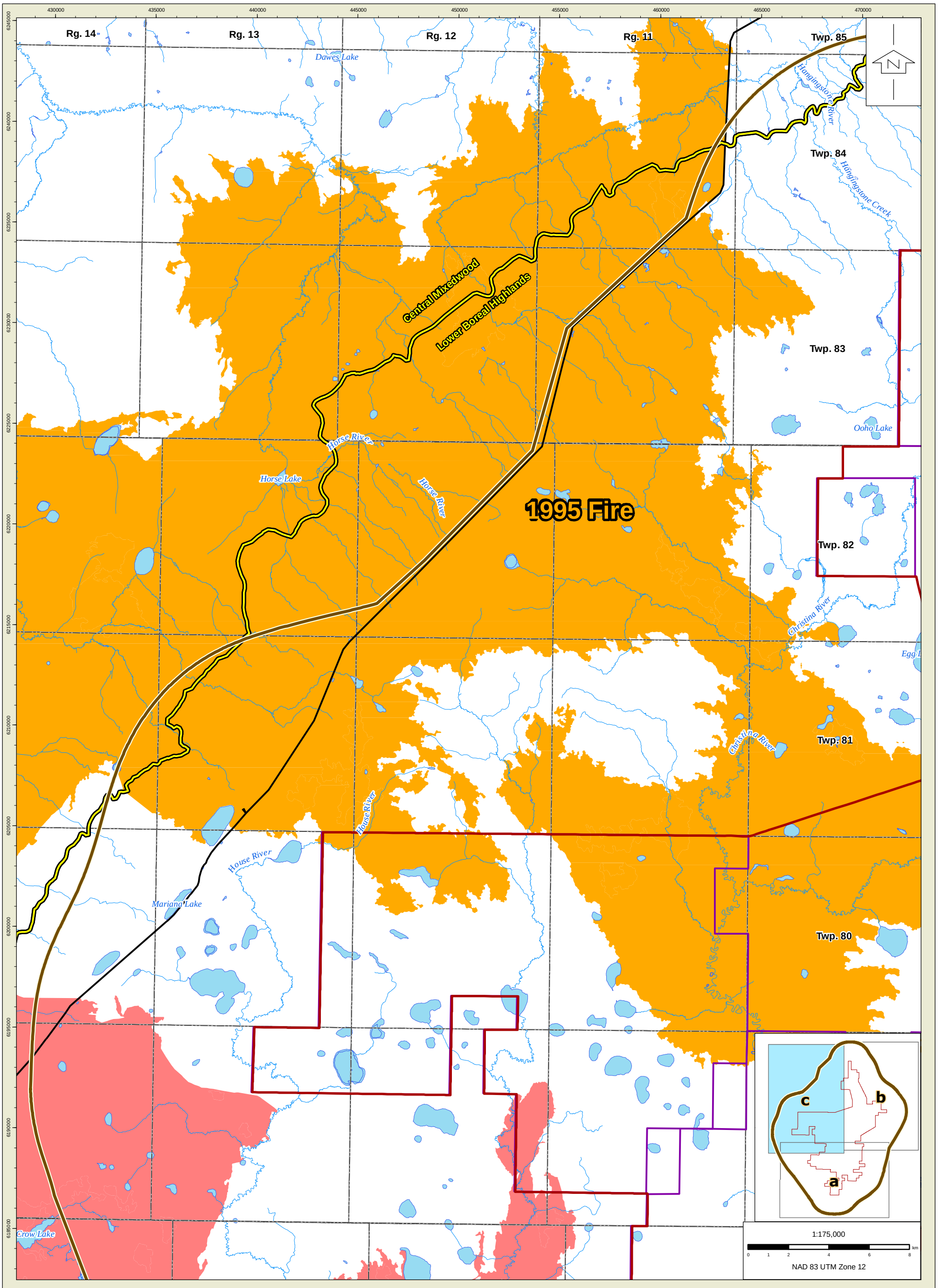


Title:

RECENT BURNS IN THE LSA AND RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	June 11, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\RecentBurns_LSA_RSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.5-9c

10.6 Impact Assessment and Mitigative Measures

Development of the Project will include construction of CPF hubs, well pads, access roads and utility corridors for power lines and pipelines, all of which will require removal of vegetation. This direct loss of vegetation will impact ecological units, predominantly within the Lower Boreal Highlands Subregion. The footprint will require the removal of vegetation from 2,854 ha (or 2.0% of the LSA) within the Lower Boreal Highlands and 3 ha (or <0.1% of the LSA) within the Central Mixedwood Subregion. Removal of vegetation due to construction activities for Project development is summarized for ecosite phases and disturbance units in the LSA in Table 10.6-1 and is presented graphically in Figures 10.6-1 and 10.6-1a to 10.6-1c. The area of the footprint in relation to the RSA is shown in Figures 10.6-2 and 10.6-2a to 10.6-2c.

Table 10.6-1 Impact of the Kai Kos Dehseh Project on Ecosite Phases and Wetlands by Natural Subregion in the LSA

	Baseline Scenario						Footprint						Application Scenario					
	Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA		Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA		Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA	
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA
Upland Ecosite Phase																		
a1	9	0.0	2477	1.7			0	0.0	65	0.0			9	0.0	2412	1.7		
b1	109	0.1	3994	2.7			0	0.0	157	0.1			109	0.1	3837	2.6		
b2	0	0.0	962	0.7			0	0.0	62	0.0			0	0.0	900	0.6		
b3	27	0.0	626	0.4			1	0.0	14	0.0			26	0.0	612	0.4		
b4	24	0.0	N/A	N/A			0	0.0	N/A	N/A			24	0.0	N/A	N/A		
c1	58	0.0	11540	7.9			0	0.0	362	0.2			58	0.0	11178	7.7		
d1	477	0.3	7852	5.4			0	0.0	232	0.2			477	0.3	7620	5.2		
d2	287	0.2	3185	2.2			0	0.0	42	0.0			287	0.2	3143	2.2		
d3	111	0.1	1142	0.8	N/A		0	0.0	10	0.0	N/A		111	0.1	1133	0.8	N/A	
e1	311	0.2	1343	0.9			1	0.0	26	0.0			310	0.2	1317	0.9		
e2	77	0.1	N/A	N/A			0	0.0	N/A	N/A			77	0.1	N/A	N/A		
e3	19	0.0	N/A	N/A			0	0.0	N/A	N/A			19	0.0	N/A	N/A		
f1	4	0.0	86	0.1			0	0.0	1	0.0			4	0.0	84	0.1		
f2	8	0.0	N/A	N/A			0	0.0	N/A	N/A			8	0.0	N/A	N/A		
f3	2	0.0	N/A	N/A			0	0.0	N/A	N/A			2	0.0	N/A	N/A		
g1	83	0.1	14151	9.7			0	0.0	309	0.2			83	0.1	13842	9.5		
h1	96	0.1	N/A	N/A			0	0.0	N/A	N/A			96	0.1	N/A	N/A		
Terrestrial Subtotal	***1701***	***1.2***	***47358***	***32.6***	***49060***	***33.8***	***2***	***0.0***	***1279***	***0.9***	***1281***	***0.9***	***1699***	***1.2***	***46079***	***31.7***	***47779***	***32.9***
Wetland/Peatland Ecosite Phase																		
h1	N/A	N/A	37516	25.8			N/A	N/A	720	0.5			N/A	N/A	36795	25.3		
h2	N/A	N/A	6198	4.3			N/A	N/A	132	0.1			N/A	N/A	6066	4.2		
i1	548	0.4	7308	5.0			0	0.0	150	0.1			548	0.4	7157	4.9		
i2	36	0.0	7210	5.0			0	0.0	90	0.1			36	0.0	7120	4.9		
j1	41	0.0	10688	7.4			0	0.0	112	0.1			41	0.0	10576	7.3		
j2	109	0.1	4360	3.0	N/A		0	0.0	41	0.0	N/A		109	0.1	4320	3.0	N/A	
j3	N/A	N/A	3647	2.5			N/A	N/A	42	0.0			N/A	N/A	3604	2.5		
k1	15	0.0	N/A	N/A			0	0.0	N/A	N/A			15	0.0	N/A	N/A		
k2	204	0.1	N/A	N/A			0	0.0	N/A	N/A			204	0.1	N/A	N/A		
k3	62	0.0	N/A	N/A			0	0.0	N/A	N/A			62	0.0	N/A	N/A		
l1	0	0.0	N/A	N/A			0	0.0	N/A	N/A			0	0.0	N/A	N/A		
Wetland Subtotal	***1015***	***0.7***	***76927***	***52.9***	***77942***	***53.6***	***0***	***0.0***	***1287***	***0.9***	***1288***	***0.9***	***1015***	***0.7***	***75639***	***52.0***	***76654***	***52.7***
Other																		
Burn	0	0.0	8388	5.8	8388	5.8	0	0.0	29	0.0	29	0.0	0	0.0	8359	5.8	8359	5.8
Burn Clearcut	0	0.0	38	0.0	38	0.0	0	0.0	0	0.0	0	0.0	0	0.0	38	0.0	38	0.0
Burn Regen	0	0.0	1100	0.8	1100	0.8	0	0.0	20	0.0	20	0.0	0	0.0	1081	0.7	1081	0.7
Meadow	1	0.0	35	0.0	36	0.0	0	0.0	0	0.0	0	0.0	1	0.0	35	0.0	36	0.0
NMC (Cutbank)	1	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0
Shrubland	1	0.0	41	0.0	42	0.0	0	0.0	0	0.0	0	0.0	1	0.0	41	0.0	42	0.0
Other Subtotal	***2***	***0.0***	***9602***	***6.6***	***9604***	***6.6***	***0***	***0.0***	***49***	***0.0***	***49***	***0.0***	***2***	***0.0***	***9553***	***6.6***	***9556***	***6.6***
Water																		
NWF (Flooded)	10	0.0	276	0.2	287	0.2	0	0.0	2	0.0	2	0.0	10	0.0	275	0.2	285	0.2
NWL (Lake)	25	0.0	2991	2.1	3016	2.1	0	0.0	0	0.0	0	0.0	25	0.0	2991	2.1	3016	2.1
NWR (River)	72	0.0	320	0.2	392	0.3	0	0.0	5	0.0	5	0.0	72	0.0	315	0.2	387	0.3
Water Subtotal	***107***	***0.1***	***3588***	***2.5***	***3694***	***2.5***	***0***	***0.0***	***6***	***0.0***	***6***	***0.0***	***107***	***0.1***	***3581***	***2.5***	***3688***	***2.5***
Disturbance																		
AIG (Gravel/Borrow Pit)	26	0.0	5	0.0	31	0.0	0	0.0	0	0.0	0	0.0	0	0.0	16	0.0	16	0.0
AIH (Roads)	0	0.0	1608	1.1	1608	1.1	0	0.0	74	0.1	74	0.1	29	0.0	2441	1.7	2469	1.7
AII (Industrial Sites)	0	0.0	19	0.0	19	0.0	0	0.0	1	0.0	1	0.0	0	0.0	643	0.4	643	0.4
CC (Clearcut)	392	0.3	1149	0.8	1541	1.1	0	0.0	23	0.0	23	0.0	392	0.3	1126	0.8	1518	1.0
CIP (Pipelines)	27	0.0	1481	1.0	1507	1.0	0	0.0	115	0.1	115	0.1	27	0.0	1772	1.2	1799	1.2
CIW (Wellsites)	9	0.0	284	0.2	293	0.2	0	0.0	18	0.0	18	0.0	9	0.0	1171	0.8	1180	0.8
CL (Clearing)	0	0.0	49	0.0	49	0.0	0	0.0	1	0.0	1	0.0	0	0.0	48	0.0	48	0.0
CP (Reclaimed to grass)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Disturbance Subtotal	***454***	***0.3***	***4594***	***3.2***	***5049***	***3.5***	***0***	***0.0***	***232***	***0.2***	***232***	***0.2***	***457***	***0.3***	***7216***	***5.0***	***7673***	***5.3***
Total	**3280**	**2.3**	**142069**	**97.7**	***145349***	**100.0**	**3**	**0.0**	**2854**	**2.0**	**2856**	**2.0**	**3280**	**2.3**	**142069**	**97.7**	***145349***	**100.0**

10.6.1 Ecological Land Units

Terrestrial vegetation accounted for 33.8% of the LSA (49,060 ha). Project development will require the removal of 1,281 ha of terrestrial vegetation, or 0.9% of the LSA. The ecosite phase c1 (Labrador tea-mesic, jack pine, black spruce) is associated with the largest area of vegetation removal, with an area of 362 ha, or 0.2% of the LSA. Ecosite phases with comparable areas of vegetation removal (0.2% of the LSA) are g1 (Labrador tea-hygric, jack pine, black spruce) and d1 (aspen, low-bush cranberry).

Wetlands comprised 53.6% (77,942 ha) of the LSA. Within the footprint of the Project there are 1,288 ha of wetlands, representing 1.7% of the total wetland area or 0.9% of the LSA.

Terrestrial ecosite phases will be reclaimed to equivalent pre-disturbance conditions. Reclamation of existing disturbance areas within the project footprint may result in slight increases of upland ecosite phase. Further, clearcuts within the footprint will be reclaimed to a d1 (aspen, low-bush cranberry) ecosite phase.

Portions of disturbed wetlands will be reclaimed to equivalent wetland ecosite phases, upland ecosite phase g1, and a “transitional g1” ecosite phase. Pipelines and power lines will be reclaimed to pre-disturbance wetland ecosite phases, whereas access roads will be reclaimed to a g1 ecosite phase. Well sites and CPFs on peatlands will have portions reclaimed to upland (g1) and a “transitional g1” ecosite phase. Further discussion is presented in the Conservation and Reclamation section (Volume 1, Section 6).

The extent of wetlands will decrease following reclamation while the extent of upland terrestrial vegetation will increase, as portions of Project components occurring on wetland sites will be reclaimed to upland g1 and to “transitional-g1” ecosite phases. Thus, after closure and reclamation, areas of upland ecosite phase g1 will increase by 196 ha and areas of “transitional g1” ecosite phase will increase by 650 ha. In total, upland terrestrial ecosite phases increase by 931 ha or 1.9% (0.6% of LSA) after closure and reclamation. Correspondingly, wetlands will have a 705 ha or 0.9% (0.5% of LSA) decrease following reclamation and will represent 77,237 ha or 53.1% of the LSA (Table 10.6-2). It is predicted that the re-establishment of forest vegetation will take many years, particularly for old-growth and late successional stages. Bogs and poor fens will require time, beyond the life span of the Project, to return to conditions equivalent to pre-disturbance.

Figures 10.6-3 and 10.6-3a to 10.6-3c show the ELC closure scenario in the LSA. The distribution of AGCC cover classes in the RSA at closure is shown in Figures 10.6-4 and 10.6-4a to 10.6-4c.

Table 10.6-2 Comparison of Baseline and Closure Scenarios for Ecosite Phases and Disturbance Areas by Natural Subregion in the LSA

	Baseline Scenario						Closure Scenario						Change to Resource		
	Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA		Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA		Central Mixedwood Subregion	Lower Boreal Highlands Subregion	LSA
Upland Ecosite Phase	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**% Change to Resource***		
a1	9	0.0	2477	1.7			9	0.0	2484	1.7			0.0	0.3	
b1	109	0.1	3994	2.7			109	0.1	4004	2.8			0.0	0.2	
b2	0	0.0	962	0.7			0	0.0	966	0.7			N/A	0.4	
b3	27	0.0	626	0.4			27	0.0	628	0.4			0.0	0.2	
b4	24	0.0	N/A	N/A			24	0.0	N/A	N/A			0.0	N/A	
c1	58	0.0	11540	7.9			58	0.0	11566	8.0			0.0	0.2	
d1	477	0.3	7852	5.4			477	0.3	7884	5.4			0.0	0.4	
d2	287	0.2	3185	2.2			287	0.2	3187	2.2			0.0	0.1	
d3	111	0.1	1142	0.8			111	0.1	1143	0.8			0.0	0.1	
e1	311	0.2	1343	0.9	N/A		311	0.2	1344	0.9	N/A		0.0	0.1	N/A
e2	77	0.1	N/A	N/A			77	0.1	N/A	N/A			0.0	N/A	
e3	19	0.0	N/A	N/A			19	0.0	N/A	N/A			0.0	N/A	
f1	4	0.0	86	0.1			4	0.0	86	0.1			0.0	0.1	
f2	8	0.0	N/A	N/A			8	0.0	N/A	N/A			0.0	N/A	
f3	2	0.0	N/A	N/A			2	0.0	N/A	N/A			0.0	N/A	
g1	83	0.1	14151	9.7			83	0.1	14347	9.9			0.2	1.4	
g1/transition	N/A	N/A	N/A	N/A			0	0.0	650	0.4			N/A	N/A	
h1	96	0.1	N/A	N/A			96	0.1	N/A	N/A			0.0	N/A	
Terrestrial Subtotal	***1701***	***1.2***	***47358***	***32.6***	***49060***	***33.8***	***1702***	***1.2***	***48289***	***33.2***	***49991***	***34.4***	***N/A***	***N/A***	***N/A***
Wetland/Peatland Ecosite Phase															
h1	N/A	N/A	37516	25.8			N/A	N/A	37125	25.5			N/A	-1.0	
h2	N/A	N/A	6198	4.3			N/A	N/A	6117	4.2			N/A	-1.3	
i1	548	0.4	7308	5.0			548	0.4	7222	5.0			0.0	-1.2	
i2	36	0.0	7210	5.0			36	0.0	7164	4.9			0.0	-0.6	
j1	41	0.0	10688	7.4			41	0.0	10633	7.3			0.0	-0.5	
j2	109	0.1	4360	3.0	N/A		109	0.1	4339	3.0	N/A		0.0	-0.5	N/A
j3	N/A	N/A	3647	2.5			N/A	N/A	3622	2.5			N/A	-0.7	
k1	15	0.0	N/A	N/A			15	0.0	N/A	N/A			0.0	N/A	
k2	204	0.1	N/A	N/A			204	0.1	N/A	N/A			0.0	N/A	
k3	62	0.0	N/A	N/A			62	0.0	N/A	N/A			0.0	N/A	
l1	0	0.0	N/A	N/A			0	0.0	N/A	N/A			N/A	N/A	
Wetland Subtotal	***1015***	***0.7***	***76927***	***52.9***	***77942***	***53.6***	***1015***	***0.7***	***76222***	***52.4***	***77237***	***53.1***	***N/A***	***N/A***	***N/A***
Other															
Burn	0	0.0	8388	5.8	8388	5.8	0	0.0	8359	5.8	8359	5.8	N/A	-0.3	-0.3
Burn Clearcut	0	0.0	38	0.0	38	0.0	0	0.0	38	0.0	38	0.0	N/A	0.0	0.0
Burn Regen	0	0.0	1100	0.8	1100	0.8	0	0.0	1134	0.8	1134	0.8	N/A	3.1	3.1
Meadow	1	0.0	35	0.0	36	0.0	1	0.0	35	0.0	36	0.0	0.0	0.0	0.0
NMC (Cutbank)	1	0.0	0	0.0	1	0.0	1	0.0	0	0.0	1	0.0	0.0	N/A	0.0
Shrubland	1	0.0	41	0.0	42	0.0	1	0.0	41	0.0	42	0.0	0.0	0.0	0.0
Other Subtotal	***2***	***0.0***	***9602***	***6.6***	***9604***	***6.6***	***2***	***0.0***	***9607***	***6.6***	***9609***	***6.6***	***N/A***	***N/A***	***N/A***
Water															
NWF (Flooded)	10	0.0	276	0.2	287	0.2	10	0.0	277	0.2	287	0.2	0.0	0.0	0.0
NWL (Lake)	25	0.0	2991	2.1	3016	2.1	25	0.0	2991	2.1	3016	2.1	0.0	0.0	0.0
NWR (River)	72	0.0	320	0.2	392	0.3	72	0.0	320	0.2	392	0.3	0.0	0.0	0.0
Water Subtotal	***107***	***0.1***	***3588***	***2.5***	***3694***	***2.5***	***107***	***0.1***	***3588***	***2.5***	***3694***	***2.5***	***N/A***	***N/A***	***N/A***
Disturbance															
AIG (Gravel/Borrow Pit)	26	0.0	5	0.0	31	0.0	0	0.0	5	0.0	5	0.0	-100.0	0.0	-84.8
AIH (Roads)	0	0.0	1608	1.1	1608	1.1	26	0.0	1535	1.1	1561	1.1	N/A	-4.6	-3.0
AII (Industrial Sites)	0	0.0	19	0.0	19	0.0	0	0.0	18	0.0	18	0.0	N/A	-3.2	-3.2
CC (Clearcut)	392	0.3	1149	0.8	1541	1.1	392	0.3	1126	0.8	1518	1.0	0.0	-2.0	-1.5
CIP (Pipelines)	27	0.0	1481	1.0	1507	1.0	27	0.0	1365	0.9	1392	1.0	0.0	-7.8	-7.6
CIW (Wellsites)	9	0.0	284	0.2	293	0.2	9	0.0	266	0.2	275	0.2	0.0	-6.4	-6.2
CL (Clearing)	0	0.0	49	0.0	49	0.0	0	0.0	49	0.0	49	0.0	N/A	0.1	0.1
CP (Reclaimed to grass)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	N/A	N/A	N/A
Disturbance Subtotal	***454***	***0.3***	***4594***	***3.2***	***5049***	***3.5***	***454***	***0.3***	***4364***	***3.0***	***4818***	***3.3***	***N/A***	***N/A***	***N/A***
Total	**3280**	**2.3**	**142069**	**97.7**	***145349***	**100.0**	**3280**	**2.3**	**142069**	**97.7**	***145349***	**100.0**	***N/A***	***N/A***	***N/A***

*% Change to Resource = ((Area at Closure - Area at Baseline) / Area at Baseline)*100 (Not applicable to cases where baseline area is zero)
Summed totals may differ due to rounding.
N/A - not applicable

Impacts on terrestrial (upland) ecosite phases are rated as positive, regional in extent, negligible in magnitude, of medium term duration, isolated in frequency, reversible in the medium term, with medium confidence. Environmental impact is predicted to be low. Removal of vegetation impacts on wetland ecosite phases are rated as negative, subregional in extent, negligible in magnitude, long-term in duration, isolated in frequency, irreversible, with medium confidence. Environmental impact is low.

Changes in drainage patterns will occur with construction of facilities and operation of the Project. Increases (from impoundment) or decreases in water levels in any given vegetation community can result in changes to structural and functional attributes of that community. Development in wetlands and peatlands will be avoided wherever possible. Where avoidance is not possible, strategic placement of culverts and diversion channels in operational schemes are outlined mitigation options to minimize impacts of possible flooding or impounding. Drainage channels will be re-contoured and re-established at closure. According to the Hydrology section (Volume 3, Section 6), environmental impacts on water level and flow changes from drainage pattern changes are not anticipated.

There will be no anticipated environmental impact to upland ecosite phases. With mitigation measures, potential impacts to wetland ecosite phases from alterations in hydrology are predicted to be neutral, subregional, negligible in magnitude, medium-term in duration, continuous during the life of the Project, and reversible in the medium-term, with medium confidence. Environmental impact is low.

10.6.2 Communities of Limited Distribution

The LSA lies within two natural subregions: the Central Mixedwood Natural Subregion and the Lower Boreal Highlands Natural Subregion. Approximately 97.7% of the LSA falls in the Lower Boreal Highlands Subregion with 2.3% in the Central Mixedwood. The low proportionate representation of the Central Mixedwood Natural Subregion in the LSA skews data analyses for communities of limited distribution, thus only the Lower Boreal Highlands ecosite phases are considered in this assessment.

Communities of limited distribution in the LSA include the b2 (blueberry, aspen), b3 (blueberry, white spruce, jack pine), d3 (low-bush cranberry, white spruce), e1 (fern, white spruce), and f1 (horsetail, white spruce) ecosite phases.

Table 10.6-2 summarizes the extent of these ecosite phases in the LSA and the percent change associated with vegetation removal in the LSA. Within the project footprint, communities of limited distribution account for 112.3 ha or 0.1% of the LSA (Table 10.6-1).

In the Lower Boreal Highlands Natural Subregion, the f1 ecosite phase is uncommon in the LSA having the smallest area of any ecosite phase, at 86 ha or 0.1% of the LSA. The f1 ecosite phase sites are nutrient rich with high water tables that occur along drainage channels or seepage areas. Although reclamation of these sites is possible, Beckingham and Archibald (1996) suggest that removal of trees and vegetation may result in rising water tables, making it difficult for trees to establish. The e1 ecosite phase is also nutrient rich and may occur in seepage areas; however, high water table levels exist for only a portion of the growing season. Beckingham and Archibald (1996) suggest reclamation of e1 ecosite phases may proceed slowly due to the rapid establishment of ground and shrub vegetation cover following disturbance, making it difficult for conifer trees to establish. The remaining ecosite phases of limited distribution occur in upland areas, where these reclamation concerns are not anticipated.

Taking into consideration that it is possible to reclaim b2, b3, d3, e1, and f1 ecosite phases, impacts from removal of vegetation on communities of limited distribution are rated as neutral, subregional in extent, negligible in magnitude, medium-term in duration, isolated, and reversible in the medium-term with medium level of confidence. Overall environmental impact is predicted to be low.

Alterations in hydrology that would reduce water table levels may have a negative impact on ecosite phases with wet soils, such as e1 and f1. According to the Hydrology section (Volume 3, Section 6), environmental impacts on water level and flow changes from drainage pattern changes are not anticipated. As a result; impacts from alterations in hydrology on communities of limited distribution are rated neutral, subregional, negligible in magnitude, continuous in duration over the life of the Project, reversible in the medium-term, with medium confidence. Environmental impact is assessed to be low.

10.6.3 Economic Forests

10.6.3.1 Productive Forests

The project footprint will remove a total of 2,263 ha of forested area (1.6% of the LSA; Table 10.6-3). Of that, 2,049 ha (1.4% of the LSA) is productive forest. Coniferous forests will show the greatest reduction in area (1,528 ha; 1.1% of the LSA). Timber removal will be coordinated under an Integrated Land Management Plan with Al-Pac.

The reclamation plan aims to reclaim sites in upland forested areas to ecosite phases and land uses that will be the same as, or similar to, pre-disturbance conditions. At closure the total area of forested land is expected to be 105,574 ha (72.6% of the LSA). Of this, 93,535 ha (64.4% of the LSA) is considered productive. This represents an increase of 0.7% (614 ha) in productive forests over baseline levels. Coniferous forests are expected to cover an area of 86,887 ha (59.8% of the LSA), of which 74,863 ha (51.5% of the LSA) are considered productive. This represents an increase of 0.4% over baseline levels. Mixedwood forest is expected to cover 10,010 ha (6.9% of the LSA), of which 9,997 ha (6.9% of the LSA) is considered productive. This represents an increase of 0.4% over baseline levels. There is predicted to be 8,676 ha of deciduous forest at closure (6.0% of the LSA), of which 8,675 ha is considered productive (6.0% of the LSA). The amount of non-forested land at closure is predicted to be 31,560 ha (21.7% of the LSA), of which 10,357 ha (7.1% of the LSA) are considered productive. This represents a decrease from baseline levels of 0.2% (20 ha).

Currently, productive land for forestry is assumed to increase, which will result in an impact on timber resources in the LSA that is positive in direction, subregional in extent, negligible in magnitude, medium-term in duration, isolated in frequency and reversible in the medium-term. Reclamation of the central areas of well pads on peatland to upland areas may result in an increase in upland Black spruce stands and an overall loss of wetland forest stands. The overall environmental impact of the Project on productive forests is predicted to be low. Confidence in this assessment is medium, based on the assumed success of reclamation at closure.

Table 10.6-3 Effects of Vegetation Removal on Productive Forests in the LSA

TPR Rating	Coniferous Forest Area (ha)	% LSA	Deciduous Forest Area (ha)	% LSA	Mixedwood Forest Area (ha)	% LSA	Total Forested Area (ha)	% LSA	% Change in Resource	% Change in LSA	Non-forested Area (ha)	% LSA	% Change in Resource	% Change in LSA
Baseline														
Good	9836	6.8	7619	5.2	5461	3.8	22915	15.8	N/A	N/A	193	0.1	N/A	N/A
Medium	48980	33.7	1018	0.7	4250	2.9	54249	37.3	N/A	N/A	6681	4.6	N/A	N/A
Fair	15483	10.7	6	0.0	268	0.2	15757	10.8	N/A	N/A	3462	2.4	N/A	N/A
Total Productive	74299	51.1	8643	5.9	9979	6.9	92921	63.9	N/A	N/A	10337	7.1	N/A	N/A
Unproductive	12239	8.4	2	0.0	14	0.0	12254	8.4	N/A	N/A	21397	14.7	N/A	N/A
All	**86538**	**59.5**	**8644**	**5.9**	**9993**	**6.9**	**105175**	**72.4**			**31734**	**21.8**		
Footprint Area														
Good	220	0.2	175	0.1	104	0.1	499	0.3	N/A	N/A	7	0.0	N/A	N/A
Medium	983	0.7	58	0.0	177	0.1	1219	0.8	N/A	N/A	46	0.0	N/A	N/A
Fair	325	0.2	0	0.0	6	0.0	331	0.2	N/A	N/A	41	0.0	N/A	N/A
Total Productive	1528	1.1	233	0.2	287	0.2	2049	1.4	N/A	N/A	94	0.1	N/A	N/A
Unproductive	215	0.1	0	0.0	0	0.0	215	0.1	N/A	N/A	265	0.2	N/A	N/A
All	**1743**	**1.2**	**233**	**0.2**	**287**	**0.2**	**2263**	**1.6**			**360**	**0.2**		
Closure Scenario														
Good	9627	6.6	7445	5.1	5357	3.7	22430	15.4	-2.1	-0.3	186	0.1	-3.7	0.0
Medium	48922	33.7	1225	0.8	4377	3.0	54524	37.5	0.5	0.2	6750	4.6	1.0	0.0
Fair	16314	11.2	5	0.0	262	0.2	16581	11.4	5.2	0.6	3421	2.4	-1.2	0.0
Total Productive	74863	51.5	8675	6.0	9997	6.9	93535	64.4	0.7	0.4	10357	7.1	0.2	0.0
Unproductive	12024	8.3	2	0.0	14	0.0	12039	8.3	-1.8	-0.1	21203	14.6	-0.9	-0.1
All	**86887**	**59.8**	**8676**	**6.0**	**10010**	**6.9**	**105574**	**72.6**			**31560**	**21.7**		

Summed Totals may differ due to rounding of original GIS values in columns

10.6.3.2 Forest Merchantability

The project footprint will remove 982 ha of merchantable timber in the LSA (0.7 ha of the LSA). At closure it is predicted that there will be 35,190 ha of merchantable timber (24.2% of the LSA), of which 33,619 ha is in the Lower Boreal Highlands Subregion (23.1% of the LSA) and 1,570 ha (1.1% of the LSA) is in the Central Mixedwood Subregion (Table 10.6-4). In total, this represents an increase of 1,230 ha (3.6%) over the area at baseline.

The removal of merchantable forests by the proposed development is deemed to be positive in direction, subregional in extent, low in magnitude, medium-term in duration, isolated in frequency and reversible in the medium-term. The overall environmental impact of the Project on merchantable timber is predicted to be low. Confidence in this assessment is medium, based on the assumed success of reclamation at closure.

Table 10.6-4 Effects of Vegetation Removal on Merchantable Forests in the LSA

Ecosite Phase	Baseline				Footprint Area				Closure Scenario							
	Central Mixedwood		Central Mixedwood		Lower Boreal Highlands		Central Mixedwood		Central Mixedwood				Lower Boreal Highlands			
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	% Change in Resource	% Change in LSA	Area (ha)	% of LSA	% Change in Resource	% Change in LSA
a1	9	0.0	2477	1.7	0	0.0	65	0.0	9	0.0	0.0	0.0	2484	1.7	0.3	0.0
b1	109	0.1	3994	2.7	0	0.0	157	0.1	109	0.1	0.0	0.0	4004	2.8	0.2	0.0
b2	0	0.0	962	0.7	0	0.0	62	0.0	0	0.0	N/A[2]	N/A[2]	966	0.7	0.4	0.0
b3	27	0.0	626	0.4	1	0.0	14	0.0	27	0.0	0.0	0.0	628	0.4	0.2	0.0
b4	24	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	24	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
c1	58	0.0	10980	7.6	0	0.0	352	0.2	58	0.0	0.0	0.0	11016	7.6	0.3	0.0
d1	477	0.3	7852	5.4	0	0.0	232	0.2	477	0.3	0.0	0.0	7884	5.4	0.4	0.0
d2	287	0.2	3136	2.2	0	0.0	42	0.0	287	0.2	0.0	0.0	3138	2.2	0.1	0.0
d3	111	0.1	1094	0.8	0	0.0	10	0.0	111	0.1	0.0	0.0	1095	0.8	0.1	0.0
e1	311	0.2	347	0.2	1	0.0	7	0.0	311	0.2	0.0	0.0	367	0.3	5.8	0.0
e2	77	0.1	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	77	0.1	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
e3	19	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	19	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
f1	4	0.0	86	0.1	0	0.0	1	0.0	4	0.0	0.0	0.0	86	0.1	0.2	0.0
f2	8	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	8	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
f3	2	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	2	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
g1	0	0.0	808	0.6	0	0.0	39	0.0	0	0.0	N/A[2]	N/A[2]	1925	1.3	138.2	0.8
h1	47	0.0	0	0.0	0	0.0	0	0.0	47	0.0	0.0	0.0	0	0.0	N/A[2]	N/A[2]
h2	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]
i1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	0	0.0	N/A[2]	N/A[2]
i2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	0	0.0	N/A[2]	N/A[2]
j1	0	0.0	28	0.0	0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	28	0.0	-1.0	0.0
j2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	0	0.0	N/A[2]	N/A[2]
j3	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]
k1	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
k2	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
k3	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
l1	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Total	**1570**	**1.1**	**32389**	**22.3**	**0**	**0.0**	**980**	**0.7**	**1570**	**1.1**			**33619**	**23.1**		

Summed Totals may differ due to rounding of original GIS values in columns
N/A[1] – ecosite does not occur in this subregion
N/A[2] – no merchantable forest present at baseline

10.6.4 Old-Growth Forests

At closure there is expected to be 7,591 ha of old growth in the LSA (Table 10.6-5). This represents a loss of 128 ha of the old growth forest present at baseline or 1.7% of the resource (equivalent to 0.1% of the area of the LSA). The potential exists for old growth to return to disturbed areas that are reclaimed to an ecosite phase that supports forest growth. However, recovery is beyond the time frame of the closure scenario.

Table 10.6-5 Effects of Vegetation Removal on Old-Growth Forests by Ecosite Phases in the LSA

Ecosite Phase	Baseline				Footprint Area				Closure							
	Central Mixedwood		Lower Boreal Highlands		Central Mixedwood		Lower Boreal Highlands		Central Mixedwood				Lower Boreal Highlands			
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	% Change in Resource	% Change in LSA	Area (ha)	% of LSA	% Change in Resource	% Change in LSA
a1	0	0.0	0	0.0	0.0	0.0	0	0.0	0	0.0	N/A[2]	N/A[3]	0	0.0	N/A[2]	N/A[2]
b1	53	0.0	322	0.2	0.0	0.0	1	0.0	53	0.0	0.0	0.0	321	0.2	-0.4	0.0
b2	0	0.0	210	0.1	0.0	0.0	22	0.0	0	0.0	N/A[2]	N/A[3]	188	0.1	-10.5	0.0
b3	13	0.0	85	0.1	0.0	0.0	2	0.0	13	0.0	0.0	0.0	83	0.1	-2.2	0.0
b4	0	0.0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	n/a	N/A[1]	N/A[1]
c1	0	0.0	109	0.1	0.0	0.0	1	0.0	0	0.0	N/A[2]	N/A[2]	108	0.1	-0.8	0.0
d1	52	0.0	829	0.6	0.0	0.0	9	0.0	52	0.0	0.0	0.0	820	0.6	-1.1	0.0
d2	48	0.0	1158	0.8	0.0	0.0	20	0.0	48	0.0	0.0	0.0	1138	0.8	-1.7	0.0
d3	92	0.1	445	0.3	0.0	0.0	1	0.0	92	0.1	0.0	0.0	444	0.3	-0.3	0.0
e1	69	0.0	544	0.4	0.0	0.0	11	0.0	69	0.0	0.0	0.0	533	0.4	-2.0	0.0
e2	43	0.0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	43	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
e3	19	0.0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	19	0.0	0.0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]
f1	0	0.0	19	0.0	0.0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	19	0.0	0.0	0.0
f2	0	0.0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
f3	0	0.0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
g1	7	0.0	1170	0.8	0.0	0.0	28	0.0	7	0.0	0.0	0.0	1142	0.8	-2.4	0.0
h1	30	0.0	1756	1.2	0.0	0.0	25	0.0	30	0.0	0.0	0.0	1731	1.2	-1.4	0.0
h2	N/A	N/A	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]
i1	0	0	229	0.2	0.0	0.0	4	0.0	0	0.0	N/A[2]	N/A[2]	225	0.2	-1.8	0.0
i2	0	0	0	0.0	0.0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	0	0.0	N/A[2]	N/A[2]
j1	0	0	416	0.3	0.0	0.0	4	0.0	0	0.0	N/A[2]	N/A[2]	413	0.3	-0.9	0.0
j2	0	0	0	0.0	0.0	0.0	0	0.0	0	0.0	N/A[2]	N/A[2]	0	0.0	N/A[2]	N/A[2]
j3	N/A	N/A	0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[1]	N/A[1]	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]
k1	0	0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	0.0	N/A[1]	N/A[1]
k2	0	0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	0.0	N/A[1]	N/A[1]
k3	0	0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	0.0	N/A[1]	N/A[1]
l1	0	0	N/A	N/A	0.0	0.0	N/A[1]	N/A[1]	0	0.0	N/A[2]	N/A[2]	N/A[1]	0.0	N/A[1]	N/A[1]
Total	**425**	**0.3**	**7293**	**5.0**	**0.0**	**0.0**	**128**	**0.1**	**425**	**0.3**			**7165**	**4.9**		

Summed totals may differ due to rounding.
1 ecosite does not occur in this subregion
2 no old growth present at baseline

In terms of forest types, 1.6% (60.7 ha) of the existing coniferous old growth forest, 0.9% (3.9 ha) of deciduous old growth forest, and 2.1% (63.0 ha) of mixedwood old-growth forest in the LSA is expected to be removed during Project construction (Table 10.6-6).

Table 10.6-6 Effects of Vegetation Removal on Coniferous, Deciduous and Mixedwood Old Growth Forests in the LSA

Old-Growth Forest Type	Baseline		Footprint		Closure			
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	% Change in Resource	% Change in LSA
Central Mixedwood								
Coniferous	148	0.1	0	0.0	148	0.1	0.0	0.0
Deciduous	121	0.1	0	0.0	121	0.1	0.0	0.0
Mixedwood	156	0.1	0	0.0	156	0.1	0.0	0.0
Total	**425**	**0.3**	**0**	**0.0**	**425**	**0.3**	**0.0**	**0.0**
Lower Boreal Highlands								
Coniferous	3813	2.6	61	0.0	3753	2.6	-1.6	0.0
Deciduous	416	0.3	4	0.0	413	0.3	-0.9	0.0
Mixedwood	3063	2.1	63	0.0	3000	2.1	-2.1	0.0
Total	**7293**	**5.0**	**128**	**0.1**	**7165**	**4.9**	**-1.7**	**-0.1**
Overall total	**7718**	**5.3**	**128**	**0.1**	**7591**	**5.2**	**-1.7**	**-0.1**

Summed totals may differ due to rounding.

The loss of old-growth forest in the LSA from development and timber harvesting has implications for wildlife and biodiversity. Appropriate land management will help maintain the distribution of older stands across the landscape as juvenile stands are left to mature into advanced stages of development.

The impact of the proposed development on old-growth forest resources in the LSA is judged to be negative in direction, subregional in extent, negligible in magnitude, long-term in duration, isolated in frequency and reversible in the long-term. The overall environmental impact of the Project on old growth forests is predicted to be low. Confidence in this assessment is medium as factors that contribute to the longer term abundance of old-growth forest in the LSA include both predictable anthropogenic disturbances and unpredictable variables such as fire and climate.

10.6.5 Traditional and Medicinal Plants

Table 10.6-7 outlines the summary of the berry picking habitat in the project LSA. Aboriginal peoples in the oil sands area use numerous boreal plant species for traditional and medicinal purposes. Plants of traditional or medicinal use are found in all ecosite phases and wetland types. Therefore, to focus this assessment, those species identified in the Resource Use section (Volume 5, Section 13) as being most commonly used by persons in the area have been selected as assessment indicators. They are blueberries (*Vaccinium* spp.), cranberries (*Viburnum edule*) and wild strawberries (*Fragaria virginiana*).

Removal of vegetation will disturb 1012 ha or 0.7% of blueberry habitat. Disturbed portions of wetland ecosite phases will be reclaimed to g1 and “transitional g1” ecosite phases which will increase blueberry habitat. Therefore there will be an increase in blueberry habitat after closure and reclamation of 897 ha representing a 0.6% increase in the LSA.

Impacts on blueberry habitat from vegetation removal are positive in direction, subregional, negligible in magnitude, long term in duration, isolated in frequency, and reversible in the short-term. Overall environmental impact on blueberry habitat is judged to be low with medium confidence.

Removal of vegetation will disturb 468 ha or 0.3 % of cranberry habitat in the LSA. The affected ecosite phases are all upland sites and will be reclaimed to upland sites similar to baseline conditions. Clear cuts from timber harvesting are anticipated to be reclaimed as d1 ecosite phases, thus there will be an increase of 156 ha of cranberry habitat within the LSA.

Impacts of vegetation removal on cranberry habitat are positive in direction, subregional, negligible in magnitude, short-term in duration, isolated, reversible in the short-term with high confidence. Overall environmental impact is low.

Removal of vegetation will disturb 14 ha or 1.5% of potential wild strawberry habitat. Ecosite phases that provide potential strawberry habitat will be reclaimed to upland habitats similar to those at baseline so that the amount of potential strawberry habitat in the Central Mixedwood subregion at closure is expected to be the same as at baseline. The amount of potential strawberry habitat in the Lower Boreal Highlands subregion at closure is expected to have increased by 2 ha to 628 ha (0.4% of the LSA).

Impacts of vegetation removal on wild strawberry habitat are positive in direction, subregional in extent, negligible in magnitude, short-term in duration, isolated, reversible in the short-term with high confidence. Overall environmental impact is low.

Table 10.6-7 Summary of Berry Picking Habitat in the Project LSA

	Baseline Scenario						Footprint							Closure Scenario					
	Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA (Baseline Scenario)		Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA (Baseline Scenario)			Central Mixedwood Subregion		Lower Boreal Highlands Subregion		LSA (Baseline Scenario)	
Blueberry (Vaccinium myrtilloides)	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Blueberry (Vaccinium myrtilloides)**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**	**Area (ha)**	**% of LSA**
a1	9	0.0	2477	1.7			0	0.0	65	0.0			a1	9	0.0	2484	1.7		
b1	109	0.1	3994	2.7			0	0.0	157	0.1			b1	109	0.1	4004	2.8		
b2	0	0.0	962	0.7			0	0.0	62	0.0			b2	0	0.0	966	0.7		
b3	27	0.0	626	0.4	n/a		1	0.0	14	0.0			b3	27	0.0	628	0.4	n/a	
b4	24	0.0	n/a	n/a			0	0.0	n/a	n/a			b4	24	0.0	n/a	n/a		
d2	n/a	n/a	3185	2.2			n/a	n/a	42	0.0			d2	n/a	n/a	3187	2.2		
c1	58	0.0	11540	7.9			0	0.0	362	0.2			c1	58	0.0	11566	8.0		
g1	83	0.1	14151	9.7			0	0.0	309	0.2			g1	83	0.1	14347	9.9		
													"transitional g1"	0	0.0	650	0.4		
Subtotal	***310***	**0.2**	***36936***	**25.4**	***37245***	**25.6**	**1**	**0.0**	**1010**	**0.7**	**1012**	**0.7**	***Subtotal***	***310***	**0.2**	***37832***	**26.0**	***38142***	**26.2**
Cranberry (Viburnum edule)													**Cranberry (Viburnum edule)**						
b1	n/a	n/a	3994	2.7			n/a	n/a	157	0.1			b1	109	0.1	4004	2.8		
d1	477	0.3	7852	5.4			0	0.0	232	0.2			d1	477	0.3	7884	5.4		
d2	287	0.2	3185	2.2			0	0.0	42	0.0			d2	287	0.2	3187	2.2		
d3	111	0.1	1142	0.8			0	0.0	10	0.0			d3	111	0.1	1143	0.8		
e1	311	0.2	1343	0.9			1	0.0	26	0.0			e1	311	0.2	1344	0.9		
e2	77	0.1	n/a	n/a			0	0.0	n/a	n/a			e2	77	0.1	n/a	n/a		
e3	19	0.0	n/a	n/a			0	0.0	n/a	n/a			e3	19	0.0	n/a	n/a		
f1	4	0.0	86	0.1			0	0.0	1	0.0			f1	4	0.0	86	0.1		
f2	8	0.0	n/a	n/a			0	0.0	n/a	n/a			f2	8	0.0	n/a	n/a		
f3	2	0.0	n/a	n/a			0	0.0	n/a	n/a			f3	2	0.0	n/a	n/a		
Subtotal	***1296***	**0.9**	***17602***	**12.1**	***18898***	**13.0**	**1**	**0.0**	**468**	**0.3**	**468**	**0.3**	***Subtotal***	***1405***	**1.0**	***17649***	**12.1**	***19054***	**13.1**
Strawberry (Fragaria virginiana)													**Strawberry (Fragaria virginiana)**						
b3	n/a	n/a	626	0.4			n/a	n/a	14	0.0			b3	n/a	n/a	628	0.4		
d2	287	0.2	n/a	n/a			0	0	n/a	n/a			d2	287	0.2	n/a	n/a		
Subtotal	***287***	**0.2**	***626***	**0.4**	***914***	**0.6**	**0**	**0.0**	**14**	**0.0**	**14**	**0.1**	***Subtotal***	***287***	**0.2**	***628***	**0.4**	***915***	**0.6**

Summed totals may differ due to rounding.

n/a - not applicable

According to the Hydrology section (Volume 3, Section 6), there will be no impacts due to water level and flow changes. Therefore, impacts from alterations in hydrology on blueberries, cranberries, and wild strawberries are rated neutral, subregional, negligible in magnitude, medium-term in duration, continuous in frequency, reversible in the long-term, with low confidence. The environmental impact is predicted to be low.

10.6.6 Wetlands and Peatlands

Wetlands and peatlands in Alberta have evolved in response to climate, hydrology and groundwater influences. Wetlands function to store water and energy, recharge aquifers, filter and buffer water, trap and store sediment and maintain biodiversity. They are both carbon sources, as primary productivity is high in wetlands; and carbon sinks because carbon is sequestered in organic matter. Wetlands also provide habitat (food, shelter and space) for numerous organisms ranging from microscopic invertebrates to large mammals.

Water storage functions of wetlands contribute to sustained forest growth. As natural reservoirs in the landscape, they hold water which helps maintain water table levels and moisture in surrounding soils. Evaporation and evapotranspiration processes associated with wetlands contribute to humidity and rainfall, affording conditions for plant and forest growth.

Wetlands comprised 53.6% (77,942 ha) of the LSA. Removal of vegetation due to project development will affect 1,287 ha, or 1.7% of wetland resources in the LSA (0.9% of the LSA). Treed bogs will have the largest amount of disturbance from the Project footprint.

Wetlands disturbed by the development footprint will be reclaimed to equivalent wetland (h1-j3), for linear disturbances and upland g1, and “transitional g1” ecosite phases for well pads and central facility hubs (Volume 1, Section 8). After closure and reclamation, there will be an overall decrease of approximately 0.5% in wetland area (or 0.9% of LSA) as a result of the proposed development. Impacts of disturbance to wetlands due to vegetation removal is predicted to be negative, subregional, negligible in magnitude, long-term in duration, isolated in frequency, irreversible with low confidence. Environmental impact is low.

Hydrology is a major factor influencing the development of wetlands and wetland characteristics. Alterations in hydrology will occur with development and operational activities for the Project and are described in the Hydrology section (Volume 3, Section 6). Following reclamation and restoration of the drainage patterns, it is expected that there may be a minor reduction in infiltration rates due to increased soil compaction at depth, however run off rates are expected to be comparable to natural conditions. According to the Hydrology section (Volume 3, Section 6), environmental impacts on water level and flow changes from drainage pattern changes are not anticipated. Therefore, impacts from alterations in hydrology on wetlands and peatlands are rated neutral, subregional, negligible in magnitude, medium-term in duration, continuous in frequency, reversible in the long-term with low confidence. The environmental impact is predicted to be low.

10.6.7 Potential Rare Plant Habitat

The development footprint will affect 393 ha of high potential rare plant habitat (0.3% of the high potential rare plant habitat in the LSA), 833 ha (0.6%) of moderate potential rare plant habitat, 901 ha (0.6%) of low potential rare plant habitat and 504 ha (0.3%) of very low potential (Table 10.6-8).

Because disturbed areas are ranked as having a moderate potential to support rare plants, development of the Project results in a temporary increase in habitat for some species that respond positively to disturbance.

Closure and reclamation activities of the development footprint area will convert wetland areas to g1 and 'g1-transition' ecosite phases and upland clear cut areas to d1 (both with a low potential rare plant habitat ranking). At closure, there will be approximately 29,728 ha (20.5%of LSA) of high potential rare plant habitat representing a decrease of 208 ha or 0.1% in the LSA. Moderate potential rare plant habitat will decrease by 612 ha or 0.4% in the LSA. Vegetation communities with a low potential to support rare plants will increase by 300 ha or 0.2% and very low potential habitat will increase by 38 ha or 0.03%.

Areas of high potential rare plant habitat are wetland communities which will be reclaimed to upland g1 and "g1-transition" communities. Therefore, the impact of vegetation removal on areas with a high potential rare plant habitat ranking is rated as negative in direction, subregional, negligible in magnitude, long-term in duration, isolated in frequency and irreversible. This assessment has been determined with a low level of confidence. The overall environmental impact of vegetation removal on areas with a high potential rare plant habitat ranking is judged to be low.

Moderate potential rare plant habitat is comprised of upland communities and wetland communities. Upland sites will be reclaimed to similar upland sites, however, wetlands are to be reclaimed to an upland g1 and "g1-transition" communities. Although the overall impact of vegetation removal on areas with a potential rare plant habitat ranking of moderate is rated as negative in direction, subregional in extent, negligible in magnitude and isolated in frequency, duration will be medium-term for upland sites and long-term for wetland sites and effects will be reversible in the medium-term for uplands and irreversible for wetlands. This assessment has been determined with a low level of confidence. The overall environmental impact of vegetation removal on areas with a moderate potential rare plant habitat ranking is low.

The overall impact of vegetation removal on areas with a low potential rare plant habitat ranking is rated as positive in direction, subregional in extent, negligible in magnitude, medium-term in duration (the duration for one community type of shrubby bog that will be long-term), isolated in frequency and reversible in the medium-term (the duration for one community type of shrubby bog will be irreversible). This assessment has been determined with a medium level of confidence. The overall environmental impact of vegetation removal on areas with a low potential rare plant habitat ranking is low.

The impact of vegetation removal on areas with a very low potential rare plant habitat ranking is rated as neutral in direction, subregional in extent, negligible in magnitude, medium-term in duration, isolated in frequency and reversible in the medium-term. This assessment has been determined with a medium level of confidence. The overall environmental impact of vegetation removal on areas with a very low potential rare plant habitat ranking is judged to be low.

Table 10.6-8 Rare Plant Potential Habitat in the LSA of the Kai Kos Dehseh SAGD Project at Closure

Central Mixedwood		Baseline		Footprint		Closure			
Potential	Ephase	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	% Change in LSA	% Change to Resource
High	**(j1)** Treed Poor Fen	41	0.0	0	0.0	41	0.0	0.0	0.0
	(j2) Shrubby Poor Fen	109	0.1	0	0.0	109	0.1	0.0	0.0
	(k1) Treed Rich Fen	15	0.0	0	0.0	15	0.0	0.0	0.0
	(k2) Shrubby Rich Fen	204	0.1	0	0.0	204	0.1	0.0	0.0
	Total High Potential	**370**	**0.3**	**0**	**0.0**	**370**	**0.3**	**0.0**	
Moderate	**(d3)** Low bush cranberry (Aspen-White spruce)	111	0.1	0	0.0	111	0.1	0.0	0.0
	(i1) Treed bog	548	0.4	0	0.0	548	0.4	0.0	0.0
	(k3) Graminoid Fen	62	0.0	0	0.0	62	0.0	0.0	0.0
	(l1) Marsh	0	0.0	0	0.0	0	0.0	0.0	0.0
	NWL Lake	25	0.0	0	0.0	25	0.0	0.0	0.0
	Burn Regeneration	0	0.0	0	0.0	0	0.0	0.0	0.0
	Disturbed	455	0.3	0	0.0	454	0.3	0.0	0.0
	Total Moderate Potential	**1200**	**0.8**	**0**	**0.0**	**1200**	**0.8**	**0.0**	
Low	**(b1)** Blueberry (Jack pine/Aspen)	109	0.1	0	0.0	109	0.1	0.0	0.0
	(d1) Low bush cranberry (Aspen)	477	0.3	0	0.0	477	0.3	0.0	0.0
	(d2) Low bush cranberry (Aspen/White spruce)	287	0.2	0	0.0	287	0.2	0.0	0.0
	(e1) Dogwood (Balsam poplar/Aspen)	311	0.2	1	0.0	311	0.2	0.0	0.0
	(e3) Dogwood (White spruce)	19	0.0	0	0.0	19	0.0	0.0	0.0
	(g1) Labrador tea (Black spruce/Jack pine)	83	0.1	0	0.0	83	0.1	0.0	0.2
	(i2) Shrubby bog	548	0.4	0	0.0	36	0.0	-0.4	-93.5
	Deciduous Regeneration	0	0.0	0	0.0	0	0.0	0.0	0.0
	Shrubland	1	0.0	0	0.0	1	0.0	0.0	0.0
	NWF Flooded areas	10	0.0	0	0.0	10	0.0	0.0	0.0
	Total Low Potential	**1845**	**1.3**	**1**	**0.0**	**1333**	**0.9**	**-0.4**	
Very Low	**(a1)** Lichen (Jack pine)	9	0.0	0	0.0	9	0.0	0.0	0.0
	(b2) Blueberry (Aspen/Paper birch)	0	0.0	0	0.0	0	0.0	0.0	0.0
	(b3) Blueberry (Aspen/White spruce)	27	0.0	1	0.0	27	0.0	0.0	0.0
	(b4) Blueberry (White spruce/Jack pine)	24	0.0	0	0.0	24	0.0	0.0	0.0
	(c1) Labrador Tea (Jack pine/Black spruce)	58	0.0	0	0.0	58	0.0	0.0	0.0
	(e2) Dogwood (Balsam poplar/White spruce)	77	0.1	0	0.0	77	0.1	0.0	0.0
	(f1) Horsetail (Balsam poplar/Aspen)	4	0.0	0	0.0	4	0.0	0.0	0.0
	(f2) Horsetail (Balsam poplar/White spruce)	8	0.0	0	0.0	8	0.0	0.0	0.0
	(f3) Horsetail (White spruce)	2	0.0	0	0.0	2	0.0	0.0	0.0
	(h1) Labrador tea (White spruce/Black spruce)	96	0.1	0	0.0	96	0.1	0.0	0.0
	Total Very Low Potential	**305**	**0.2**	**1**	**0.0**	**305**	**0.2**	**0.0**	

Note: Summed Totals may differ due to rounding of original GIS values in columns.

Lower Boreal Highlands		Baseline		Footprint		Closure			
Potential	Ephase	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA	% Change in LSA	% Change to Resource
High	**(i1)** Treed Poor Fen	7308	5.0	150.3	0.1	7222	5.0	-0.1	-1.2
	(i2) Shrubby Poor Fen	7210	5.0	90.3	0.1	7164	4.9	0.0	-0.6
	(j1) Treed Rich Fen	10688	7.4	111.5	0.1	10633	7.3	0.0	-0.5
	(j2) Shrubby Rich Fen	4360	3.0	40.6	0.0	4339	3.0	0.0	-0.5
					0.0				
	Total High Potential	**29566**	**20.3**	**392.6**	**0.3**	**29358**	**20.2**	**-0.1**	
Moderate	**(d3)** Low bush cranberry (White spruce)	1142	0.8	9.5	0.0	1143	0.8	0.0	0.1
	(h) Treed bog	37516	25.8	720.5	0.5	37125	25.5	-0.3	-1.0
	(i3) Graminoid Fen & Marsh	3647	2.5	42.2	0.0	3622	2.5	0.0	-0.7
	NWL Lake	2991	2.1	0.0	0.0	2991	2.1	0.0	0.0
	Burn Regeneration	1100	0.8	19.6	0.0	1134	0.8	0.0	3.1
	Disturbed	4545	3.1	41.0	0.0	4314	3.0	-0.2	-5.1
	Total Moderate Potential	**50941**	**35.0**	**832.8**	**0.6**	**50329**	**34.6**	**-0.4**	
Low	**(b1)** Blueberry (Jack pine/Aspen)	3994	2.7	157.1	0.1	4004	2.8	0.0	0.2
	(d1) Low bush cranberry (Aspen)	7852	5.4	232.3	0.2	7884	5.4	0.0	0.4
	(d2) Low bush cranberry (Aspen/White spruce/Black Spruce)	3185	2.2	41.8	0.0	3187	2.2	0.0	0.1
	(e1) Fern (White Spruce)	1343	0.9	25.8	0.0	1344	0.9	0.0	0.1
	(g1) Labrador tea (Black spruce/Jack pine)	14151	9.7	309.1	0.2	14347	9.9	0.1	1.4
	(g1-transition) Labrador tea (Black spruce)	0	0.0	0.0	0.0	650	0.4	0.4	+
	(h2) Shrubby bog	6198	4.3	132.1	0.1	6117	4.2	-0.1	-1.3
	Shrubland	41	0.0	0.1	0.0	41	0.0	0.0	0.0
	NWF Flooded areas	276	0.2	1.7	0.0	277	0.2	0.0	0.0
					0.0				
	Total Low Potential	**37041**	**25.5**	**899.9**	**0.6**	**37852**	**26.0**	**0.6**	
Very Low	**(a1)** Bearberry (Jack pine)	2477	1.7	64.6	0.0	2484	1.7	0.0	0.3
	(b2) Blueberry (Aspen)	962	0.7	61.6	0.0	966	0.7	0.0	0.4
	(b3) Blueberry (White spruce/Jack pine)	626	0.4	14.3	0.0	628	0.4	0.0	0.2
	(c1) Labrador Tea (Jack pine/Black spruce)	11540	7.9	361.7	0.2	11566	8.0	0.0	0.2
	(f1) Horsetail (White spruce)	86	0.1	1.1	0.0	86	0.1	0.0	0.1
	Total Very Low Potential	**15691**	**10.8**	**503.2**	**0.3**	**15728**	**10.8**	**0.0**	

Note: Summed Totals differ due to rounding of original GIS values in columns.

Rare Plant Potential Habitat	Baseline		Footprint		Closure	
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of LSA
Total High Potential	**29936**	**20.6**	**393**	**0.3**	**29728**	**20.5**
Total Moderate Potential	**52141**	**35.9**	**833**	**0.6**	**51529**	**35.5**
Total Low Potential	**38886**	**26.8**	**901**	**0.6**	**39186**	**27.0**
Total Very Low Potential	**15995**	**11.0**	**504**	**0.3**	**16033**	**11.0**
						93.9

Note: Percent numbers do not add to 100 because not all areas are included in rare plant potential habitat calculations (i.e., rivers, roads)

Hydrology is a defining factor in wetland type, structure and function. Reclamation and mitigation strategies outlined in Volume 3, Section 6 include placement of culverts and diversion channels, and the re-establishment of drainage channels at closure. Based on negligible impact assessments to surface water and hydrological regimes found in Volume 3, Section 6 and with reclamation and mitigation measures in place, impacts of alterations in hydrology on potential rare plant habitat are predicted to be neutral, subregional, negligible in magnitude, medium-term duration, continuous in frequency, and reversible in the medium-term with medium confidence. The overall environmental impact is assessed to be low.

10.6.8 Rare Plants

There were 13 rare plant species observed in the LSA at 44 different locations (Table 10.5-10, Figure 10.5-8). Ten of the species were vascular plants and three were moss species. Provincial conservation status ranking for these species ranged from SU to S3. Three of the vascular species, beaked sedge, white-stem pondweed and floating-leaf pondweed (*Carex rostrata*, *Potamogeton praelongus* and *Potamogeton natans* respectively*)* were removed from ANHIC's tracking and watch lists in July of 2006. Some rare species will be encountered and affected by development disturbances.

Meadow bitter cress (*Cardamine pratensis* ssp *paludosa*), as yet unranked by ANHIC because it is a new listing for Alberta, was observed at 10 locations. It is ranked as globally secure (G5). It was observed at 10 sites and generally was found growing on the edges of open pools of water in rich or shrubby fens. None of the occurrences were located within the Project footprint therefore there is no environmental impact to this species.

Hudson Bay sedge (*Carex heleonastes*) ranked by ANHIC as S2 provincially and G4 globally was observed at one site. Its habitat is wetlands, usually fens or marshes. The occurrence observed was not within the Project footprint, therefore there is no anticipated environmental impact to this species.

Green saxifrage (*Chrysosplenium tetrandrum*) ranked as S3/G5 was observed at two locations. Green saxifrage prefers wetland areas and has been found growing in swamps and open areas along cutlines in bogs and fens. The two occurrences were not within the Project footprint, therefore there is no anticipated environmental impact to this species.

Ground-fir (*Diphasiastrum sitchense*) ranked as S2/G5 was observed at two locations. Both occurrences of ground fir were in a c1 ecosite phase which is an upland jack pine and black spruce forest type. One occurrence is located within a well pad site and the second occurrence is located close to an access route. This species will be impacted by construction and development of the well pad (20-78-09 W4M). Mitigation strategies for rare plants are avoidance and relocation (transplanting) where possible. Avoidance is not feasible due to engineering constraints with placement of the well pad. This species is in the Lycopod family and reproduces by spores not by seeds, so collection of seeds for planting in an adjacent offsite area is not feasible. It has creeping stems mostly beneath the surface of the ground making translocation difficult. Translocation success is unknown, however it will be attempted. For this occurrence only, of this species, there may be an irreversible, negative environmental impact.

Hudson Bay Eyebright (*Euphrasia hudsoniana*), another new listing for Alberta (SU), is often observed in disturbed areas such as access routes and is typically surrounded by forested areas. This suggests that it may benefit from disturbance such as removal of vegetation, thus providing the ecological and habitat conditions conducive to its growth. It was observed at six locations in the Project area, of which none will be affected by Project development. Therefore, there is no anticipated environmental impact to this species.

Stygian rush (*Juncas stygius var americanus*) ranked as S2/G5 was observed at one location. Stygian rush is a wetland species. Its location was not within the Project footprint, and therefore there is no anticipated environmental impact to this species by Project construction and development.

One occurrence of *Pseudobryum cinclidioides* (a moss species) was observed along an access route to the Leismer hub (1-79-08W4M). This species is ranked as S2/G5 by ANHIC. It is not easily identifiable in the field (it requires a microscope for identification of leaf cell structure) and typically grows mingled together with other mosses that are similar in appearance. The location was on the edge of the access route and may therefore be marked as a general area to avoid for any future expansion of the access route or borrow pit placement.

Pitcher plant (*Sarracenia purpurea*) ranked as S2/G5 was observed in one area. The site is also considered a rare plant community, *Andromeda polifolia* / *Sarracenia purpurea* / *Sphagnum angustifolium,* ranked S1/S2 by ANHIC. It was observed growing in a shrubby fen (wetland) which is its typical habitat. Its location was not within the Project footprint, and therefore there is no anticipated environmental impact to this species or rare community by Project construction and development.

Red collar moss and yellow collar moss (*Splachnum rubrum* and *Splachnum luteum*, respectively) are ranked as S3/G3 and were observed at four locations. These moss species grow on animal (usually moose) droppings mostly in fens and bogs (Vitt et al., 1988). One location was in a c1 ecosite phase which is upland jack pine and black spruce forest community. This location, although upland was adjacent to a bog. These occurrences were not found within the Project footprint, and therefore there is no anticipated environmental impact to these species.

Project impacts to rare plants are predicted to be neutral for 12 species listed and potentially negative for Ground-fir, subregional in extent, low in magnitude, medium-term in duration, (long-term duration for Ground-fir), isolated in frequency, reversible in the medium-term (irreversible for ground fir) with low confidence. Although one occurrence of Ground-fir will be negatively impacted, it represents 1 in 44 total observed rare plant occurrences within the LSA. Therefore, the overall environmental impact to rare plants is judged to be low.

Nine of thirteen rare plants observed in the LSA were found in wetland areas. As discussed in the hydrology section (Volume 3, Section 6), environmental impacts on water level and flow changes from drainage pattern changes are not anticipated. Therefore, alterations to hydrology are not anticipated to have an affect on observed rare plants in the LSA. The overall environmental impact on rare plants observed in the LSA is low.

Reclamation and mitigation strategies outlined in Volume 3, Section 6 include placement of culverts and diversion channels, and re-establishment of drainage channels at closure. Based on negligible impact assessments to surface water and hydrological regimes found in Volume 3, Section 6 and with reclamation and mitigation measures in place, impacts of alterations in hydrology on rare plants are predicted to be neutral, subregional, negligible in magnitude, medium term duration, continuous in frequency, and reversible in the medium term with medium confidence. The overall environmental impact is assessed to be low.

10.6.9 Rare Communities

One rare community, *Andromeda polifolia* / *Sarracenia purpurea* / *Sphagnum angustifolium* listed as S1/S2 in ANHIC's database was observed. The community was not within the Project footprint, and therefore there is no anticipated environmental impact for removal of vegetation and alterations in hydrology.

10.6.10 Acid Deposition

The Project will generate air emissions from the extraction and processing of bitumen. Components of air emissions pertinent to vegetation include SO_2 and NO_2 and will be discussed relative to their contribution to acid deposition. Methods and results related to air emissions are found in the Air section (Volume 2, Section 2). Effects on vegetation from acid deposition may include changes to health and vigour, and has the potential to result in the loss of sensitive species. Air emissions effects on vegetation can occur directly through foliar deposition and/or indirectly through changes in soil chemistry.

In this EIA sensitivity to acid deposition is assessed at the level of AGCC ground cover classes for the RSA. Although the sensitivity of some plant species has been researched (Kennedy et al., 1988) and sensitivity ratings suggested, the response to air emissions of any particular plant species is highly variable due to additive factors such as stress induced by interspecific and intraspecific competition, disease and herbivory. Abiotic conditions that affect growth rates, such as drought, lack of nutrients and light availability can also influence sensitivity to acid deposition. For this assessment, the sensitivity of groundcover classes has been determined using modelled soil sensitivities rather than the composition of sensitive plant species. Methods of determining soil sensitivity are described and discussed in the soils section (Volume 4, Section 9).

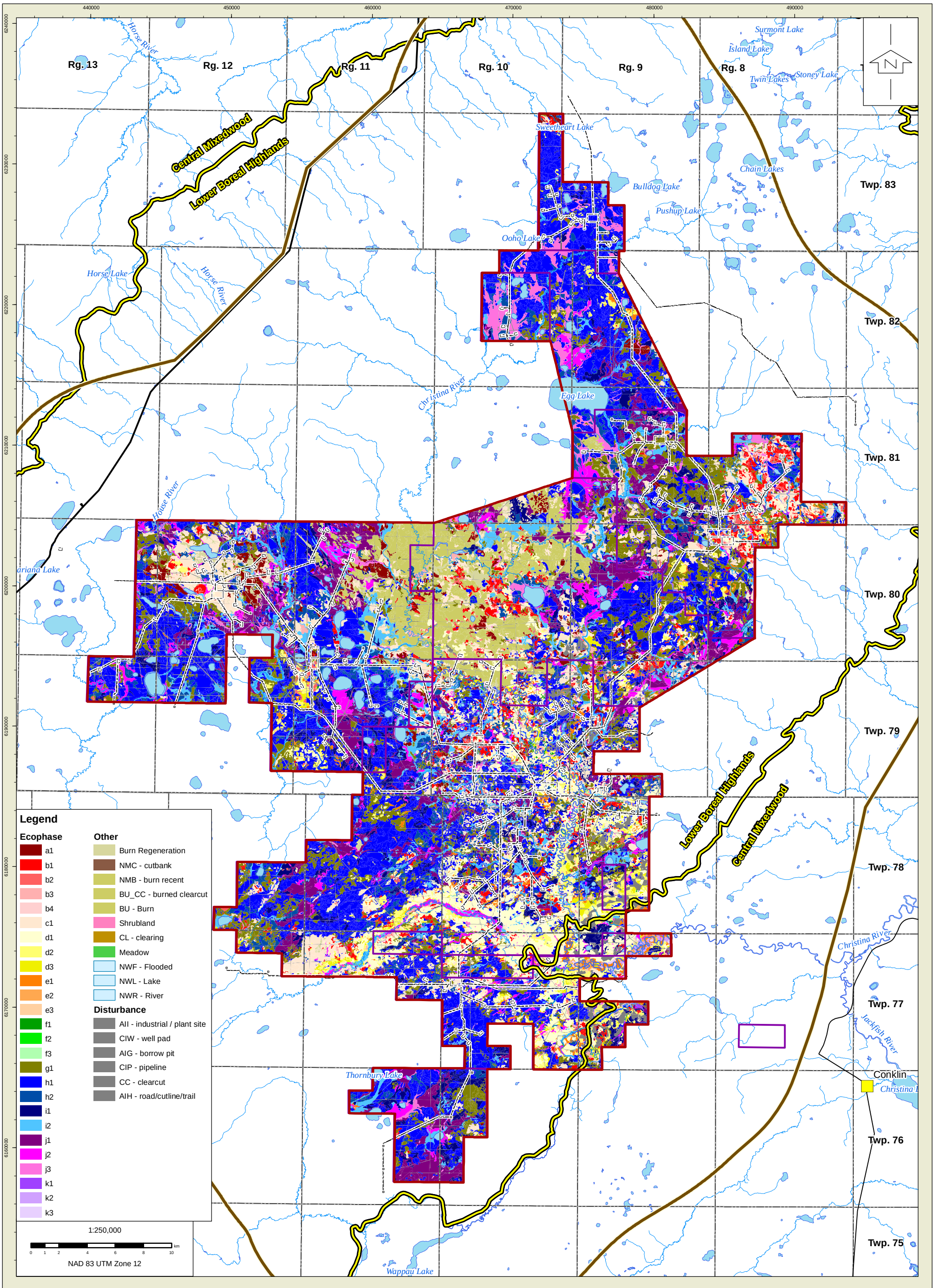
To determine potential impacts from PAI, land cover classes in the RSA were correlated with sensitivity to acidification ratings for the dominant soils in those classes. Soil sensitivity, therefore, was used as a proxy for possible vegetation sensitivities. The cumulative effects case and impact results for soils in this assessment are based on modelled soil sensitivities (Volume 4, Section 9.8.2). Areas that fall under a PAI load greater than their critical load will be identified as potential monitoring locations.

No highly sensitive soils were found in the RSA and the total area of soils that are predicted to receive PAI greater than their critical load is less than 1.0% of the LSA (34 ha). The overall impact of the Project with respect to acid deposition is therefore considered to be low.

10.6.11 Non-native and Invasive Species

Introduction of non-native and invasive plant species may cause a displacement of native species resulting in changes to community composition and biodiversity. Non-native species are often aggressive species that can become difficult to manage if they are allowed to establish.

There was one observed occurrence of scentless chamomile in the LSA, during field work in 2005 and 2006. Observed establishment of scentless chamomile was limited and numbers were relatively low. A weed management plan will be forthcoming for the Project.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450000
460000
470000
480000
490000
6240000
6230000
6220000
6210000
6200000
6190000
6180000
6170000
6160000
Rg. 13
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Twp. 83
Twp. 82
Twp. 81
Twp. 80
Twp. 79
Twp. 78
Twp. 77
Twp. 76
Twp. 75
Central Mixedwood
Lower Boreal Highlands
Horse River
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
Jackfish River
Thornbury Lake
Wappau Lake
Conklin
N
Legend
Ecophase
a1
b1
b2
b3
b4
c1
d1
d2
d3
e1
e2
e3
f1
f2
f3
g1
h1
h2
i1
i2
j1
j2
j3
k1
k2
k3
Other
Burn Regeneration
NMC - cutbank
NMB - burn recent
BU_CC - burned clearcut
BU - Burn
Shrubland
CL - clearing
Meadow
NWF - Flooded
NWL - Lake
NWR - River
Disturbance
AII - industrial / plant site
CIW - well pad
AIG - borrow pit
CIP - pipeline
CC - clearcut
AIH - road/cutline/trail
1:250,000
0 1 2 4 6 8 10 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Project Footprint
Title:
FOOTPRINT IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: July 9, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_LSA.mxd
Drawn by: TG
Checked: LM
Fig. No.: 10.6-1

455000 460000 465000 470000 475000 480000

6195000 6190000 6185000 6180000 6175000 6170000 6165000 6160000

Rg. 12 Rg. 11 Rg. 10

Twp. 80 Twp. 79 Twp. 78 Twp. 77

Christina River

Thornbury Lake

Lower Boreal Highlands

Central Mixedwood

Legend

Ecophase	Other
a1	Burn Regeneration
b1	NMC - cutbank
b2	NMB - burn recent
b3	BU_CC - burned clearcut
b4	BU - Burn
c1	Shrubland
d1	CL - clearing
d2	Meadow
d3	NWF - Flooded
e1	NWL - Lake
e2	NWR - River
e3	**Disturbance**
f1	AII - industrial / plant site
f2	CIW - well pad
f3	AIG - borrow pit
g1	CIP - pipeline
h1	CC - clearcut
h2	AIH - road/cutline/trail
i1	
i2	
j1	
j2	
j3	
k1	
k2	
k3	

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

b c a

Project Location

Legend

North American Vegetation RSA
North American Vegetation LSA
North American Lease
Natural Subregions
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Project Footprint

Title:

FOOTPRINT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 9, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_LSA_A.mxd

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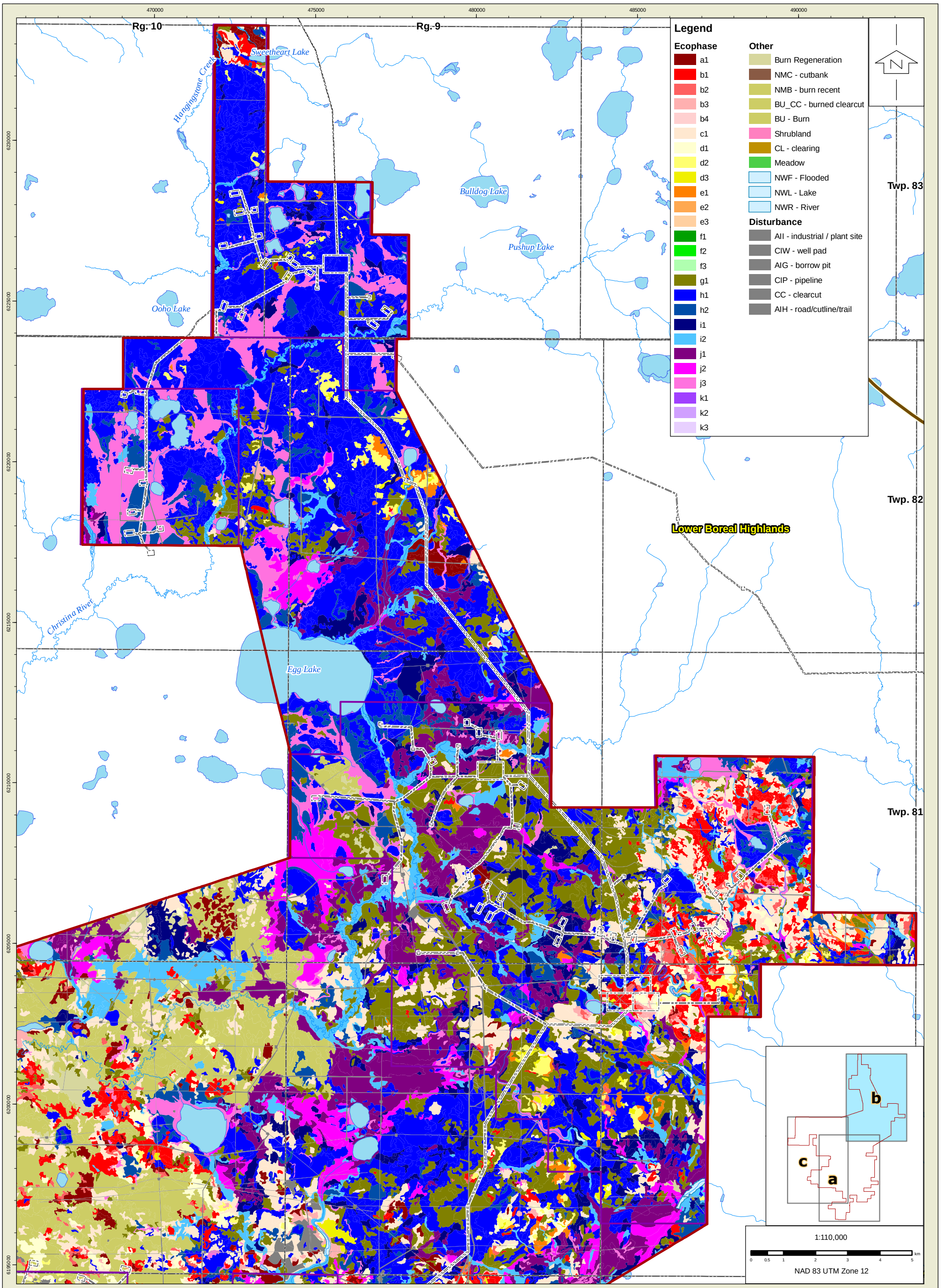
Rg. 10
Rg. 9
Twp. 83
Twp. 82
Twp. 81
Lower Boreal Highlands
Sweetheart Lake
Hangingstone Creek
Bulldog Lake
Pushup Lake
Ooho Lake
Christina River
Egg Lake
470000
475000
480000
485000
490000
6230000
6225000
6220000
6215000
6210000
6205000
6200000
6195000
Legend
Ecophase
a1
b1
b2
b3
b4
c1
d1
d2
d3
e1
e2
e3
f1
f2
f3
g1
h1
h2
i1
i2
j1
j2
j3
k1
k2
k3
Other
Burn Regeneration
NMC - cutbank
NMB - burn recent
BU_CC - burned clearcut
BU - Burn
Shrubland
CL - clearing
Meadow
NWF - Flooded
NWL - Lake
NWR - River
Disturbance
AII - industrial / plant site
CIW - well pad
AIG - borrow pit
CIP - pipeline
CC - clearcut
AIH - road/cutline/trail
N
a
b
c
1:110,000
0 0.5 1 2 3 4 5 km
NAD 83 UTM Zone 12
Project Location
Legend
North American Vegetation RSA
North American Vegetation LSA
North American Lease
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Project Footprint
Title:
FOOTPRINT IN THE LSA
NORTH AMERICAN OIL SANDS CORPORATION
Approved: LM/PB
Revision Date: July 9, 2007
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_LSA_B.mxd
Drawn by: TG
Checked: LM
Fig. No.: 10.6-1b

440000 445000 450000 455000 460000 465000

6200000 6195000 6190000 6185000 6180000 6175000 6170000

Rg. 13 Rg. 12 Rg. 11 Twp

Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76

House River House River House River

Christina River

Lower Boreal Highlands

Base Lake Thornbury Lake

Legend

Ecophase

a1 b1 b2 b3 b4 c1 d1 d2 d3 e1 e2 e3 f1 f2 f3 g1 h1 h2 i1 i2 j1 j2 j3 k1 k2 k3

Other

Burn Regeneration
NMC - cutbank
NMB - burn recent
BU_CC - burned clearcut
BU - Burn
Shrubland
CL - clearing
Meadow
NWF - Flooded
NWL - Lake
NWR - River

Disturbance

AII - industrial / plant site
CIW - well pad
AIG - borrow pit
CIP - pipeline
CC - clearcut
AIH - road/cutline/trail

b c a

1:110,000

0 0.5 1 2 3 4 5 km

NAD 83 UTM Zone 12

Project Location

Legend

North American Vegetation RSA
North American Vegetation LSA
North American Lease
Major Road (Hwy. 63)
Road (881)
Rivers
Lake
Twp. Rg. Lines
Project Footprint

Title:

FOOTPRINT IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 9, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_LSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.6-1c

Ground Cover Classes

- Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)
- Closed Aspen, Balsam Poplar and/or Birch
- Closed Coniferous and Deciduous Cover (40-60%)
- Closed Pine
- Closed Se/Sw
- Closed Upland Shrub
- Cloud / Haze
- Exposed Soil
- Graminoid (grasses/sedges/forbs) dominated burn
- Graminoid (grasses/sedges/forbs) dominated clear-cut
- Graminoid Wetlands (sedges/grasses/forbs) (<6% tree cover) (<25% shrub)
- Lake, pond, reservoir, river and stream
- Major roads, highway and railways
- Mixed Grassland
- New Burn
- Open Pine
- Rock, Talus, and/or Avalanche Chute
- Shadow
- Shrubby Wetlands (willow and birch)
- Tree/shrub dominated burn
- Undifferentiated burn

430000 440000 450000 460000 470000 480000 490000 500000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000 6150000

Rg. 11 Rg. 10 Rg. 9 Rg. 8 Rg. 7

Twp. 84 Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75 Twp. 74

Central Mixedwood
Lower Boreal Highlands

Hangingstone Creek
Sweetheart Lake
Bulldog Lake
Pushup Lake
Chain Lakes
Ooho Lake
Horse River
Christina River
Egg Lake
Mariana Lake
Crazy Lake
Kinosis Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Base Lake
Thornbury Lake
Jackfish River
Conklin
Christina Lake
Caribou Lake
Wappau Lake
Steepbank Lake
Little Fish Lake
Goodwin Lake
Rat Lake
Wiau Lake
Edwards Lake
Glover Lake

1:300,000
0 1 2 4 6 8 10 12 km
NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines
- Project Footprint

Title:

FOOTPRINT IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 9, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_RSA.mxd

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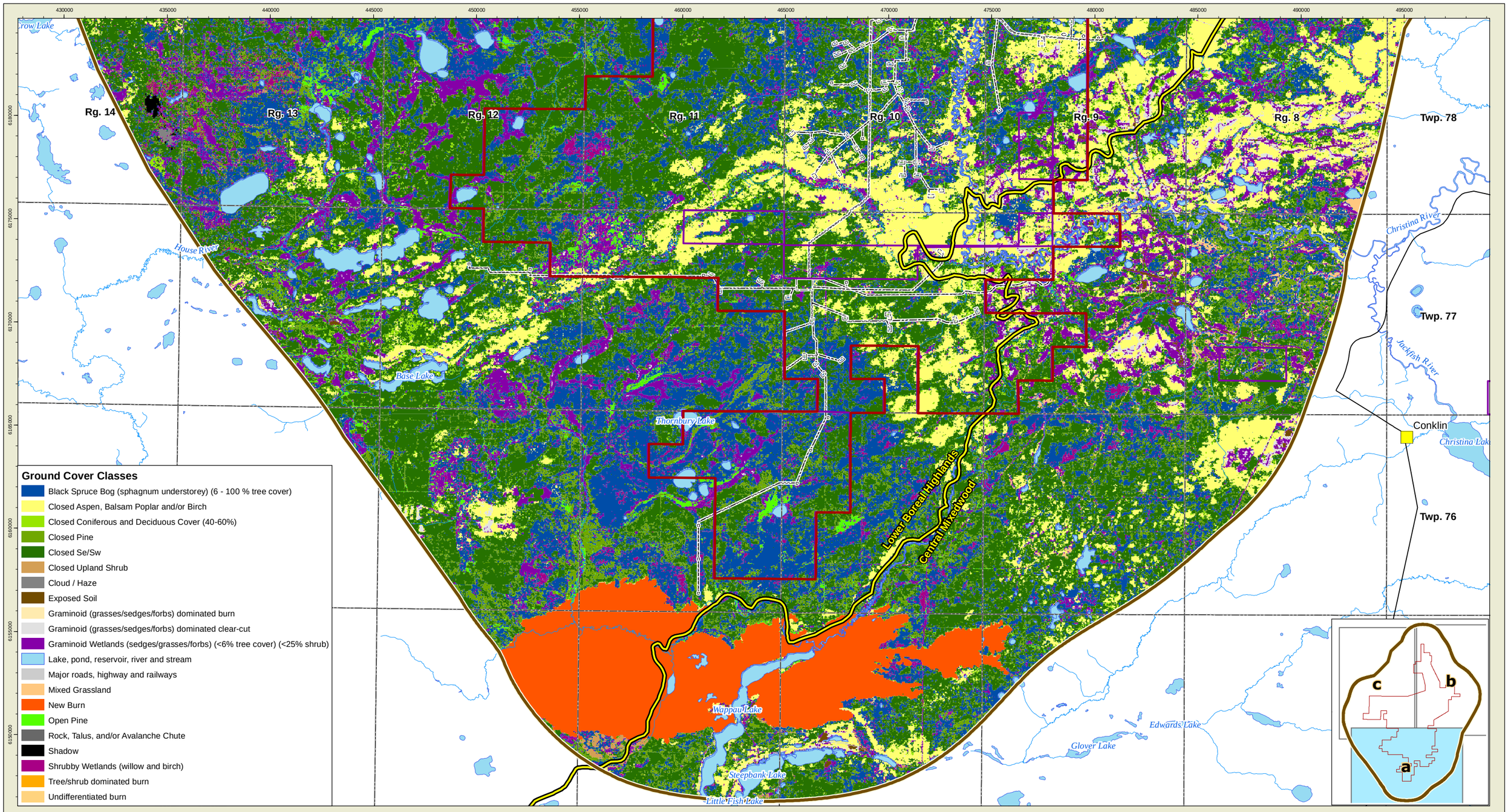

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines
- Project Footprint

1:175,000

0 1 2 4 6 8 km

NAD 83 UTM Zone 12

N

Title:

FOOTPRINT IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved: LM/PB	Revision Date: July 9, 2007
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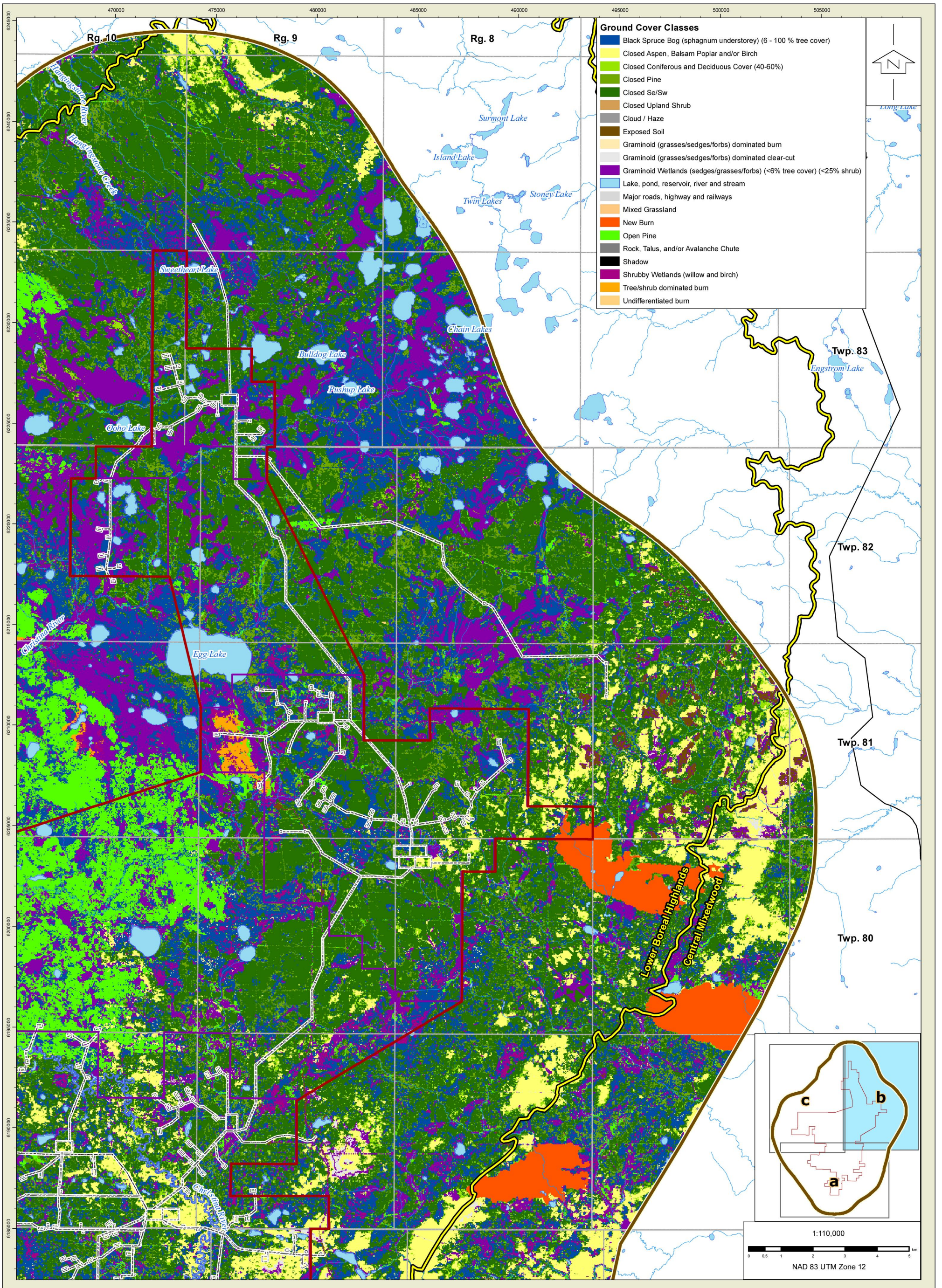
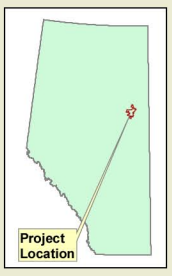
Drawn by: TG	Checked: LM
	Fig. No.: 10.6-2a





Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines
- Project Footprint

Title:

FOOTPRINT IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

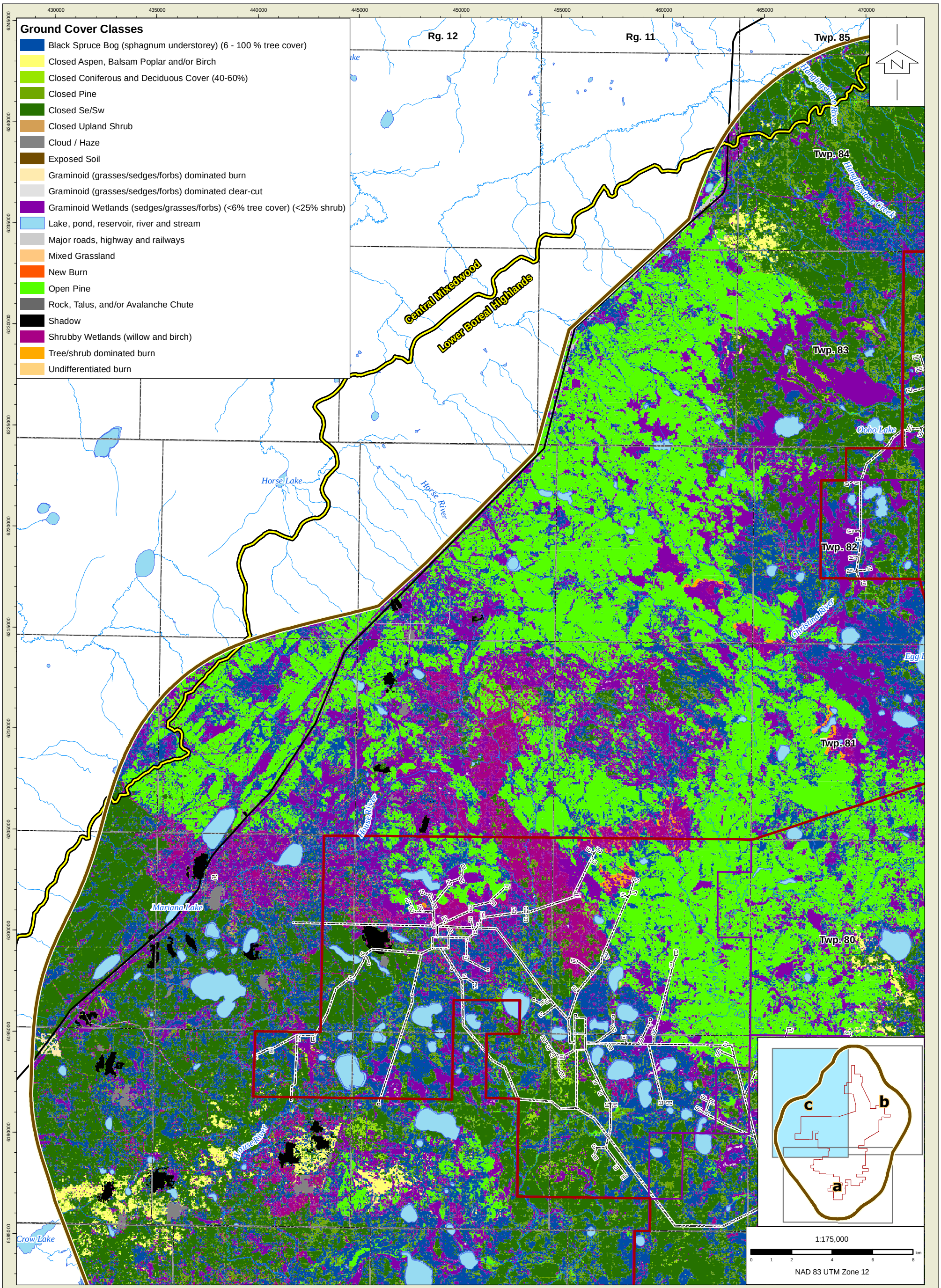
Approved:	Revision Date:
LM/PB	July 9, 2007

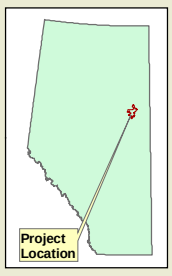
File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_RSA_B.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.6-2b

Ground Cover Classes

- Black Spruce Bog (sphagnum understorey) (6 - 100 % tree cover)
- Closed Aspen, Balsam Poplar and/or Birch
- Closed Coniferous and Deciduous Cover (40-60%)
- Closed Pine
- Closed Se/Sw
- Closed Upland Shrub
- Cloud / Haze
- Exposed Soil
- Graminoid (grasses/sedges/forbs) dominated burn
- Graminoid (grasses/sedges/forbs) dominated clear-cut
- Graminoid Wetlands (sedges/grasses/forbs) (<6% tree cover) (<25% shrub)
- Lake, pond, reservoir, river and stream
- Major roads, highway and railways
- Mixed Grassland
- New Burn
- Open Pine
- Rock, Talus, and/or Avalanche Chute
- Shadow
- Shrubby Wetlands (willow and birch)
- Tree/shrub dominated burn
- Undifferentiated burn





Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines
- Project Footprint

Title:

FOOTPRINT IN THE RSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 9, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\Footprint_in_the_RSA_C.mxd

Drawn by:	Checked:	Fig. No.:
TG	LM	10.6-2c

440000 450000 460000 470000 480000 490000

6240000 6230000 6220000 6210000 6200000 6190000 6180000 6170000 6160000

Rg. 13 Rg. 12 Rg. 11 Rg. 10 Rg. 9 Rg. 8

Twp. 83 Twp. 82 Twp. 81 Twp. 80 Twp. 79 Twp. 78 Twp. 77 Twp. 76 Twp. 75

Horse River
Central Mixedwood
Lower Boreal Highlands
Horse Lake
Surmont Lake
Island Lake
Twin Lakes
Stoney Lake
Sweetheart Lake
Chain Lakes
Bulldog Lake
Pushup Lake
Ooho Lake
Egg Lake
Christina River
Jackfish River
Thornbury Lake
Wappau Lake
Conklin

Legend

Ecophase

- a1
- b1
- b2
- b3
- b4
- c1
- d1
- d2
- d3
- e1
- e2
- e3
- f1
- f2
- f3
- g1
- g1 / transit
- h1
- h2
- i1
- i2
- j1
- j2
- j3
- k1
- k2
- k3

Other

- Burn Regeneration
- NMC - cutbank
- NMB - burn recent
- BU_CC - burned clearcut
- BU - Burn
- Shrubland
- CL - clearing
- Meadow
- NWF - Flooded
- NWL - Lake
- NWR - River

Disturbance

- AII - industrial / plant site
- CIW - well pad
- AIG - borrow pit
- CIP - pipeline
- CC - clearcut
- AIH - road/cutline/trail

1:250,000

0 1 2 4 6 8 10 km

NAD 83 UTM Zone 12

Project Location

Legend

- North American Vegetation RSA
- North American Vegetation LSA
- North American Lease
- Natural Subregions
- Major Road (Hwy. 63)
- Road (881)
- Rivers
- Lake
- Twp. Rg. Lines

Title:

ELC CLOSURE SCENARIO IN THE LSA

NORTH AMERICAN OIL SANDS CORPORATION

Approved:	Revision Date:
LM/PB	July 9, 2007

File: N:\PROJECTS\63200000\ArcView\MXD\Vegetation\ELC_Closure_LSA.mxd

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TG	LM	10.6-3