VEGETATION

Fort McKay
Specific Assessment

Fort McKay
Industry Relations Corporation

March 2010

Contents

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Appendices

7.0 Vegetation

7.1 Fort McKay Concerns Related to Vegetation

Fort McKay has existed on their Traditional Lands for generations and the Community places great value on the land and all that the land supports. Fort McKay has major concerns associated with the "loss of land" due the development of numerous large oil sands operations on the Community's traditional lands.

Vegetation was selected as a (valued) component for the Fort McKay Specific Assessment because vegetated landscapes are a critical component of the "land" that contribute to and support Fort McKay's cultural values such as tradition, self-reliance, self-determination, cohesion, rootedness, peace, connectedness and purpose (HEG 2009, Fort McKay IRC 2010a). Vegetated landscapes, consisting of both uplands and wetlands, provide the land base on which the Community of Fort McKay undertakes traditional activities such as hunting, trapping, fishing, and the gathering of plants for food and medicine. These landscapes are also intrinsic to the raising of children and education of community members. Accessible and healthy land is vital to Fort McKay's ability to sustain its values. Further discussion on the links between the vegetation and community values is found in Section 7.2.

Plants and vegetated ecosystems contribute to biodiversity and can be used as indicators of ecosystem health. Vegetated landscapes are an important component of wildlife habitat and the hydrologic system. Community members feel that industrial development within Fort McKay's Traditional Lands has been adversely affecting the amount and quality of land, including plants and ecosystems. A substantial amount of development has occurred within Fort McKay's Traditional Lands since the late 1990s. There is concern that the adverse effects will increase as development continues to proceed. Fort McKay community members have consistently expressed concerns about the impacts of these developments on the land, air and water (Healing the Earth Strategy, Fort McKay IRC 2010b). They have also expressed the need to assess effects based on conditions that existed in the 1960s prior to industrial development in the Fort McKay's Traditional Lands.

The purpose of this assessment is to predict the potential environmental effects of Shell Canada Limited's (Shell's) proposed Jackpine Mine Expansion and Pierre River Mine Project(s) on vegetation (land) resources with respect to the Community of Fort McKay.

7.2 Fort McKay Specific Assessment Approach to Vegetation

7.2.1 Introduction

Fort McKay has seen large tracts of their traditional land be developed by oil sands operators, beginning in the 1960s. The Community considers the condition of the land prior to any development as an important baseline to which all effects of development should be compared. In addition to measuring effects of the Projects on the vegetation resources that exist at the time of project application (i.e., Shell's Base Case) this assessment has been structured to compare the Jackpine Mine Expansion and Pierre River Mine applications with conditions that existed prior to the industrial development of oil sands. Information about the vegetation that existed prior to 1960 is not available in the same format and detail as is available for most subsequent time intervals that are included in this assessment. This more generalized vegetation information is also all that is available for the time intervals that project the future conditions. These data constraints limit some of the aspects of the vegetation assessment but efforts have been made to accommodate these constraints.

While Fort McKay's Traditional Lands extend beyond the present area of oil sands development, the majority of this development occurs close to the Community of Fort McKay and the Athabasca River. A Forty Township Study Area (FTSA), that includes the two proposed mine areas and the Community of Fort McKay, has been used in this assessment. This 379,641 hectare (ha) study area straddles the Athabasca River and includes the lower portions of the MacKay River, Ells River, Joslyn Creek, Tar River, Calumet River, Pierre River, Asphalt Creek, Gymundson Creek, Big Creek, Firebag River, Fort Creek and Muskeg River watersheds. As a result, the FTSA study area encompasses many areas of high value and use by Fort McKay (Healing the Earth Strategy, Fort McKay IRC 2010b).

Fort McKay requested that Shell provide ecosite phase and wetland types mapping and associated data as well as interpretations for key vegetation indicators for the FTSA. The FTSA is intended to provide detailed vegetation information for land centered on the Community of Fort McKay for use in the assessment of the effects of the proposed Projects on vegetation. Mapping and data for this FTSA has been prepared in two formats:

- AVI based mapping, similar to that prepared for the Proposed Project(s) Local Study Areas (LSAs); and
- Landsat based mapping (using broad ecological land cover types) as per the Regional Study Area (RSA) mapping. Additional discussion of the data is provided in Section 8.3.3 (Data Sources and Limitations).

Several scenarios have been used to present and analyze vegetation data for the FTSA (Table 7-1).

Table 7-1: Assessment Scenario/Cases and Data Availability

Scenario/Case	AVI Format (Ecosite Phase and Wetland Classes)	Regional Ecological Land Cover Classification (Landsat)
Pre-Development Scenario	no	yes
Late 1990s Scenario[1]	yes	no
Base Case[2]	yes	yes
Base Case + Jackpine Mine Expansion	yes	yes
Base Case + Pierre River Mine	yes	yes
Application Case (both mines)	yes	yes
Application Case-closure	yes	yes
Planned Development Case (PDC)	no	yes
Planned development Case-closure (far future)	no	yes

Note:
[1]The Late 1990s Scenario is intended as a surrogate for pre-development for data presented and analyzed in the AVI format.
[2] Fort McKay's intent was to analyze a Current Scenario (approximately 2007) as well as a Pre-Development and this has been done for other components of this assessment (e.g., air quality, cultural heritage). However, Current Case vegetation mapping was not available. Base Case is the closest case to the current situation since it includes current disturbances plus approved (but not yet developed) projects.

The Pre-Development Scenario represents conditions prior to the occurrence of industrial development and is based on the condition of vegetation resources in the 1960s. It was prepared in the regional ecological land cover (ELC) data format based on Landsat data. It was not possible for Shell to develop AVI mapping (ecosite phase and wetland) for the Pre-Development Case for the FTSA due to time constraints, and lack of data from that period.

The Late 1990s Scenario is a presentation of vegetation cover in the AVI data format as it existed in the late 1990s. This scenario was developed for the FTSA as a surrogate for pre-development. It represents vegetation conditions before a number of the newer mines were created; however, Syncrude's Mildred Lake and Aurora North, Suncor (Fee Lot 2 and Lease 86/17) and a number of other disturbances (i.e., roads, pipelines, cutlines, sawmills and wellsites) were developed by this time.

The Base Case represents vegetation cover at the time of assessment (2007) for the Pierre River and Jackpine Mine Expansion and includes all existing and approved development up to that point in time. Application cases consider the Base Case conditions plus the development associated with each of the mines individually as well as together (the Projects); the data for the Base Case plus each of the individual mines is presented in the tables but is generally not discussed in the text. The Application Case-closure represents vegetation cover as it proposed after reclamation and closure has been completed for the Projects.

The Planned Development Case represents vegetation cover in the study area assuming that all planned and approved projects have been developed (i.e., projects are cleared and operating) at that point in time. Planned Development Case-closure represents the conditions that are expected in the study area after all projects have been reclaimed. Mapping and data in the Planned Development Case and Planned Development Case-closure are based on regional land cover mapping and future cases are based on non-spatial data from Conservation and Reclamation Plans.

7.2.2 Potential Impacts to Vegetation

Many of the Community's core values are intrinsically linked to the land and the availability of land to carry out traditional activities. Fort McKay's approach to assessing vegetation considered the effects of the Projects on the following key components of the land and associated indicators:

- ***Effects to upland forest and terrestrial communities***—the assessment considered the direct loss of upland forest (i.e., abundance and distribution of terrestrial ecosystems) due to clearing of vegetation and stripping of soil. Where possible, the effects on other indicators such as riparian areas, old growth, productive forest, and rare plant potential associated with upland forest are presented.
- ***Effects to wetland vegetation and vegetation communities***—the assessment considered the direct loss of wetlands (i.e., abundance and distribution of wetland ecosystems) due to the clearing and stripping of wetlands. Where possible, the effects to other indicators such as riparian areas, old growth, productive forest, and rare plant potential associated with wetlands are discussed.
- ***Effects to traditional plants***—the assessment considered the loss of traditional plant potential due to the clearing and stripping of land and the consequences to individual species or groups of species.

7.2.3 Data Sources, Types and Limitations

7.2.3.1 Sources

Data used in this assessment has been provided by two principal sources. Shell provided specific environmental data for the FTSA to Fort McKay (as prepared by Golder Associates Limited 2009). This environmental data is based (in part) on information presented in the *Application for Approval of the Jackpine Mine Expansion and Pierre River Mine Project* (Shell 2007). Fort McKay has also used data and information directly from Shell's Jackpine Mine Expansion and Pierre River EIA and Application in this specific assessment.

Ducks Unlimited Canada provided wetland classification and mapping data to Fort McKay for use in this assessment. This data consisted of a subset of their *Enhanced Wetland Classification for the Al-Pac Boreal Conservation Project* (Ducks Unlimited

2008) for the Fort McKay FTSA. Fort MacKay has used these data to identify and quantify impacts to wetlands and selected traditional use species in the FTSA.

7.2.3.2 Data Types

Terrestrial Vegetation, Wetlands and Forest Resources data have been presented and assessed in the *Application for Approval of the Jackpine Mine Expansion and Pierre River Mine Project* (Shell 2007). At the local scale for the Application, Alberta Vegetation Inventory (AVI) data was used in preparation of the ecological land cover classification and mapping within the local study areas (LSAs). A total of 56 land cover classes were mapped in the LSAs for the 2007 Application including 29 upland ecosites phases, 18 wetland classes, four miscellaneous vegetation types, three non-vegetated types and two disturbances types.

Terrestrial vegetation and wetlands were also mapped for a regional study area (RSA) in the 2007 Project Application (Shell 2007). This ecological land cover mapping was developed using a combination of satellite imagery and GIS/remote sensing software. A total of 13 land cover classes that belong to four broad groups were mapped in the RSA: terrestrial vegetation (six classes), wetlands (three classes), miscellaneous cover types (two classes) and disturbances (two classes).

Fundamental differences between these two data sets make comparisons between the data or between certain scenarios/cases very difficult. For instance, three classes of wetlands are differentiated using the regional ecological land classification. These three classes all contain some fen classes as identified in the more detailed AVI data. As a result it is not possible to determine how much of any particular wetland type (i.e., fen, bog, swamp or marsh) is present for any of the scenarios/cases that are only represented by this type of regional classification (i.e., Pre-Development Scenario or PDC).

A complete description of the data and methods used in preparation of the LSA and RSA ecological land cover mapping used for the 2007 Application is provided in the *Terrestrial Vegetation, Wetlands and Forest Resources Environmental Setting for the Jackpine Mine Expansion and Pierre Rive Mine Project* (Golder 2007).

In addition to the original LSAs and RSA formats used and presented in the 2007 Application, vegetation (terrestrial uplands and wetlands) data analysis and mapping have been prepared by Shell for the FTSA at the request of Fort McKay for use in this specific assessment (Golder 2009).

7.2.3.3 Data Limitations

Cumulative and incremental impacts—lack of pre-development data for vegetation resources in the Fort McKay traditional territory for use in assessment of potential regional effects of industrial development has been a concern to Fort McKay. In previous reviews of oil sands project environmental impact assessments (EIAs), Fort McKay observed that the use of different classification systems presented in

LSAs and RSAs makes comparisons between local and regional effects difficult. In many cases, the negative effects predicted at the LSA (i.e., rare plants, loss of rare and/or special plant communities, wetlands) are not observed at the regional scale, in part, because of the difference in resolution of the land classification systems. Information is lost or masked when ecosite and wetland classes used in the LSA are lumped into broader ecological land cover categories used in the RSA analysis. For example, a comparison of the effects on various wetland types delineated in the LSA (i.e., fens, bogs, swamps, marshes) cannot be made in the RSA.

The effects can also be minimized due to the large size of the RSAs used in the oil sands EIAs. Fort McKay has noted that the cumulative assessment completed for oil sands project EIA's consider Baseline to be the date of initiation of a project (including current disturbances and approved projects) and not conditions in Fort McKay's Traditional Lands prior to industrial development. The FTSA is intended to provide detailed vegetation (AVI data) information for a block of land centered on the Community of Fort McKay and the proposed Projects. Mapping and data for this FTSA has been prepared in two formats: AVI based mapping, similar to that prepared for the Projects LSAs and Landsat based mapping (using broad ecological land cover types) as per the RSA mapping. Preparation and use of detailed mapping for some scenarios/cases in the FTSA has assisted with the assessment of these Projects on the Community.

Effects thresholds—there is a lack of regional criteria and/or thresholds for measuring the effects associated with development on key vegetation indicators. Regional criteria should be developed/established. Clearing of vegetation and stripping of soils is the most visible direct impact to vegetation but vegetation cover also relates to other resources such as wildlife habitat and hydrology.

Modeling—the relationships between ecological land cover class (regional or ecosites phases and wetlands types) and indicators such as traditional plants is often difficult to express. Assessing the potential effects of development on specific indicators such as rare plants or traditional use plants necessitates the use of models. The subsequent grouping of multiple parameters into classes based on potential (i.e., high, moderate and low potential) is generally required to spatially assess the impacts of development as it is difficult to assess numerous individual species. However, this process leads to the use of subjective decision-making in modeling the distribution of indicators such as traditional plant potential. For instance, should abundance (based on high frequency of occurrence and cover of individual species) be weighed greater than rarity?

Significance interpretations—use of numeric scoring to rate factors such as magnitude, duration, geographic extent, reversibility, and frequency of effects and summing for overall score is subjective. These overall scores must then be assessed as low, moderate or high consequence and as significant or not significant. Lack of thresholds makes assessment of effects more difficult and subjective.

Reclamation uncertainty—mitigation for effects to vegetation resources is typically provided through reclamation. Unless otherwise noted, the assessment of effects to vegetation indicators in the Application Case-closure is based on Shell's assumption that reclamation will be successful in creating the ecosites and wetlands as documented in the C,C&R Plan (Shell, 2007) or in the Planned Development Case-closure using plans developed for all other existing and approved projects within the FTSA. Because upland sites can be created with reclamation the effects to upland vegetation resources are considered reversible. Shell's assumption of reversibility is also dependent on the ability of these sites to restore "equivalent capability". Historically, in the oil sands region, reclamation success for forested ecosystems has been narrowly defined as restoring equivalent forest productivity; measurement of success for other end land uses (wildlife, traditional use) or values (rare plant potential) is not presently defined. Assessment for many of the indictors also assumes that mitigation/reclamation will restore equivalent ecosystems or vegetation assemblages that can provide the full range of functions (i.e., diversity, potential for rare plants or traditional plants, structure, habitat). There is uncertainty with respect to the ability of reclamation to restore full function including diversity/abundance of traditional use plants. In addition, no technology is presently available to restore organic wetlands (muskeg; see ***Section 10 – Reclamation***). As a result, the effects of disturbance to wetlands, especially peatlands, are considered irreversible.

The effects to some vegetation indicators are considered partially reversible in this assessment. For example, the effect of disturbance on certain rare plant classes which contain a mixture of upland and wetland ecosystems, are considered as partially reversible because reclamation cannot mitigate for the loss of the wetland component. Uncertainty also exists around the time that will be required to develop and restore equivalent structure or function on sites following reclamation activities. The timeline required to develop these attributes will vary greatly. Due to the life span of the Projects, reclamation, where effective, will not provide mitigation for disturbance of the land for a minimum of two to three generations of Fort McKay Community members.

While some of Shell's reclamation specific assumptions are used for this assessment, overall Fort McKay has many concerns about reclamation and these are discussed in detail in ***Section 10 – Reclamation***. While reclamation is necessary, Fort McKay does not consider it to be sufficient mitigation for losses to traditional resources and Fort McKay's opportunities to access those resources.

7.2.4 Vegetation Study Areas

Three study areas, consisting of two locals study areas (LSAs) and one regional study area (FTSA) were defined for the assessment of vegetation.

Mine footprints, as defined by Shell (2007), are used to define the local study areas (LSAs) for the Jackpine Mine Expansion and Pierre River Mine Projects. Total project

development area for the two mines is 21,339 ha (Shell 2007). The mine development areas (footprints) were buffered by 500 m or more to create the LSAs used in the EIA as shown in Table 7-2. Together, these two LSAs capture the area where the direct effects of the Projects on vegetation resources may be expected.

Table 7-2: LSA and Mine Development Footprints

Component	Jackpine Mine Expansion Area (ha)	Pierre River Mine Area (ha)	Total (ha)
Mine development area	10,936	10,403	21,339
Mine area with Buffered area included	18,347	21,136	39,484
Previously approved (Jackpine Phase 1)	11,156	0	11,156
Totals (LSA)	29,503	21,136	50,640

As previously noted, the FTSA is the considered as the regional area in this Fort McKay Specific Assessment. The FTSA (379,641 ha) is bounded by the following Townships: Townships 93 to 100, Ranges 8 to 12, W4M. The LSA represents about 13.3% of the land within the FTSA and approximately 2.2% of the RSA of 2,277,376 ha used by Shell (2007) in the EIA for the proposed Projects.

Three Natural Subregions of the Boreal Forest Natural Region occur within the FTSA (Downing and Pettapiece 2006):

- Athabasca Plain Natural Subregion
- Boreal Highlands Natural Subregion
- Central Mixedwood Natural Subregion

7.2.5 Vegetation Key Indicators and Receptors

Key traditional activities, which are indicators of the Community's ability to sustain its values, as identified in the CHA Baseline (Fort McKay IRC 2010), include hunting, trapping, fishing, berry picking, visiting, raising of children, education, and work for Fort McKay. Stressors that affect the Community's ability to sustain these activities include access to land, loss of land, and pollution.

Measures/indicators that can be used to measure the effects of loss of land include: area and percent of land disturbed; abundance, distribution and quality of vegetation (as identified by the CHA) grouped into upland forest and wetland (muskeg) categories. The effects of loss/disturbance can be further measured on key indicators such as ecosystems (uplands and wetlands/peatlands), riparian areas, old forest, and rare plant potential, and through measurement or analysis of landscape metrics such as heterogeneity and fragmentation (see ***Section 8 – Biodiversity***). Loss of traditional use (as related to vegetation) can be assessed by

the loss of individual species or the potential to support an assemblage of traditional use plants.

Impacts to vegetation and ecosystems can also be indirect—through alteration of drainage systems (hydrology, water quality), changes to soils, or deposition of air borne pollutants (i.e., SO_2, NO_X, NH_3 and nitrogen) or dust.

Receptors include all vegetation present in the Fort McKay's traditional lands. These receptors have been considered or assessed at the ecosystem level (i.e., change in the abundance of individual ecosite phases or wetland types) or at the landscape level (i.e., changes in the distribution and abundance of upland forest or wetlands). While a substantial amount of baseline data exists at the species level for the LSAs and FTSA, the effect of the Projects on vegetation resources at the species level is outside the scope of this assessment and is not addressed in this assessment.

7.2.6 Vegetation Assessment Criteria

Assessments of project effects on vegetation resources for EIAs commonly consider criteria such as magnitude of disturbance, geographic extent, frequency of occurrence, duration of impacts, and whether an effect is reversible (i.e., it can be reversed through some type of mitigation). As discussed above, thresholds to measure the effects of development have not been established for the oil sands region. This Fort McKay Specific Assessment uses the same criteria as were used to assess the impacts of the Project(s) in the Jackpine Mine Expansion and Pierre River Applications (Shell 2007; Table 7-3). However, some revisions were made to the rating and scoring system used for the duration and reversibility criteria to reflect Fort McKay's perspective on effects assessment. In this assessment, the FTSA has been substituted for the RSA.

As per the Shell (2007) EIA, the environmental significance (consequence) rating combines the results of the numerical score assigned to each of the impact criteria with the exception of direction, into one rating. Direction is measured as positive, negative or neutral and is not assigned a score. The rating for the component being assessed is then place in one of four categories (negligible, low, moderate and high) that describe the environmental consequence.

Fort McKay further classifies each of these environmental consequences into a green, yellow or red situation as follows:

- **Negligible**—0 to 5 (a **green** situation): generally associated with effects that are of negligible magnitude; or effects of low magnitude, local in extent and reversible.
- **Low**—6 to 10 (a **green** situation): associated with effects of low magnitude that is reversible.

Table 7-3: Criteria and Numerical Scores for Significance Assessment of Project Activities to Vegetation

Criterion	Rating	Numerical Score	Description
Direction	Positive	na	The ultimate long-term trend of the effect is positive
	Neutral	na	The ultimate long-term trend of the effect is neutral
	Negative	na	The ultimate long-term trend of the effect is adverse
Magnitude	Negligible	0	<1% change on the measurement end point
	Low	+5	<10% change in the measurement end point
	Moderate	+10	10 to 20% change in the measurement end point
	High	+15	>20% change in the measurement end point
Geographic Extent	Local	0	Effects restricted to the LSA
	Regional	+1	Effects extends beyond the LSA into the FTSA
	Beyond Regional	+2	Effects extended beyond the FTSA
Frequency	Low	0	Effect occurs only once
	Medium	+1	Effect occurs intermittently
	High	+2	Effect occurs continuously
Duration	Short-term	0	Effect is limited to <3 years
	Medium-term	+1	Effect occurs 3 to 10 years
	Long-term	+2	Effect extends 10-20 years
	Far future	+3	Effect extends for one to several generations (>20 years)
Reversibility	Irreversible	+3	Effect is not reversible over time
	Reversible	-3	Effect is reversible over time
	Partially reversible	0	Effect is only partially reversible over time

Notes:
Direction: describes the ultimate long-term trend of the effect (positive, negative or neutral).
Magnitude: describes the intensity, or severity of an effect. Definitions of magnitude are unique to the characteristics of the measured parameter or variable.
Geographical Extent: The area within which an effect of a defined magnitude occurs.
Frequency: the number of times during a project or a specific project phase that an effect may occur.
Duration: considers the length of time over which an environmental impact occurs and affects the Community of Fort McKay. It considers all phases of the Project(s) including construction, operations, reclamation and closure. It also considers the time for the environmental component to recover from the disturbance. A generation is to be considered as 20 years (Ohno 1996).
Reversibility: the likelihood that a measurable parameter will recover from an effect, including through active management techniques such as reclamation.

Source: adapted from the Introduction to EIA, Jackpine Mine Expansion and Pierre River Mine Project (Shell 2007).

- **Moderate**—11 to 15 (a **yellow** situation): associated with effects of moderate magnitude that are irreversible; or effects of low magnitude, that are local extent, irreversible and far future in duration; or effects of low magnitude, regional extent, irreversible, far future in duration.
- **High**—>15 (a **red** situation); associated with effects of moderate magnitude, local in extent, far future in duration and irreversible; moderate magnitude, regional in extent, far future duration, irreversible and of medium frequency; high magnitude, local in extent, irreversible or partially reversible and long-term or far future in duration; high magnitude and regional in extent.

A high rating is considered to be significant (a **red** situation), while a moderate rating was considered to be potentially significant (a **yellow** situation). A green situation is considered to be of low environmental consequence but may require mitigation and monitoring to ensure that it does not move into a **yellow** situation.

In general, the assessment of the effects in the Application Case-closure and Planned Development Case-closure is based on Shell's assumptions about reclamation. These include assumptions regarding the abundance (i.e., area in hectares) of ecosite phases and wetland types and the potential of these reclaimed sites to restore ecological functions in the post-closure landscape. Note that while the rating system assists in categorizing the environmental consequence and in determining significance, changes in vegetation fall along a continuum. From a practical perspective, a moderate rated yellow situation, for example, may be closer to a green situation or a red one, depending on the magnitude of the change and the particular vegetation community. Additional mitigation, management and accommodation measures may be needed for both **yellow** and **red** situations depending on the specifics of the situation.

The ratings of environmental consequence into **green**-**yellow**-**red** situation categories are specific to this Fort McKay assessment and were not used by Shell in the EIA.

7.2.7 Fort McKay's Healing the Earth Strategy

Fort McKay's Healing the Earth Strategy (HTES; Fort McKay IRC 2010) has four tenets (retain, reclaim, improve and offset) that the Community supports with regard to addressing environmental issues. Mining results in the clearing of vegetation and the alteration of the physical characteristics (i.e., parent material, soil type, drainage patterns, and nutrient pathways) that support a complex arrangement of plants and ecosystems in the landscape. Of the four tenets of the Healing the Earth Strategy, the vegetation component relies heavily on reclamation to at least partially address the direct effects associated with the loss of vegetation and ecosystems. The community of Fort McKay has consistently stated that the goal of reclamation should be to restore disturbed land to as close as possible to its original condition. This includes "replacing a diversity of plants (including medicinal

plants and berries) and re-creating wetlands, bogs and muskeg" (HTES, Fort McKay IRC 2010).

The tenants of retention and offset are important strategies to accommodate the impacts to vegetation communities that Fort McKay relies on for traditional use. However, these strategies do not negate the necessity to restore ecosystems on disturbed lands that provide a full range of uses and functions. Effects to vegetation can also be reduced if the tenant to improve practices or technologies can provide ways to reduce the direct footprint of the mines (i.e., improved tailings management or reduce the size of end pit lakes).

7.3 Upland (Forest) Impact Assessment

7.3.1 Stressors on Vegetation

The principle stressor that adversely affects vegetation resources is land disturbance (i.e., removal of vegetation and the soil that supports vegetation communities). Additional stressors include the adverse effects of air borne pollutants (i.e., SO_2, NO_X, NH_3 and nitrogen) or dust to vegetation resources. The effects of air emissions are addressed in detail in ***Section 2 – Air Quality***.

7.3.2 Fort McKay Baseline Conditions

7.3.2.1 Pre-Development Scenario

The Pre-Development Scenario is based on completion and analysis of land cover classification mapping using Landsat imagery from the 1960s for the FTSA (Figure 7-1). This case represents the condition of vegetation, as expressed by land cover classes, in the landscape prior to industrial development in this portion of Fort McKay's Traditional Lands (Figure 7-2). The only disturbances present in this scenario are forestry cutblocks and natural disturbances (i.e., burned areas).

Distribution of Upland Forest

Six terrestrial land cover classes covered approximately 158,166 ha (42%) of the land area in the Pre-Development Scenario (***Appendix 7-1, Table 1***; adapted from 5.4–24 in Golder 2009). The deciduous aspen-balsam poplar was the dominant terrestrial land cover class (13%) followed closely by the mixedwood aspen–white spruce cover class (12%). The mixedwood aspen–jackpine class was the least common.

Burns covered approximately 11% (40,061 ha) of the FTSA in the Pre-Development Scenario while water bodies occupied about 3% (9,851 ha). Disturbances such as cutblocks covered much less than 1% of the FTSA and other industrial developments were non-existent.

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
Calumet River
Lillian Lake
Calumet Lake
McClelland Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
MacKay River
Dover River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Pre-Development Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

LAND COVER CLASSES

- BURN
- CLOUDS
- CONIFEROUS JACK PINE
- CONIFEROUS JACK PINE-BLACK SPRUCE
- CONIFEROUS WHITE SPRUCE
- CUTBLOCK
- DECIDUOUS ASPEN-BALSAM POPLAR
- MIXEDWOOD ASPEN-JACK PINE
- MIXEDWOOD ASPEN-WHITE SPRUCE
- NON-TREED WETLANDS
- TREED BOG / POOR FEN
- TREED FEN

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
LAND COVER CLASSES IN THE FORT MCKAY 40 TOWNSHIP BLOCK (LANDSAT)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	AA	26 Jan. 2009	**FIGURE 7-1**	
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

I:\CLIENTS\SHELL\08-1346-0006\mapping\mxd\5722\Veg\New_Maps\rsa_lcover.mxd

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
Calumet River
Lillian Lake
Calumet Lake
McClelland Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
MacKay River
Dover River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Pre-Development Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY
- NATURAL AREA
- DISTURBANCE AREA

5 0 5
SCALE 1:250,000 KILOMETRES

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
NATURAL AND HUMAN DISTURBED AREAS IN THE FORT MCKAY 40 TOWNSHIP BLOCK (LANDSAT)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009	**FIGURE 7-2**	
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

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Old Growth

Old growth is estimated to have covered about 18% of the FTSA in the Pre-Development Scenario (***Appendix 7-1, Table 2***; Table 5.4–20 in Golder 2009). This estimate is based on the assumption that old growth occupied the mid-range of the area that is typical for each of the regional ecological land cover types in the subregions. Upland forest cover types are estimated to have covered about 11% (41,917 ha) of the FTSA.

Timber Productive Forest

Pre-Development Scenario productive and unproductive forests in the FTSA are shown in Figure 7-3. Productive forests are estimated to have covered about 42% (158,168 ha) of the FTSA in the 1960s (***Appendix 7-1, Table 3***; Table 5.4–21 in Golder 2009). The data, as presented in Table 3, do not differentiate productivity between upland and wetland forest types; however, based on AVI data for productive forests, the majority of this productive forest in the Pre-Development Scenario would be upland forest.

Riparian Areas

Upland forest located on riparian sites occupied about 6% (22,282 ha) of the FTSA in the 1960s (***Appendix 7-1, Table 4***; Table 5.4–18 in Golder 2009).

Rare Plant Potential

Pre-Development rare plant potential in the FTSA is shown in Figure 7-4. Rare plant potential for the land cover classes used in the Pre-Development Scenario are based on the correlation of LSA units (ecosite phase and wetland type) to the regional land cover classes used in the Shell Application 2007. No forested ecological land cover classes have been ranked with high rare plant potential in the FTSA. Moderate ranked sites largely consist of upland classes although burns, which are ranked as having moderate potential, may also occur in wetlands. Low ranked sites include three terrestrial land cover classes along with disturbances and water. Upland land cover classes with moderate and low rare plant potential occupy about 14% and 29% of the FTSA, respectively (***Appendix 7-1, Table 5***; from 5.4–22 in Golder 2009).

7.3.2.2 Late 1990s Scenario

The Late 1990s Scenario is based on AVI (ecosite) mapping equivalent to that used for mapping vegetation in the two local study areas in the Jackpine Mine Expansion and Pierre River Mine Project (Shell 2007; Figure 7-5). The Late 1990s Scenario is intended as a surrogate for pre-development for data presented and analyzed in the AVI format. Human and natural disturbances in the FTSA for the Late 1990s Scenario are shown in Figure 7-6.

Distribution of Upland Forest

About 53% (200,270 ha) of the FTSA is occupied by upland ecosites in the Late 1990s Scenario (***Appendix 7-1, Table 6***; from 5.4–9 in Golder 2009). The a1 ecosite (bearberry jack pine) is the most abundant upland ecosite phase in the Athabasca Plains subregion portion of the FTSA; it occupies about 10% of the total FTSA. The d1 ecosite phase (low-bush cranberry aspen) is most abundant in the Central Mixedwood Natural Subregion—it occupies about 12% of the FTSA; next most common is the d2 ecosite phase (low-bush cranberry aspen-white spruce; 6%). Three upland ecosite phases, the d1, b2, and b1, each occupy about 1% of the FTSA within Boreal Highlands Subregion.

Old Growth

About 90% (34,137 ha) of the old growth found in the FTSA in the Late 1900's Scenario is associated with upland sites. In the Late 1990's Scenario, old growth upland forest covered about 9% of the total FTSA (***Appendix 7-1, Table 7***; from Table 5.4–10 in Golder 2009). The majority of the old growth is found in b and d ecosites phases.

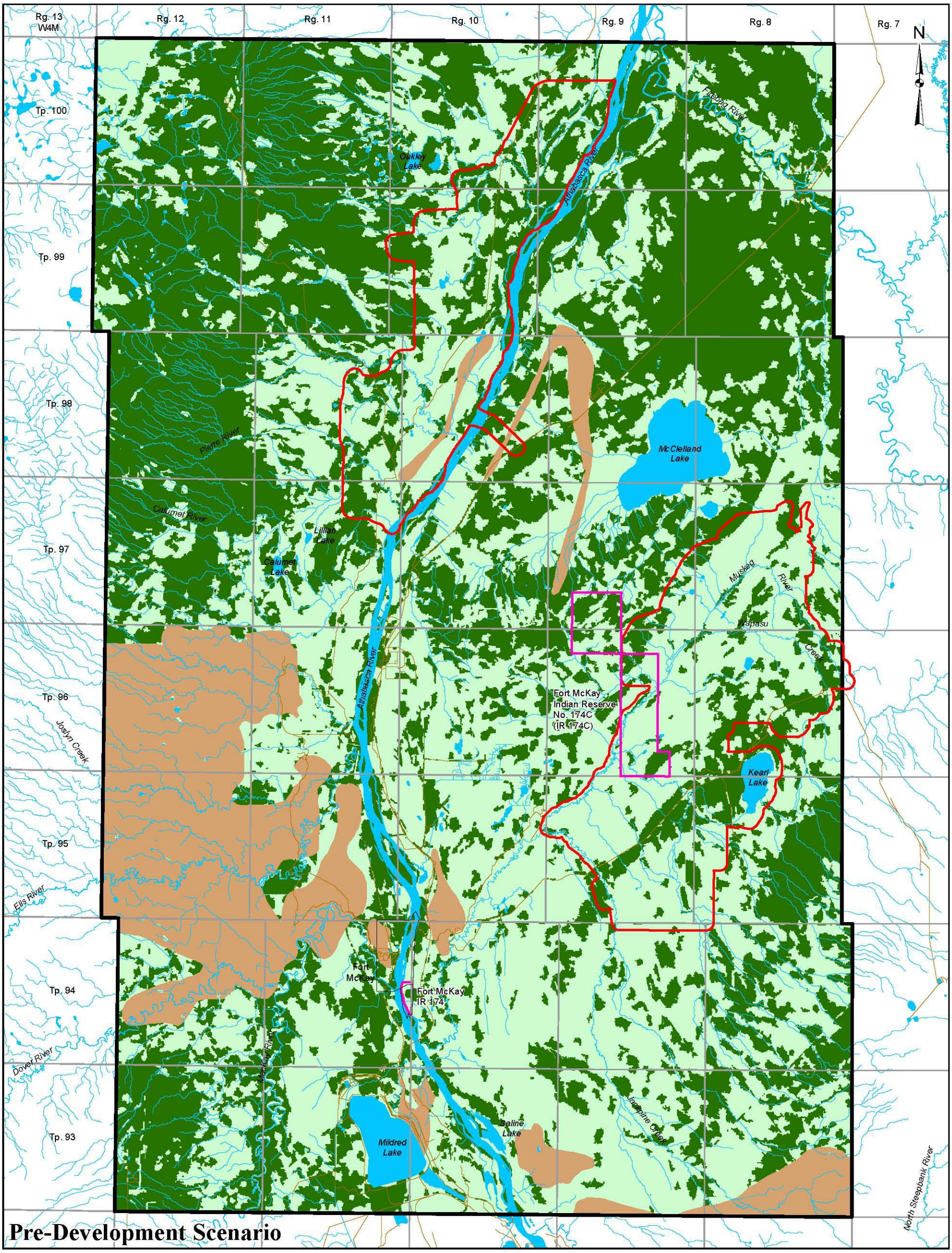
Timber Productive Forest

Forest productivity in the FTSA is shown in Figure 7-7. Approximately 52% (197,469 ha) of the FTSA supported timber productive forest stands in the Late 1990s Scenario (***Appendix 7-1, Table 8***; Table 5.4–4 in Golder 2009). The majority of this area (97%) is assumed to be upland forest as only one wetland class (STNN) mapped in the FTSA is considered to be timber productive. The majority of the timber productive areas were in the mature stage in the late 1990s.

Land supporting timber productive forest has been further rated as having good, medium or fair productivity. Areas of good and fair productivity are about equal in extent and occupy 24% and 25% of the FTSA, respectively, and the majority (46.3% and 48.7%) of the productive, largely upland forest.

Riparian Areas

Riparian areas are considered as the interface between upland and aquatic habitats. They consist of vegetated ecosystems that border waterbodies such as rivers, streams, lakes and ponds. The area of these ecosystems found within 100 m of a waterbodies and watercourses has been included in the totals for this assessment. Riparian areas in the FTSA are shown in Figure 7-8.



LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

FOREST PRODUCTIVITY

- YES
- NO
- BURN

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
PRODUCTIVE AND UNPRODUCTIVE FORESTS IN THE FORT MCKAY 40 TOWNSHIP BLOCK (LANDSAT)

		PROJECT No. 08-1346-0006.5722	SCALE AS SHOWN	REV. 0
	DESIGN	AA	26 Jan. 2009	
	GIS	JH	26 Jan. 2009	
	CHECK	MJ	27 Feb. 2009	**FIGURE 7-3**
	REVIEW	TC	02 Mar. 2009	

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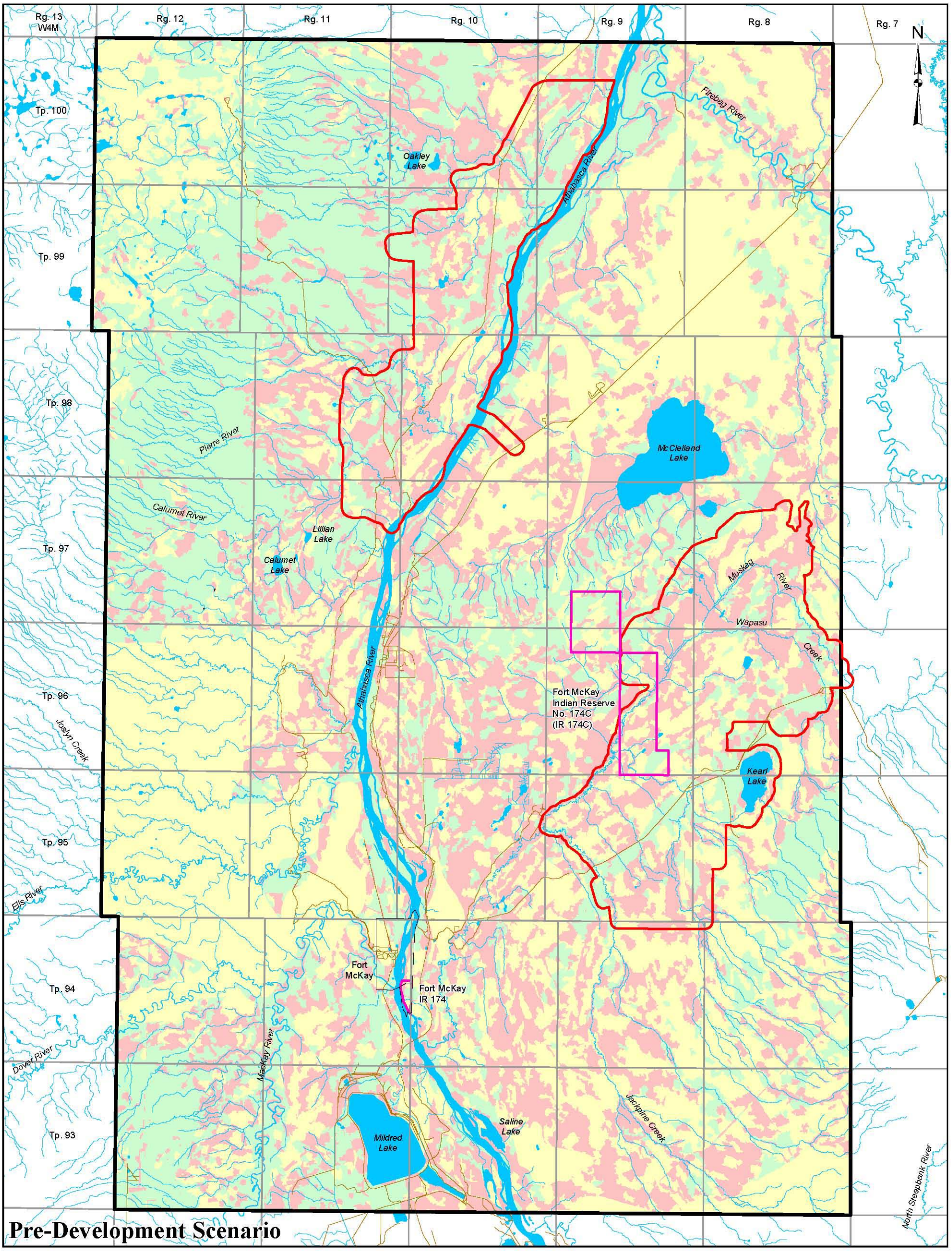

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

RARE PLANT POTENTIAL

- HIGH
- MODERATE
- LOW

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5

SCALE 1:250,000 KILOMETRES

PROJECT

JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE

RARE PLANT POTENTIAL IN THE FORT MCKAY 40 TOWNSHIP BLOCK (LANDSAT)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	AA	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009	**FIGURE 7-4**	
REVIEW	TC	02 Mar. 2009		

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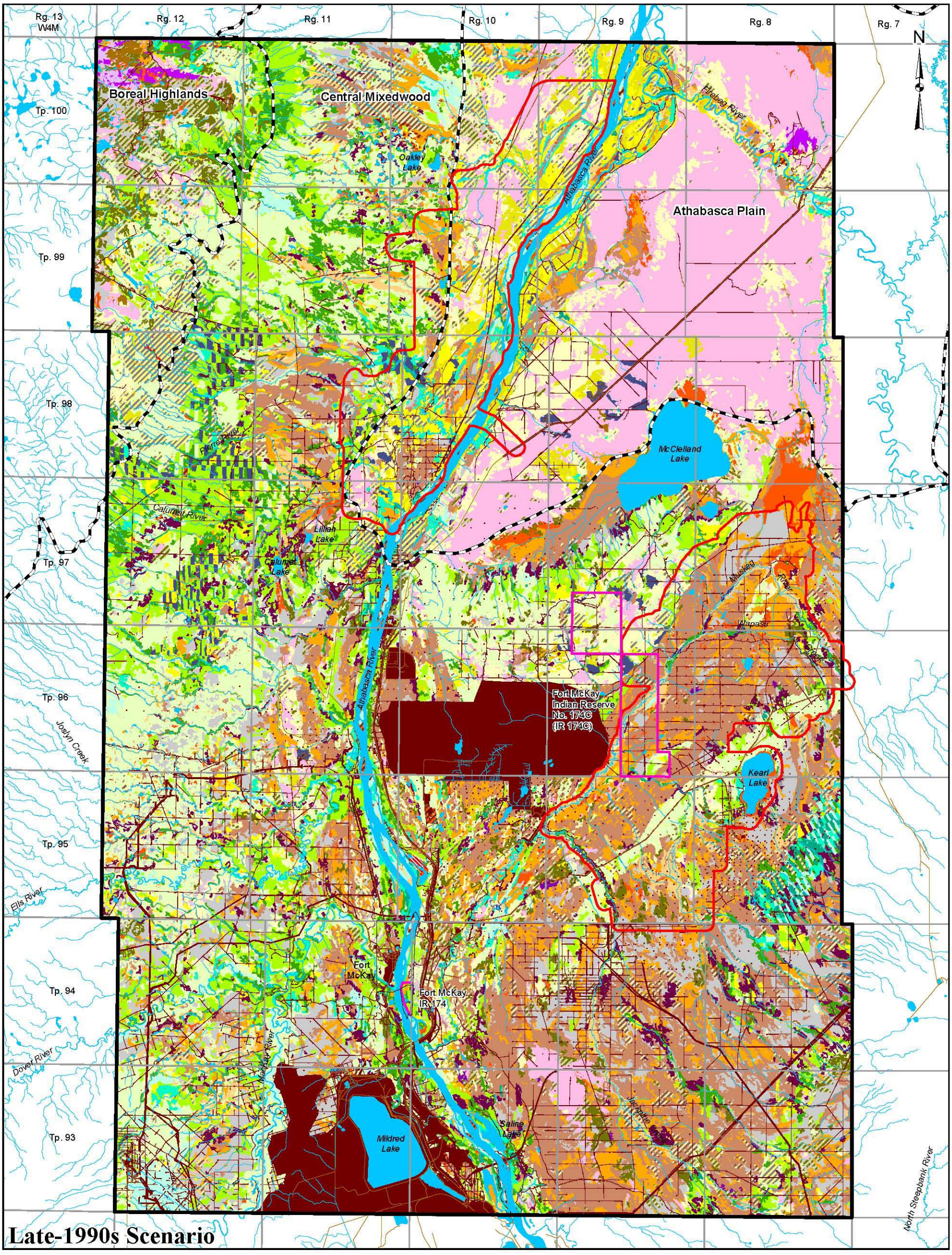

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- NATURAL SUBREGION
- OPEN WATER
- PUBLIC ROADWAY

ECOSITE PHASES

a1, b1, b2, b3, b4, c1, d1, d2, d3, e1, e2, e3, g1, h1

WETLANDS TYPES

BFNN, BTNN, FFNN, FONG, FONS, FTNN, MONG, SONS

OTHER

STNN, WONN, BUu, BUw, CUTBANK, CUTBLOCK, MEADOW (Me), Pj-Lt Complex, SHRUBLAND (Sh), SAND

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

Note: Refer to Table 5.4-9 for ecosite phases and wetlands types descriptions. Ecosite phases do not correspond across natural subregions, but are merged here for mapping simplification.

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
ECOSITE PHASES AND WETLANDS TYPES IN THE FORT McKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722		SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009	
GIS	JH	26 Jan. 2009	FIGURE 7-5
CHECK	MJ	27 Feb. 2009	
REVIEW	TC	02 Mar. 2009	

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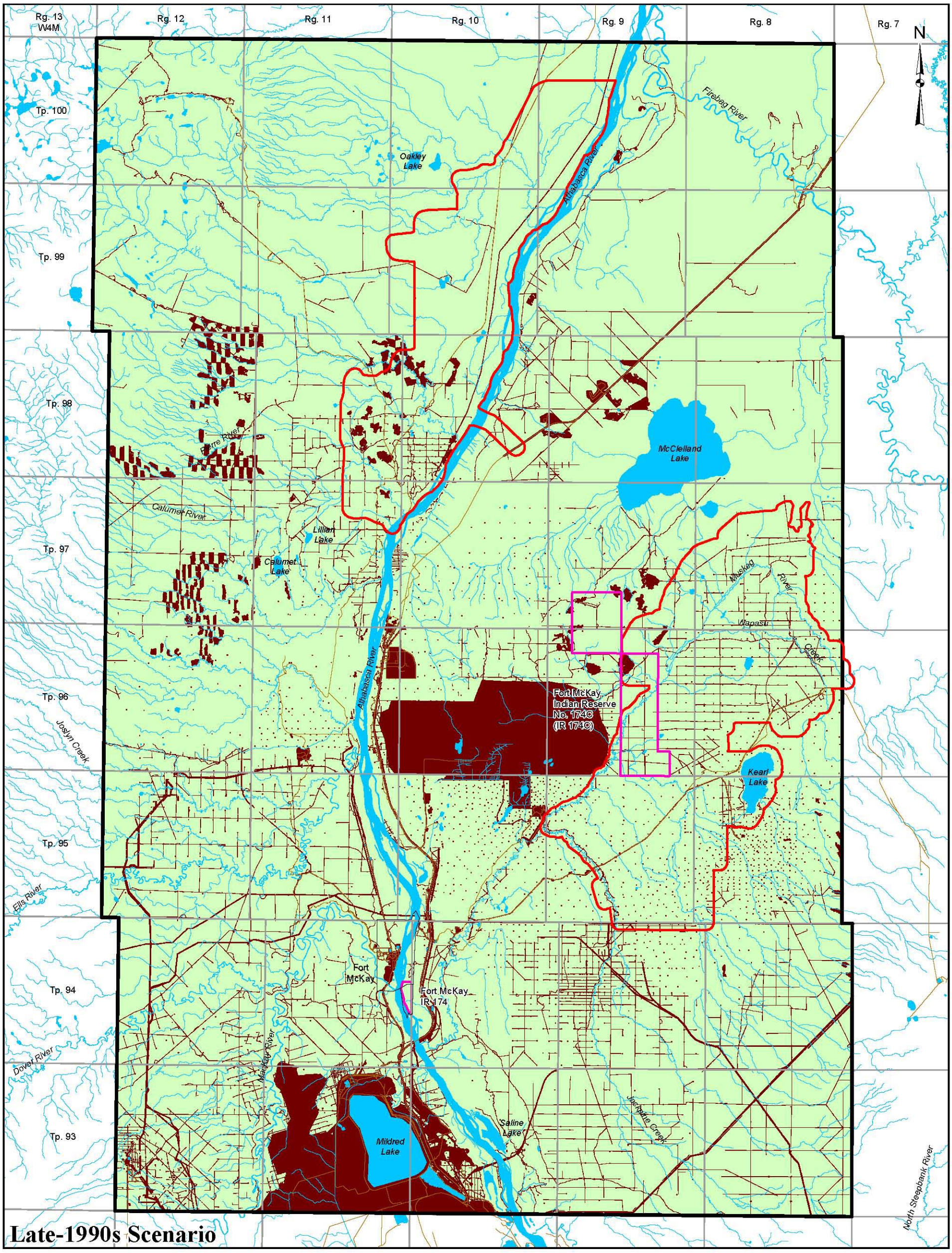

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY
- NATURAL AREA
- DISTURBANCE AREA
- LINEAR DISTURBANCE

5 0 5

SCALE 1:250,000 KILOMETRES

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

PROJECT

JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE

NATURAL AND HUMAN DISTURBED AREAS IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009	FIGURE 7-6	
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

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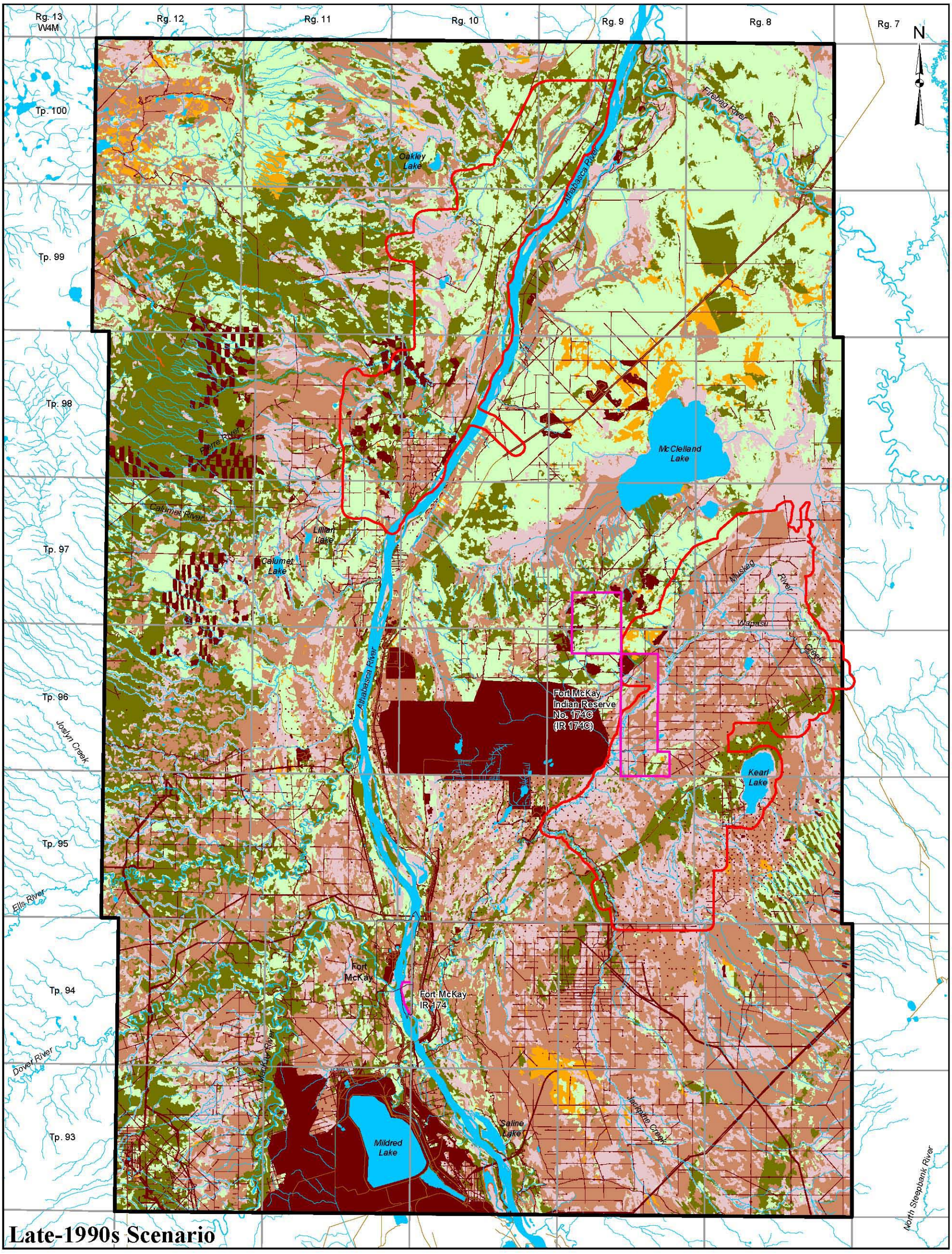

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

FOREST PRODUCTIVITY

- GOOD
- MEDIUM
- FAIR
- UNPRODUCTIVE
- NON-TREED
- NON-VEGETATED

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
FOREST PRODUCTIVITY IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722		SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009	
GIS	JH	26 Jan. 2009	
CHECK	MJ	27 Feb. 2009	
REVIEW	TC	02 Mar. 2009	

FIGURE 7-7

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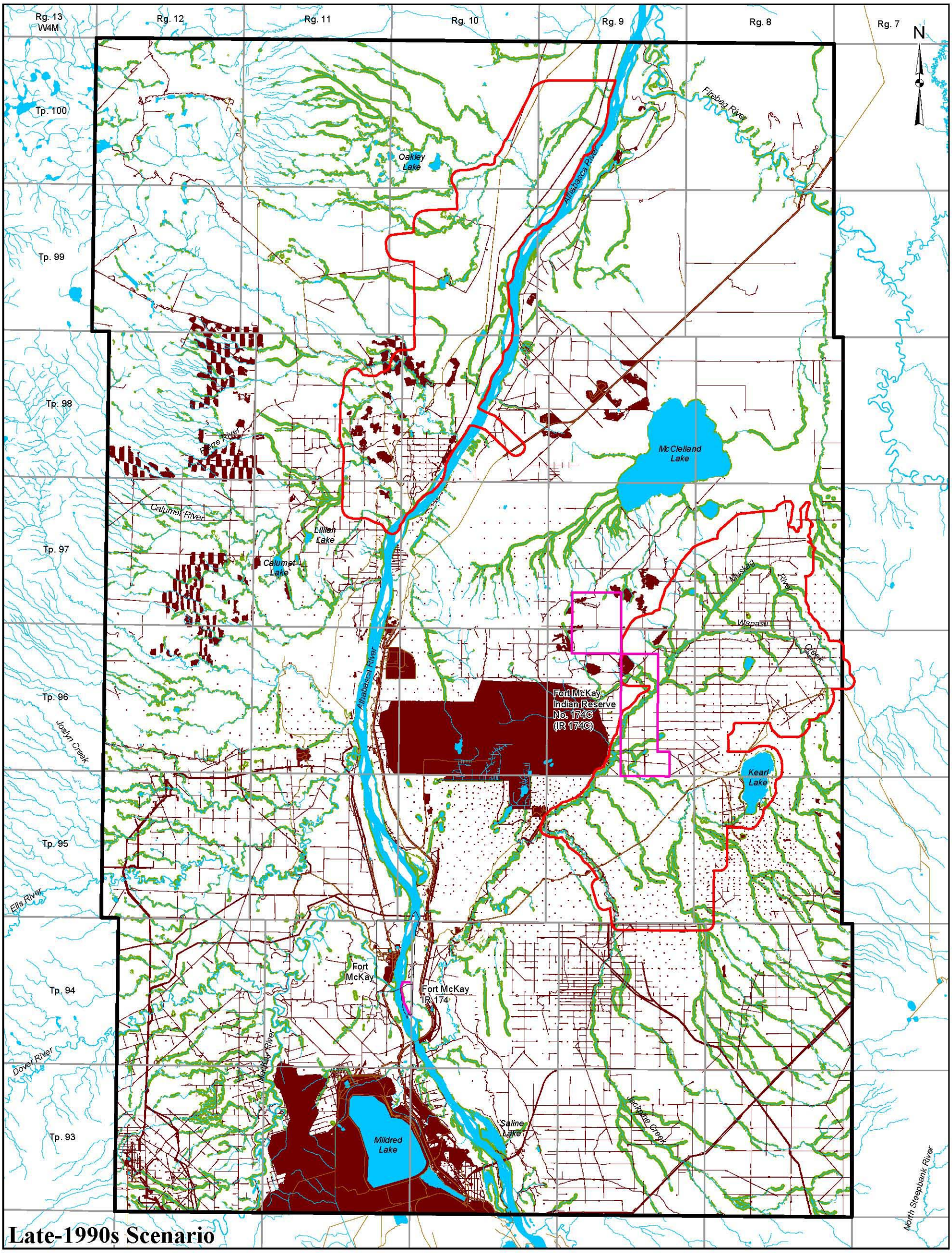

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY
- RIPARIAN ZONE

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
RIPARIAN AREAS
IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

FIGURE 7-8

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Approximately 26,071 ha or 7% of the FTSA were classified as riparian in the Late 1990s Scenario (*Appendix 7-1, Table 9*; from 5.4–2 in Golder 2009). Of this total, only 4,589 ha or 18% consists of upland forest riparian. About 1% of the total riparian area present in the late 1990s can be considered as upland forest; these forests consist of moist to wet, medium to rich e, f and h ecosites.

Rare Plant Potential

Rare plant potential rankings for the FTSA were created by applying the ratings used for ecosites and wetlands in the Jackpine and Pierre River LSAs (Shell 2007) (Figure 7-9). These ratings were applied to the ecosites based on the natural subregion, wetlands, miscellaneous vegetation types, non-vegetation types and disturbances for each of the development scenarios. Rare plant potential rankings for the ecosites within the Boreal Highlands were not available from the Shell EIA since neither of the mine's local study areas fell within that natural subregion. Ratings for the Boreal Highlands are based on ratings for similar ecosites in the Central Mixedwood Natural Subregion (Note: there should be limited error with this approach since the Boreal Highlands ecosites represent only about 4% of the FTSA).

Approximately 53% of the FTSA is covered by upland ecosites phases within the three natural subregions in the Late 1990s Scenario (*Appendix 7-1, Table 10*; adapted Table 5.4–5 from Golder 2009 with ecosites). This upland area is nearly equally divided between ecosite phases with moderate and low rare plant potential. None of the upland ecosite phases have been ranked as having high rare plant potential. Additional vegetation types that may be considered as upland include burned upland (<1 %) and cutblock (1%) also have moderate rare plant potential. Distribution of moderate and low ranked ecosites phases is not uniform amongst the subregions. The majority (96%) of the upland within the Athabasca Plains subregion is rated as moderate while the about 55% of the Boreal Highlands is similarly ranked. About 76% of upland areas in the Central Mixedwood are ranked as having low rare plant potential.

7.3.2.3 Base Case

Landsat

The six terrestrial land cover classes present in the Pre-Development Scenario remain in the Base Case but are reduced to 138,907 ha (37%) of the land area in the FTSA. This represents a 12% reduction in the areas covered by upland (terrestrial) vegetation between 1960 and 2007 (*Appendix 7-1, Table 1*). The relative proportion or ranking of cover of the classes has remained steady over this period.

Old growth forest covered a total 57,223 ha (15%) of the FTSA in the Base Case; of this total 36,975 ha consisted of upland forest types. The area covered by upland old growth declined by 12% between the Pre-Development Scenario and the Base Case (*Appendix 7-1, Table 2*). Burned areas, which include upland and some wetland

area, were reduced in area from 40,061 ha (11%) of the FTSA to 6,863 ha (2%) over this time.

Timber productive forest area covered about 143,623 ha or 38% of the FTSA in the Base Case. This represents a decline of 9% since pre-development (***Appendix 7-1, Table 3***).

Riparian areas occupied by upland (terrestrial) forest covered about 20,927 ha (6%) of the FTSA in the Base Case. Upland riparian area decreased by about 6% between the Pre-development Scenario and the Base Case (***Appendix 7-1, Table 4***).

Upland areas with moderate rare plant potential occupied about 12% (42,520 ha) of the FTSA in the Base Case while low potential areas covered approximately 25% (96,386 ha). The area covered by moderate and low ranked areas decreased by about 13and 12%, respectively between pre-development and the Base Case (***Appendix 7-1, Table 5***).

AVI Data

Distribution of Upland Forest

The total area occupied by the upland/forested ecosites within the FTSA in the Base Case is 168,477 ha (44%) (***Appendix 7-1, Table 6***; Table 5.4–9 in Golder 2009). This represents a loss of 31,793 ha of uplands since the late 1990s. Most of this loss has occurred in the Central Mixedwood Natural Subregion; the area occupied by uplands has decrease by 28,414 ha over this time period. This represents a decrease of 23% in the land covered by upland forest within the subregion. Within the Athabasca Plains Natural Subregion the total area occupied by upland ecosite phases has declined by 3,375 ha (6%) since the Late 1990s scenario. No change in the distribution of ecosites has occurred in the Boreal Highland Natural Subregion over the same time period.

Burned upland areas occupied about 2,223 ha (1%) in the Base Case, an increase from 810 ha of the area in the late 1990s.

Old Growth

Approximately 32,519 ha of old growth is located in the FTSA in the Base Case, the majority (29,784 ha) of which is associated with upland forest types. Old growth upland forest occupies 8% of the FTSA in the Base Case (***Appendix 7-1, Table 7***; Table 5.4–10 in Golder 2009). Old growth is found in all three natural subregions. Based on the data available, old growth is most common in the Central Mixedwood subregion where it accounts for about 23% of the area occupied by forested upland ecosite phases. Old growth accounts for about 11 and 12% of the upland forested ecosites in the Athabasca Plain and Boreal Highland subregions, respectively. The majority of old growth forest is associated with b and d ecosite phases in natural subregions.

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
Calumet River
Lillian Lake
Calumet Lake
McClelland Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
Dover River
MacKay River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Late-1990s Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

RARE PLANT POTENTIAL

- HIGH
- MODERATE
- LOW

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
RARE PLANT POTENTIAL
IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

FIGURE 7-9

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Timber Productive Forest

The total area supporting timber productive forests (generally upland with exception of some swamps) is estimated to be 168,821 ha (or 169,478 ha) in the Base Case; this represents about 44% of the FTSA (***Appendix 7-1, Table 8***; Table 5.4-4 in Golder 2009). This represents a decrease from the 52% that was present in the late 1990s. The area occupied by good and medium rated forest has declined to 20% and 22%, respectively since the late 1990s while the area rated as fair now occupies about 2% of the total FTSA. The relative proportion of the three classes expressed as percent of the total area of productive forest has remained stable over this period.

Riparian Areas

The total area occupied by all riparian areas decreased to 20,393 ha or 5% of the total FTSA in the Base Case (***Appendix 7-1, Table 9***; Table 5.4–2 in Golder 2009) as compared to the Late 1990s Scenario. The portion occupied by riparian communities that could be classed as upland forest has decreased to 3,888 ha, which represents about 19% of the total riparian area. Most of the decline occurred in the Central Mixedwood natural subregion, especially in the h1 ecosite phase.

Rare Plant Potential

Upland ecosites phases with rare plant potential (moderate or low) within the FTSA occupy about 40% of the land in the Base Case (***Appendix 7-1, Table 10***). The area covered by moderate rated areas has been reduced from 97,276 ha in the Late 1990s Scenario to 87,534 ha in the Base Case; this represents a reduction of 11% of moderate rated areas since the late 1990s. During the same period the area covered by low rare plant potential ecosites phases has declined from 102,893 to 80,941 ha (21%). A large part of this change is due to the conversion of landform natural ecosite phases to disturbance; the area covered by disturbance categories has increased from 25,303 to 90,004 ha between the Late 1990s Scenario and Base Case.

The majority of the change in cover of upland natural ecosite phases occurred in the Central Mixedwood Natural Subregion since the late 1990s. The area covered by ecosite phases with moderate rare plant potential declined by 22% from 30,333 to 23,714 ha while the area covered by ecosites with low potential declined by 23% from 94,094 to 72,299 ha. The total area of upland ecosites with rare plant potential declined somewhat (3,377 ha or 6%) in the Athabasca Plain subregion, with changes largely in the moderate ranked class. The area and distribution of upland ecosites with rare plant potential in the Boreal Highlands Natural Subregion remained stable between the Late 1990s and Base Case.

7.3.3 Impacts to Uplands (Forest)

7.3.3.1 Application Case

Distribution of Upland Forest (AVI)

The total disturbance area increases from 93,446 ha (25% of the total FTSA) in the Base Case to 115,730 ha (30%) in the Application case; this represents a net increase of 22,284 ha or 24% change in the area disturbed.

The Projects will result in a loss of 7,337 ha of upland ecosite phases in the FTSA when compared to the Base Case (***Appendix 7-1, Table 6***). While the area occupied by upland vegetation decreases from 44% at the Base Case to 43% at application, this represents a further loss of about 4% of the actual upland ecosites found within the FTSA. The majority of the uplands affected by the application are located within the Pierre River LSA. Approximately 5,790 and 1,547 ha of the upland ecosites (forest) in the Pierre River Mine and Jackpine Mine Expansion respectively, will be affected by the Projects.

The Application Case will result in a cumulative loss of about 17,883 ha of upland ecosite phases in the FTSA as compared to conditions that existed in the late 1990s. This represents a cumulative decrease of about 19% in the area occupied by upland forest since the late 1990s.

According to reclamation plans prepared by Shell (2007) and assuming that these plans are realized, following closure, terrestrial upland ecosites (forest/vegetation) will increase by 4% in the FTSA to 182,387 ha (48%) from 168,477 ha (44%). This represents an increase of 13,910 ha (8%) of the area covered by upland vegetation when compared to the Base Case.

Shell's reclamation plan indicates that the area covered by upland vegetation will increase from the Base Case by 2,857 ha (5%) following closure in the Athabasca Plain natural subregion. Some substantial changes in the distribution of ecosite phases will occur within the area occupied by the Pierre River Mine in the subregion. Large increases in the area occupied by c1 (Labrador tea-mesic jack pine-black spruce) and d1 (Labrador tea-subhygric black spruce-jack pine) ecosite phases will occur. The area occupied by the c1 ecosite phase will increase by 1,811 ha (443%), from 409 ha at the Base Case to 2,220 ha at closure while the area covered by the d1 ***will*** increase by 2,925 ha (663%), from 411 ha at Base Case to 3,366 ha at closure. Decreases in the area occupied by 7 of the 11 ecosites mapped in the area will occur following closure.

Statement of Significance

- When compared to the Base Case, the construction and operation phases of the Projects result in a net loss of 4% of the upland forest. This is scored as a negative, low magnitude, local, far future, reversible and low frequency effect

with an overall rating of (5+0+3-3+0 = 5) negligible consequence (a **green** situation).

- Closure results in a positive, low magnitude (8%), local, far future, reversible and low frequency effect with and overall rating of (5+0+3-3+0 = 5) negligible consequence.
- When compared to the Late 1990s Scenario the Application Case results in a net loss of 19% of the upland forest. This is a moderate magnitude, regional, far future, reversible and medium frequency effect of (10+1+3+-3+1= 12) of moderate significance (a **yellow** situation). The magnitude is very near to the point (>20%) where the effect would be considered as adverse and highly significance (a **red** situation).

Old Growth

The Projects will result in the loss of 1,160 ha of old growth upland forest, representing a loss of about 4% of the resource in the FTSA (***Appendix 7-1, Table 7***). The losses will continue through closure until the upland forested sites develop old growth attributes (a minimum of 100 to 140 years assuming successful reclamation, depending on the species planted). This effect will occur into the far future and will result in the loss of old growth available in the FTSA for traditional uses by approximately seven generations of Fort McKay community members. Shell (2007) noted that effects may be greater (i.e., greater area affected) under long-term harvesting since the estimate is based on timber harvest plans to 2011.

When compared to the Late 1990s Scenario the Application Case will result in the cumulative loss of 16% (5,513 ha) of old growth forest located on upland sites. Again, the duration of this loss of the resource will be experienced into the far future by the Community of Fort McKay.

Statement of Significance

- The loss of 4% (1,160 ha) of old growth upland forest represents a negative, low in magnitude, local, far future, reversible and low frequency effect (5+0+3-3+0 = 5) of negligible environmental significance in the application and closure cases (a **green** situation).
- The cumulative decrease in the area covered by old growth forest since the late 1990s results in a moderate magnitude (16%), regional, far future, reversible, and medium frequency adverse effect (10+1+3-3+1= 12) of moderate significance (a **yellow** situation).

Timber Productive Forest

There will be a reduction of 8,369 ha in the amount of land occupied by productive forest in the Application Case compared to the Base Case (***Appendix 7-1, Table 8***).

This represents about 5% of the resource that existed in the Base Case. A greater amount of timber productive land is affected in the Pierre River Mine area (5,866 ha) compared to the Jackpine Mine Expansion (2,504 ha). The majority of the losses occur in the good and medium productive classes in both of the mine areas. A decrease in the area covered by unproductive forest (i.e., wooded/forested bogs and fens) and non-treed vegetation will occur in the Application Case due to the loss of wetlands while the amount of land in the disturbed category increases.

The area covered by productive forest will be reduced by 37,360 ha since the late 1990s with the addition of the Projects (i.e., Application Case). This represents a cumulative decrease of 19% of the resource in the FTSA since the late 1990s.

Based on Shell's reclamation plan and assuming that those plans are realized, following closure, the amount of land classed as timber productive will increase to 181,356 ha (48% of the FTSA) compared to 168,478 ha (44% of the FTSA) in the Base Case. This represents an increase of about 8% of the resource over the Base Case. Most of the increase occurs in the fair productivity class. The amount of land occupied by the unproductive and non-treed classes will be about 9,278 and 2,247 ha less after closure when compared to the Base Case. This is largely due to the increase in upland ecosites and the loss of wetland cover (see Section 7.5.3). The amount of land classified as non-vegetated (i.e., disturbed or water) at closure (98,491 ha) will be slightly less than present in the Base Case (99,843 ha) in the FTSA.

Statement of Significance

- The decrease (5%) in area covered by timber productive forests as a result of the Projects is negative in direction, low in magnitude, local, far future, reversible and low frequency effect (5+0+3-3+0 = 5) which is scored as a negligible environmental consequence when compared to the Base Case (a **green** situation).
- At closure, the increase (8%) in timber productive forest is considered positive in direction, low in magnitude, local, far future, reversible, and low in frequency (5+0+3-3+0 = 5) and of negligible environmental consequence when compared to the Base Case.
- The cumulative decrease in area covered by timber productive forest since the late 1990s following application of the Project is a moderate magnitude (19%), regional, far future, reversible and medium frequency adverse effect (10+1+3-3+1 = 12) of moderate significance. This is a currently a **yellow** situation; an additional 1% change in magnitude would result in a high significance rating, a **red** situation.

Riparian Areas

Upland riparian communities occupy about 3,615 ha of the FTSA in the Application Case, a decrease of 223 ha from the Base Case of 3,838 ha (***Appendix 7-1, Table 9***). This represents a decline of about 6% of the upland riparian resource. Most of the loss is associated with the Pierre River Mine.

In the Application Case, upland riparian areas cover about 974 ha less than were present in the late 1990s. This represents a cumulative decrease of about 21% within the FTSA over the 8–10 year period.

Closure will result in minor changes in the Application Case and; upland riparian ecosites are projected to occupy about 3,624 ha. Closure does not effectively mitigate for the clearing of upland riparian ecosites since the proportion of riparian areas occupied by upland ecosites is projected to decline from 19% in the Base Case to about 17% at closure. The total area occupied by riparian communities (all classes) is expected to increase by 655 ha from 20,393 ha (5% of the FTSA) to about 21,048 ha (6% of the FTSA) as a result of closure. This is largely due to the increase in area occupied by miscellaneous vegetation types (i.e., cutbanks, meadow and shrubland) from 665 ha in the Base Case (3% of the total riparian area) to 2,421 ha (16%) following closure. Most notably, the shrubland class increases by 2,757 ha (567%) over both the Base and Application cases (this shrubland class is not common in pre-development and may not have a natural equivalent in all situations).

Statement of Significance

- The decrease (6%) in upland riparian area represents a negative in direction, low in magnitude, local, far future, reversible and low frequency effect (5+0+3-3+0 = 5) which is scored as a an adverse effect of negligible environmental consequence when compared to the Base Case (a **green** situation). The loss remains similar at closure and is also scored as a negligible environmental consequence.
- The decrease in upland riparian areas since the Late 1990s represents a high magnitude (21%), regional, far future, reversible and medium frequency adverse effect (15+1+3-3+1 = 17) of high significance (a **red** situation).

Rare Plant Potential

Upland ecosites with moderate rare plant potential will decrease by about 4,976 from 87,534 to 82,558 ha in the Application Case; while the total proportion of the FTSA covered by upland moderate ranked rare plant sites remains at about 21% this change represents a decline of about 6% in the area covered by resource (***Appendix 7-1, Table 10***). Upland phases with low rare plant potential will remain relatively stable at 19% of the FTSA. The upland area with low rare plant potential

will decrease by 2,360 ha (3% of the resource) from 80,941 to 78,581 ha in the Application Case.

Rare plant potential in the Application Case has also been compared to the land cover as existed in the late 1990s. In the FTSA, upland areas ranked as moderate potential will decrease by 15% (14,818 ha) in the Application Case while low ranked areas will decrease by 24% (24,312 ha).

The area covered by upland ecosites with moderate rare plant potential will increase by 2,807 ha (3%) to 23% of the FTSA at closure. Areas with low rare plant potential will increase by 11,103 ha. This represents an increase of 14% in the area covered by the resource, such that the total portion of the FTSA covered by upland sites with low rare plant potential increases from 19% at the Base Case to 22% at closure.

Fort McKay considers reclamation to be only partially effective in mitigating for rare plant potential. Although upland forests are expected in the reclaimed landscape it is not clear that these forests will have the same ecological structure and function or that rare plants will colonize into the far future.

Statement of Significance

- The decrease (6%) in area covered by upland ecosites with moderate rare plant potential represents a negative, low in magnitude, local, far future, partially reversible and low frequency occurrence (5+0+3-0+0 = 8), which is considered an adverse low consequence when compared to the Base Case (a **green** situation). The 3% decrease in low ranked areas represents a negative, low in magnitude, local, long-term, and partially reversible adverse effect, which is scored as having a (5+0+3-0+0 = 8) low environmental consequence when compared to the Base Case (a **green** situation).

- At closure, the 3% increase in upland area with moderate rare plant potential represents a positive, low in magnitude, local, far future, partially reversible and low frequency occurrence (5+0+3-0+0 = 8) which is considered an effect of low consequence. The 14% increase in low ranked areas represents a negative, moderate in magnitude, local, far future, and partially reversible trend (10+0+3-0+0 = 13) of moderate environmental consequence when compared to the Base Case (a **yellow** situation).

- The cumulative decrease in moderate ranked upland area since the late 1990s is considered as a moderate magnitude (15%), regional, far future, partially reversible, and medium frequency adverse effect (10+1+3-0+1= 15) of moderate significance (a **yellow** situation). The decrease (24%) in low ranked upland areas is also considered as having an effect of high significance (a **red** situation).

7.3.3.2 Planned Development Case

Distribution of Upland Forest (Landsat)

The PDC considers the proposed Projects plus existing, approved and planned developments within the assessment area.

In the PDC the total area covered by terrestrial upland vegetation (land cover classes) will decrease by 19,917 to 118,990 ha (31% of the FTSA) from 138,907 ha (37%) in the Base Case (***Appendix 7-1, Table 1***). This represents a decrease of 14% in the area covered by terrestrial forest. In the far future (PDC-closure), the area occupied by terrestrial vegetation in the FTSA will increase by 75,794 (54%) to 214,701 ha (net increase of 57%) as compared to the Base Case.

In the PDC, upland forest will decrease by 25% (39,176 ha) when compared to Pre-Development conditions. However, these six terrestrial land cover classes will cover 15% more of the FTSA than found at Pre-Development. This represents an increase of 56,635 ha (36%) of terrestrial vegetation at PDC-closure.

While it is not possible to determine the changes in the abundance and distribution of the upland ecosites phases that will occur in the far future given the format of the existing mapping and data, it is likely that the trends observed in the Application Case will occur throughout all developments in the FTSA. This trend, if continued across all mines would result in a substantial increase in the abundance of certain ecosites and a decrease in others.

Burns covered about 40,061 ha (11%) of the FTSA in the Pre-Development Scenario (1960s). They account for 6,863 ha (2%) in the Base Case and 3,932 ha (1%) in the Application Case. The area remains static in the far future case since it is not possible to predict the location and magnitude of fires.

Water (lakes, ponds and large rivers) covered about 9,851ha (3%) of the FTSA in the Pre-Development Scenario. This decreased to 9,150 ha in the Base Case and 9,075 ha (2%) in the Application Case. However, water is currently expected to cover about 23,619 ha or 6% of the FTSA in the far future (PDC). This represents a 140% increase in the area covered by water, largely due to the area covered by pit lakes in the far future closure landscape. A discussion of the effects associated with end pit lakes is provided in Section 5.

Statement of Significance

- The total area covered by terrestrial upland vegetation will decrease by 14% as a result of the Projects and planned developments when compared to the Base Case. The duration of these effects is into the far future but is considered reversible and moderate in magnitude. Therefore the overall environmental consequence for loss of upland forest in FTSA is (10+1+3-3+2 = 13) is adverse and moderate in significance (a **yellow** situation). In the PDC-closure, the net

increase (57%) of upland forest results in a score of high environmental significance as compared to the Base Case.

- The decrease (25%) in the cover of upland forest between the PDC and Pre-Development case is a high magnitude, regional, far future, reversible and medium frequency adverse effect (15+1+3-3+1=17) of high environmental significance (a **red** situation). The net increase in upland vegetation in the FTSA at PDC-closure compared to Pre-Development is 36%. This is a positive in direction, high magnitude, regional, far future and reversible effect, which results in a score of high environmental significance.

Old Growth

Old growth upland forest is expected to decrease in area by 34% (12,440 ha) between the Base Case and the PDC. When compared to the Pre-Development Scenario, the amount of land covered by old growth upland forest will decrease by 41% (17,382 ha) in the PDC.

In the PDC-closure case, old growth upland forest is predicted to increase in area when compared to both the Base Case and Pre-Development Scenarios. Upland forests are expected to cover about 53 and 35% more area than existed in the Base Case and Pre-Development Scenario, respectively. This increase is due to the increase in upland forest that occurs as a result of reclamation; the estimates are based on assumptions that 20–28% of upland forests will be in the old growth stage at some point in the far future.

Statement of Significance

- The decrease (34%) in old growth in the PDC is high in magnitude, regional, far future, reversible and moderate frequency (15+1+3-3+1=17) adverse effect of high environmental significance as compared to the Base Case (a **red** situation). The consequence is also considered as significant due to the high magnitude change (41%) in the resource when compared to the Pre-Development Scenario (a **red** situation).

- At PDC-closure, the net increase in old growth forest results in a score of high environmental significance in the positive direction when compared to the Base Case and Pre-Development Scenarios.

Timber Productive Forests

The area occupied by productive forest in the FTSA is expected to decrease by 14% (20,384 ha) in the PDC as compared to the Base Case. A larger decrease (22%; 34,929 ha) is observed when the PDC is compared to the Pre-Development Scenario.

In the PDC-closure, the productive forest is predicted to increase by 52% (75,344 ha) when the compared to the Base Case; an increase of 38% (60,799 ha) is predicted when the PDC-closure is compared to the Pre-Development Scenario.

Statement of Significance

- A decrease in the area of timber productive forest in the PDC results in a moderate in magnitude, regional, far future, reversible and of medium frequency adverse effect of moderate environmental significance when compared to the Base Case (a **yellow** situation). The environmental consequence is considered high when compared to the Pre-Development Scenario due to the high magnitude decrease in area (a yellow situation).
- At PDC-closure, the predicted net increase in timber productive forest results in a score of high environmental significance in the positive direction when compared to the Base Case and Pre-Development Scenarios.

Riparian

The amount of land occupied by upland riparian forest will decrease by 15% (3,097 ha) when compared to the Base Case and by 20% (4,452 ha) when compared to the Pre-Development Scenario. The PDC-closure numbers are not provided due to limitations of the data for that indicator and case.

Statement of Significance

- A decrease in the area of upland riparian forest in the PDC results in a moderate in magnitude, regional, far future, reversible and medium frequency effect of moderate environmental significance when compared to the Base Case (a **yellow** situation). The environmental significance is considered adverse and high when compared to the Pre-Development Scenario due to the high magnitude (20%) decrease in area (a **red** situation).

Rare Plant Potential

None of the forested ecological land cover classes used to describe the FTSA have been ranked with high rare plant potential. In the PDC, About 12 and 20% of the FTSA is occupied by upland land cover classes with moderate and low rare plant potential, respectively. Moderate ranked forested sites will decrease by 3% (1,102 ha) in the PDC when compared to the Base Case and by 16% (7,639 ha) when compared to the Pre-Development Scenario (***Appendix 7-1, Table 5***; Table 5.4–22 in Golder 2009). Low ranked sites will decrease by 20% (18,813 ha) and 29% (31,535 ha) when compared to the Base Case and Pre-Development Scenarios, respectively.

In the PDC-closure, the area of upland forest with moderate rare plant potential is predicted to increase by 65% (27,572 ha) when compared to the Base Case and 43%

(21,035 ha) when compared to the Pre-Development Scenario. The area of low ranked upland forest is expected to increase by 50% (48,223 ha) and 33% (35,501 ha) when compared to the Base Case and Pre-Development Scenario, respectively.

Statement of Significance

- In the PDC, the decrease in moderate ranked lands is scored (5+1+3-0+1=10) as having an effect of low environmental significance (low magnitude, regional, far future, partially reversible, medium frequency) as compared to the Base Case (a **green** situation). When compared to Pre-Development, the decrease is scored (10+1+3-0+1 = 15) as an adverse effect of moderate environmental significance (moderate magnitude, regional, far future, partially reversible, medium frequency) (a **yellow** situation).
- At PDC-closure, the increase in moderate ranked lands is scored as a high environmental consequence (high magnitude, regional, far future, partially reversible, medium frequency). The increase to moderate ranked land compared to Pre-Development is also scored as having high environmental significance.
- In the PDC, the decrease that occurs in low ranked lands is scored (10+1+3-0+1=15) as a moderate environmental consequence (moderate magnitude, regional, far future, partially reversible, medium frequency) (a **yellow** situation). When compared to Pre-Development, the decrease is scored (15+1+3-0+1=20) as having a high environmental significance (high magnitude, regional, far future, partially reversible, medium frequency) (a **red** situation).
- At PDC-closure, the increase in low ranked lands is scored as a high environmental consequence (high magnitude, regional, far future, partially reversible, medium frequency). The increase to low ranked land compared to Pre-Development is also scored as having a high environmental significance. Both of these scenarios have high magnitude increases that are considered as regional, far future, partially reversible, and medium frequency. However, because the net change represents an increase in lands with low rare plant potential the effect should be negative (i.e., adverse; a **red** situation).

7.3.4 Conclusions for Upland Forest

A summary of the environmental consequences of the Projects (Application) as well as the Planned Development Case is provided in Table 7-4.

Land occupied by upland forest types will decline in the FTSA during the construction and operation phases of the projects (Application Case). The incremental effects of the Projects are scored as negligible or low for all indicators except the land with moderate ranked rare plant potential in the Application Case (i.e., Projects compared to the Base Case). However, the effects of clearing of land and removal of soil upon upland forests continue into the far future for the

Table 7-4: Summary of Effects to Upland Forest

Indicator	Application Case to Base Case		Application Case-Closure to Base Case		Application Case to Late 1990s		PDC to Base Case		PDC to Pre-Development		PDC-Closure to Base Case		PDC-Closure to Pre-Development	
	% Change	Consequence	% Change	Consequence	% Change	Consequence	% Change	Consequence	% Change	Consequence	% Change	Consequence	% Change	Consequence
Distribution of Upland Forest	-4	negligible	+8	negligible	-19	moderate	-14	moderate	-25	high	+57	high[1]	+36	high
Old Growth	-4	negligible	-4	negligible	-16	moderate	-34	high	-41	high	+53	high	+35	high
Timber Productive Forest	-5	negligible	+8	negligible	-19	moderate	-14	moderate	-22	high	+52	high	+38	high
Riparian	-6	low	-6	negligible	-21	high	-15	moderate	-20	high	-	-	-	-
Rare Plant Potential—Moderate	-6	low	+3	low	-15	moderate	-3	low	-16	moderate	+65	high	+43	high
Rare Plant Potential—Low	-3	low	+14	moderate	-24	high	-20	moderate	-29	high	+50	high	+33	high

[1] Consequences with a positive direction have not been color coded in this table but are included for the sake of completeness. While an increase in the area occupied by an indicator may result in a positive change based on Shell's assumptions regarding mitigation/reclamation at closure, the rating does not consider the potential uncertainties associated with reclamation of upland sites. While upland sites can be reclaimed, the ability of these sites to restore equivalent capability for Fort McKay traditional use (*Section 10*) or other values (such as rare plant habitat) has not been proven.

Community of Fort McKay. While the increase in the area of low ranked rare plant potential areas is positive in direction, Fort McKay considers this change as adverse since it actually increases the area of the lowest ranked class.

Effects of moderate and high significance are encountered when cumulative effects of the Projects and all developments that have occurred since the late 1990s are considered (i.e., Application Case compared to the Late 1990s Scenario). If the magnitude of change was 1% greater for upland forest distribution and timber productive forest indicators, the effects on these resources would also be considered as highly significant. The intent of these significance rankings is to provide a gauge upon which to assess affects. However, in reality the losses of vegetation follow along a continuum. As well, the predictions are estimates, not absolutes. From the perspective of Fort McKay's opportunities for traditional land use the difference between a 19% and 20% loss of upland vegetation is not discernable; both would be considered to require substantial mitigation and accommodation.

Effects of moderate and high environmental significance are observed when the PDC is compared to the Base Case except for the moderate ranked rare plant potential indicator. The cumulative effects on upland forest and related indicators are considered of high environmental significance in the PDC when compared to Pre-Development conditions except for the moderate ranked rare plant potential indicator. During the construction and operation phases of the Projects and other planned developments, these losses will negatively affect the Community's ability to carry on traditional activities.

According to Shell's assumptions regarding reclamation, the assessment of the PDC-closure cases is predicted to result in high magnitude changes in the positive direction for upland forest and associated indicators. While reclamation and closure will result in the net increase in upland areas such an increase is not entirely positive since significant effects will occur to wetland resources and biodiversity indicators. While a net increase in upland is considered positive for the indicator when viewed in isolation, the corresponding decrease in wetlands is negative; the combined effect will result in a more homogenous landscape at closure. (see Section 10 and Section 8.5). The net increase in upland forest ranked with low rare plant potential when compared to Pre-Development conditions is also considered as negative consequence by Fort McKay.

7.4 Wetland (Muskeg) Impact Assessment

7.4.1 Stressors on Wetlands

As per upland forest, the principle stressor that adversely affects wetland resources is land disturbance (i.e., removal of vegetation and the soil that supports vegetation communities). Additional stressors include the adverse effects of airborne

pollutants (i.e., SO_2, NO_X, NH_3 and nitrogen) or dust to vegetation resources. The effects of air emissions are addressed in detail in ***Section 2 – Air Quality***.

7.4.2 Fort McKay Baseline Conditions

7.4.2.1 Pre-Development Scenario

The Pre-Development Scenario is based on completion and analysis of land cover classification mapping using Landsat imagery from the 1960s for the FTSA. This case represents the condition of vegetation in the landscape, as expressed by land cover classes, prior to industrial development in this portion of Fort McKay's Traditional Lands (Figure 7-1). The only anthropogenic disturbances present for this scenario are a small area of forestry cutblocks; however natural disturbances (i.e., burned areas) were also differentiated.

Distribution of Wetlands (Landsat)

Wetlands, consisting of three classes, covered 171,493 ha (45%) of the FTSA in the Pre-Development Scenario (***Appendix 7-1, Table 1***; from Table 5.4–24 in Golder 2009). Treed fens were the most common unit (18% of the FTSA) followed by treed bog/poor fens (17%) and non-treed wetlands (10%). Burns covered about 40,061 ha (11%) of the landscape in this scenario, which likely included some wetland classes. Water occupied about 9,851 ha (3%). Disturbances (cutblocks and others) occupied much less than 1% of the area.

Peatlands

Wetland classes can be grouped into categories based on underlying parent and soil material. Those formed on organic material are termed peatlands while those formed on mineral materials with little or no organic accumulation are classed as non-peatlands. Based on the Landsat classification, wetlands with a peatland base are estimated to have covered 30% (114,901 ha) of the FTSA in the Pre-Development Scenario (***Appendix 7-1, Table 11***; from Table 5.4–19 in Golder 2009). This represented approximately 67% of the total wetland area mapped in this scenario (***Note:*** this estimate may be inaccurate since the area occupied by peatlands is less in this scenario than mapped in the Late 1990s Scenario developed using the AVI [ecosite phase and wetland type] mapping).

Old Growth

Wetlands that support old growth are estimated to have covered about 7% of the FTSA in the Pre-Development Scenario (***Appendix 7-1, Table 2***; from Table 5.4–20 in Golder 2009) or about 39% of the total area occupied by old growth. As with the case of upland forest, this estimate is based on the assumption that old growth occupied the mid-range of area that may have been present for each of the regional ecological land cover types in the 1960s.

Timber Productive Forest

It is assumed, based on distribution of productive forest within wetland classes in the detailed ecosite phase/wetland type mapping, that little of the area considered as productive forest would consist of wetlands as classified using the Landsat process.

Riparian Areas

Riparian areas occupied by wetland within the regional land cover classification system (Landsat) occupied about 5% (18,983 ha) of the FTSA in the late 1960s (***Appendix 7-1, Table 4***; from 5.4–18). This represents about 46% of the total riparian area present in the Pre-Development Scenario.

Rare Plant Potential

Areas with high rare plant potential consist only of wetland land cover classes. These high ranked areas occupied about 28% (107,213 ha) of the FTSA, while wetland classes with moderate ranked potential covered 17% (***Appendix 7-1, Table 5***; from Table 5.4–22 in Golder 2009). No regional wetland classes are ranked as having low rare plant potential.

7.4.2.2 Late 1990s Scenario

Distribution of Wetland Types (AVI)

Wetlands occupied about 36% (136,419 ha) of the landscape in the Late 1990s Scenario. Wooded fens were most abundant (12%) while wooded bogs and shrubby fens covered about 10% and 8%, respectively. A total of 10 wetland classes were mapped in the FTSA; this is eight fewer than the total number of classes mapped in the LSAs presented in the 2007 Application. Fewer classes are used because "the Golder ecosite phase and wetlands type automated mapping system was applied to the FTSA" (Golder 2009) and detailed verification and reclassification based on plot data and air photograph interpretation was not completed. Although these steps are generally completed for detailed mapping it was not possible for the FTSA given the time and budget constraints. This lack of differentiation may mask the effects to some wetlands types since they are not included in the FTSA mapping.

Miscellaneous vegetation types (burned areas, cutbanks, meadow and shrubland) occupy less than 1% in total of the FTSA. Non-vegetation types (largely lakes and rivers) covered about 3% (10,153 ha) of the area in the late 1990s. Cutblocks (1%) and disturbances (7%) occupied the remaining portion of the landscape.

Peatlands

Peatlands in the FTSA for the Late 1990s Scenario are presented in Figure 7-10. Wetlands classified as peatlands occupied about 32% (121,023 ha) of the FTSA in

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
Calumet River
Lillian Lake
Calumet Lake
McClelland Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
Dover River
MacKay River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Late-1990s Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY
- PEATLANDS

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
PEATLANDS
IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

FIGURE 7-10

I:\CLIENTS\SHELL\08-1346-0006\mapping\mxd\5722\Veg\New_Maps\lsa_peatland.mxd

the Late 1990s Scenario. Forested and wooded wetlands and non-forested peatlands occupied about 22 and 10% of the FTSA, respectively. Peatlands occupied about 89% of the total wetland area mapped in the Late 1990s Scenario.

Old Growth

Approximately 3,754 ha of old growth wetland forest existed in the FTSA in the Late 1990s Scenario; this represented about 10% of the old growth and 1% of the total FTSA. Wooded swamp, wooded bog and wooded fen classes contain old growth.

Timber Productive Forest

Approximately 52% (197,469 ha) of the FTSA supported timber productive forest stands in the Late 1990s Scenario (***Appendix 7-1, Table 8***). One timber productive wetland class, the wooded swamp (STNN), is mapped in the area; it occupies about 5,556 ha (1%) of the FTSA or 2.8% of total timber productive area (***Appendix 7-1, Table 6***). The majority of the timber productive areas were in the mature stage in the late 1990s; about 1,156 ha of the STNN was found in the old growth stage.

Riparian Areas

Riparian areas have been considered as "vegetation assemblages adjacent to streams and waterbodies and whose structure and function are influenced by, or dependent upon, this aquatic association" (Golder 2009). The area of these communities found within 100 m of waterbodies and watercourses has been included in the totals.

Approximately 26,071 ha or 7% of the FTSA was classified as riparian in the Late 1990s Scenario (***Appendix 7-1, Table 10***). Of this total, the majority, 20,697 ha or 79% consists of wetland riparian areas. About 5.5% of the FTSA was composed of wetland riparian land cover classes in the late 1990s.

Rare Plant Potential

Rare plant potential for wetland and upland areas within the FTSA was created by applying the rare plant potential ranking for the LSA to the area of ecosites and wetlands as provided by Shell and Golder (Golder 2007). Approximately 36% of the FTSA is covered by wetland classes in the Late 1990s Scenario. This wetland area (92,469 ha; 68%) is dominated by wetland types with high rare plant potential; this represents about 24% of the FTSA. Approximately 4 and 28% of the total wetland area has moderate and low rare plant potential, respectively (***Appendix 7-1, Table 10***). Burned wetlands, which occupied much less than 1% of the FTSA in the late 1990s, were rated as having moderate rare plant potential.

7.4.2.3 Base Case

Landsat

The three wetland land cover classes present in the Pre-Development Scenario remain in the Project Base Case but are reduced to 126,789 ha (33%) of the land area in the FTSA. This represents a 26% reduction in the areas covered by wetland vegetation between the 1960s and 2007. The relative proportion or ranking of cover of the wetland classes remained stable over this period. Peatlands covered about 22% (84,948 ha) of the FTSA in the Base Case. Peatland area decreased by about 26% since pre-development (***Appendix 7-1, Table 11***).

Burned areas are reduced from 40,061 ha of habitat (11%) to 6,863 ha (2%) over this time period. While the burns include both uplands and wetland ecosystem, they have not been differentiated or included in the assessment of effects on wetland resources.

Old growth associated with wetlands covered about 6% (20,248 ha) of the FTSA in the Base Case. This represents a decrease of about 24% since pre-development (***Appendix 7-1, Table 2***).

Riparian area associated with wetland land cover types occupied about 4% (15,075 ha) of the FTSA in the Base Case. The net area of wetland decreased by 21% since pre-development (***Appendix 7-1, Table 4***).

Wetlands with high rare plant potential decreased in area by 26% from 107,213 ha in the Pre-Development Scenario to 79,145 ha in the Base Case (***Appendix 7-1, Table 5***). Wetland area ranked with low potential also decreased by about 26% over the time period.

AVI Data

Distribution of Wetland Types

The total area occupied by the wetland vegetation types within the FTSA in the Base Case is 101,027 ha (27%). This represents a loss of 35,392 ha of wetlands since the late 1990s and a decrease of 26% in the land covered by wetland within the FTSA over that period.

Burned wetland increased from 319 ha in the late 1990s to 2,258 ha (1% of the FTSA) in the Base Case.

Peatlands

The area occupied by peatlands decreased to 24% (91,256 ha) of the FTSA in the Base Case. This represents a decrease of 25% (29,767 ha) of the peatland resource when compared to the Late 1990s Scenario. The decrease in area occupied by forested and wooded peatland classes was somewhat greater than the loss to non-

forested peatlands over this period, perhaps due to the increase in the amount of burned wetlands that are included non-forested category.

Old Growth

About 8% (2,736 ha) of the old growth present in the Base Case consists of wetland. This represents a decrease of 1,018 ha since the late 1990s (about 27% of the old growth wetland resource since over the time period). Losses occurred in the wooded swamp, wooded bog and wooded fen classes.

Timber Productive Forest

Approximately 44% (168,478 ha) of the FTSA supported timber productive forest stands in the Base Case (***Appendix 7-1, Table 11***). The wooded swamp (STNN) wetland occupies about 4,291 ha of the total timber productive area. The area covered by timber covered wetland type has decreased by 1,265 ha or about 23% since the Late 1990s Scenario.

Riparian Areas

The total area occupied by all riparian areas decreased to 20,393 ha or 5% of the total FTSA in the Base Case. The portion occupied by wetland riparian communities has decreased from 20,697 ha to 15,880 ha (loss of 4,817 ha) which represents a loss of about 23% of the resource between scenarios.

Rare Plant Potential

The majority of wetlands (67%) are rated with a high potential to contain rare plants. Wetlands with high rare plant potential decreased in extent from 92,469 ha in the late 1990s to 67,829 ha in the Base Case scenario. This represents a loss of 24,640 ha or about 27% of the wetlands with high rare plant potential since the late 1990s. Wetlands with moderate rare plant potential decrease by about 1,319 ha (23%) while wetlands with low potential declined by 9,434 ha (25%) in the same period (***Appendix 7-1, Table 10***). Burned wetlands, increased by 712% in area to about 2,589 ha between scenarios.

7.4.3 Impacts to Wetlands (Muskeg)

7.4.3.1 Application Case

Distribution (Loss) of Wetlands (AVI)

In the Base Case disturbances account for 93,446 ha (25% of the FTSA) and increase to 115,730 ha (30%) in the Application Case. This represents a net increase of 22,284 ha or 24% change in the total area disturbed.

The Projects will result in a loss of 11,942 ha of wetlands in the FTSA when compared to the Base Case. While the area occupied by wetland vegetation decreases from 27% at the Base Case to 23% at application, this represents a further loss of about 12% of the actual wetlands found within the FTSA. The majority of the wetlands affected by the application are located within the Jackpine Mine Expansion LSA. Approximately 8,134 and 3,808 ha of the wetlands in the Jackpine Mine Expansion and Pierre River Mine respectively, will be affected (lost) due to the Projects.

Reclamation and closure will not be effective in mitigating the losses to wetlands. Following closure, wetlands will have decreased by 11,931 ha (12%) in the FTSA to 89,096 ha (23%) from 101,027 ha (27%) at the Base Case. Nine of the 10 wetland types found in the FTSA will decline in area following closure. The only wetland type that does not decrease in area as result of the Project(s) is the marsh unit (MONG). The wooded fen and shrubby fen experience the greatest declines at 4,806 and 3,537 ha, respectively; this represents a loss of 15 and 16% of the resource in the forty township block area for these units.

The Project, along with all developments that have occurred since the late 1990s, will result in a cumulative loss of 47,323 ha of wetland ecosites in the FTSA; this represents a 35% reduction in the area covered by wetlands over the 8–10 year time period.

Statement of Significance

- A 12% decrease in the area occupied by wetlands as a result of the Projects represents a negative, moderate magnitude, local, far future, irreversible and low frequency adverse effect of (10+0+3+3+0=16) high environmental significance as compared to the Base Case (a **red** situation).
- The consequence to wetland distribution and abundance is similar at closure; the Projects result in a negative, moderate magnitude, local, far future, irreversible and low frequency adverse effect of (10+0+3+3+0=16) high significance (a **red** situation).
- When the Application Case is compared to the late 1990s, the cumulative loss of wetlands that has occurred results in a high magnitude (35%), regional, far future, irreversible, and moderate frequency adverse effect of high significance (a **red** situation).

Peatlands

Peatlands are expected to cover about 21% of the FTSA in the Application Case. As a result of the Projects, 13,039 ha of peatlands will be lost when compared to the Base Case. This represents a decrease of 14% in the area occupied by peatlands. The amount of land occupied by forested and wooded peatlands will decrease by 11% while the area occupied by non-forested wetlands will decrease by 20% due to the

Projects. Peatlands account for approximately 88% of the total wetland area in the Application Case.

Approximately 42,806 ha of peatlands will be lost as a result of the Application Case. This represents a cumulative decrease in peatlands of 35% from the Late 1990s to the Application Case. The percent decline in area occupied by forested and wooded peatlands is similar to the decrease in non-forested peatlands in the FTSA since the late 1990s.

Reclamation will result in a very minor increase (11 ha) of peatlands in the Application Case-closure as compared to the Application Case. This is due to a small area that will be cleared but not stripped of soil during operations that is predicted to return as functional peatland at closure. Fort McKay believes the restoration of a peatland plant community on this site following closure is somewhat uncertain and will be dependent on the level of disturbance on adjacent sites and the maintenance of hydrological conditions. Therefore, the 14% decrease in peatland area that occurs during the construction and operations phases of the Projects is also expected at closure.

Statement of Significance

- The 14% decrease in the wetland area occupied by peatlands in the Application Case represents a moderate magnitude, local, far future, irreversible, low frequency effect that is scored as an adverse effect of high environmental significance (a **red** situation).
- At Application Case-closure, the environmental significance to peatland wetlands is adverse and high as peatland wetlands are not reclaimed (a **red** situation).
- The cumulative loss of peatlands since the late 1990s is a high magnitude (35%), regional, far future, irreversible, medium frequency adverse effect of high significance (a **red** situation).

Old Growth

The large majority of the old growth wetland found in the Base Case remains undisturbed in the Application Case. About 6 ha of old growth wooded fen wetland will be lost in the Application Case. This represents a decrease of much less than 1% of the old growth wetland resource in the FTSA. This is considered a permanent loss since peatland wetlands will not be recreated at closure.

The Projects also result in the loss of about 6,040 ha of wooded and forested wetland types that could potentially provide old growth wetland in the FTSA during a “normal” natural disturbance cycle (i.e., no fire suppression or human clearing).

The cumulative loss of old growth wetland due to the Projects combined with all developments that have occurred since the late 1990s is estimated to be 1,024 ha or

27% of the resource. The losses throughout the FTSA occur in the wooded and forested peatland classes as well as in the wooded swamp class; losses to the swamp class may be reversible with mitigation since they can occur on mineral soils and are more feasible to reclaim with current knowledge and technology than peatlands.

Statement of Significance

- The incremental effects of the Project are of negligible environmental significance to old growth wetlands in both the Application and Application - closure cases as compared to the Base Case (a **green** situation).
- When compared to the Late 1990s Scenario, the cumulative loss of old growth wetlands in the Application Case represents a high magnitude (27%), regional, far future, partially reversible, medium frequency adverse effect of high significance (a **red** situation).

Timber Productive Forest

Approximately 42% (160,109 ha) of the FTSA is expected to support timber productive forest stands in the Base Case (***Appendix 7-1, Table 8***). The wooded swamp (STNN) wetland occupies about 4,128 ha of the total timber productive area in Application Case as compared to 4,291 ha in the Base Case. This loss (163 ha) represents a 4% decrease in the area covered by STNN since the Base Case.

The cover of the wooded swamp wetland does not change at closure. Therefore the loss of the resource is considered permanent following closure when compared to the Base Case.

Approximately 5,556 ha of wooded swamp occurred in the FTSA in the late 1990s. The decline to 4,128 ha in the Application Case represents a cumulative loss of 26% of the STNN wetland over the time period.

Statement of Significance

- The effects of the Project are of low environmental consequence to timber productive forest found on wetlands in both the Application and Application-closure case as compared to the Base Case (a **green** situation). They are low in magnitude, local, long-term, reversible and low frequency.
- The decrease in areas covered by timber productive forests classified as wetland in the Application Case as compared to the late 1990s represents a high magnitude (26%), regional, far future, reversible, and medium frequency adverse effect of high significance (a **red** situation).

Riparian Areas

Riparian areas located within wetlands decreased from 15,880 ha in the Base Case to 13,993 ha in the Application Case. This decrease of 1,887 ha represents a loss of

12% of the resource due to the Projects in the FTSA. About 1,129 ha of riparian area associated with wetland units are lost due to the Jackpine Mine Expansion while 758 ha are lost due to the Pierre River project.

The extent of riparian areas does not increase following closure since wetlands are generally not created during reclamation. The loss remains at 1,887 ha (12%) when compared closure is compared to the Base Case.

Riparian areas associated with wetlands covered about 20,697 ha of the FTSA in the Late 1990s. The decline to 13,993 ha in the Application Case represents a cumulative loss of 32% of the resource over that period.

Statement of Significance

- The Projects will have an adverse effect of moderate environmental significance (10+0+3+0+0 = 13) to riparian area found in wetlands (a **yellow** situation); these effects are considered moderate in magnitude (12%), local, far future, partially reversible, and of low frequency.
- At closure, the environmental consequence to wetland riparian areas remains as moderate (a **yellow** situation).
- The cumulative loss of riparian areas in wetlands represents a high magnitude (32%), regional, far future, partially reversible and medium frequency adverse effect of high significance (a **red** situation).

Rare Plant Potential

Wetlands with high rare plant potential decreased in extent from 67,829 ha in the Base Case to 58,028 ha in the Application Case, which represents a loss of 9,801 ha or 14% of the resource. Wetlands with moderate rare plant potential decrease by about 165 ha (4%) while wetlands with low rare potential declined by 1,975 ha (7%) in the same period (***Appendix 7-1, Table 10***). Burned wetlands decrease in area from 1,901 ha (73% loss) between the Base and Application Cases.

The losses in rare plant potential associated with high, moderate and low ranked wetlands do not change due to closure since wetlands will not be created during reclamation.

When compared to conditions in the late 1990s, the area covered by wetlands with high rare plant potential in the FTSA will decrease by 37% (34,441 ha) in the Application Case. Wetlands with moderate and low rare plant potential will decrease by 26% (1,484 ha) and 30% (11,409 ha), respectively in area over the same time period.

Statement of Significance

- The Projects will have (10+0+3+3+0 = 16) an adverse effect of high environmental significance to wetlands with high rare plant potential (a **red** situation); these effects are considered moderate in magnitude, local, far future, irreversible, and of low frequency.
- At closure, the environmental consequence to wetland with high rare plant potential remains as high (a **red** situation).
- The Projects will have a low magnitude, local, far future, irreversible, low frequency adverse effect of moderate environmental consequence (a **yellow** situation) to both the moderate and low ranked rare plant potential areas within the FTSA in the Application Case.
- When compared to the late 1990s, the cumulative loss of wetlands with high rare plant potential represents a high magnitude (37%), regional, far future, irreversible and medium frequency adverse effect of high significance (a **red** situation). The loss of wetlands with moderate and low ranked rare plant potential also is considered adverse and highly significant when compared conditions in the late 1990s (a **red** situation).

7.4.3.2 Planned Development Case

Distribution of Wetlands (Landsat)

In the PDC, wetlands cover is predicted to decrease to 107,994 ha which is about 28% of the FTSA. This represents a loss of 18,795 ha (or 15%) when compared to the Base Case. However, the loss of is much greater (63,499 ha or 37%) since industrial activity began (i.e., Pre-Development Scenario).

In the far future (PDC-closure), wetlands are predicted to cover 127,584 ha or 34% of the FTSA which is similar to the Base Case where wetlands covered 126,789 ha or 33% of the FTSA (***Appendix 7-1, Table 1***). This represents an increase of <1% (795 ha) over this period. The area covered by non-treed wetlands is predicted to increase by about 14,223 ha (56%) between the Base Case and the PDC-closure (far future). This is likely due to an increase in non-peatland and/or non-native wetland communities as predicted by Conservation, Closure & Reclamation Plans in other oil sand EIAs (i.e., shrubland, shrubby swamps, marshes, meadows, and shallow open water areas as seen in the AVI data). The area covered by non-treed wetlands is actually predicted to increase (marginally) from 38,388 to 39,744 ha when compared to the Pre-Development Scenario. This increase in area indicates that non-treed wetlands such as the open bog, shrubby bog, graminoid fen, shrubby fen, and patterned fen are being replaced by wetland types not typical of the boreal landscape. Indeed, some of these units (i.e., shrubland and meadow) may not even achieve obligate wetland characteristics at closure. Given the current state of knowledge and technology associated with wetland reclamation, Fort McKay has

low confidence that these reclaimed "wetlands" will provide capabilities and functions equivalent to naturally occurring non-treed boreal wetlands.

The area covered by treed and wooded classes' decreases in the PDC-closure case when compared to both the Base Case and Pre-Development Scenario. Area covered by treed bog/poor fen is as follows in the different scenarios: 64,280 ha (17%) at Pre-Development; 47,644 ha (13%) at Base Case, 42,751 ha (11%) at Application Case; and 41,126 ha (11%) in the PDC-closure case. This represents a loss of 6,518 ha of the wetlands in this class when compared to the Base Case or 23,154 ha when compared to the Pre-Development Scenario. The treed fen wetland class covered 68,825 ha (18%) at Pre-Development and is reduced to 53,594 ha (14%) in the Base Case and 46,684 ha (12%) in the PDC-closure case. This represents a loss of 6,910 ha between the Base Case and PDC-closure. The total area covered by wetlands in the PDC-closure case will be 25% (43,309 ha) less than found at Pre-Development.

Statement of Significance

- In the PDC, the loss of wetland area represents a moderate magnitude (15%), regional, far future, irreversible, medium frequency effect of high environment consequence to the resource as compared to the Base Case (a **red** situation). When compared to the Pre-Development Scenario, the PDC also represents an effect of high consequence (a **red** situation) of high magnitude (37%), regional, long-term, irreversible and medium frequency.
- In the PDC-closure, the area of wetlands is predicted to increase slightly (<1%) when compared to the Base Case. This represents a negligible environmental consequence (a **green** situation). When compared to the Pre-Development Scenario, the loss of wetlands in PDC-closure is an adverse effect of high magnitude, regional, far future, irreversible, and medium frequency; this represents an effect of high environmental significance (a **red** situation).

Peatlands

In the PDC, wetlands that are classified as peatland using the regional land cover class system (Landsat) are predicted to decrease by 15% (12,592 ha) when compared to the Base Case. The decrease in peatland cover for the PDC is 37% (42,545 ha) when compared to the Pre-Development Scenario.

A surprising increase in peatland area is predicted (533 ha; about 1%) in the PDC-closure (far future) data when compared to the Base Case; this increase is unlikely given that the uncertainties associated with wetland reclamation and the current inability to reclaim peatlands. This change is due to a predicted increase in the area covered by non-treed wetlands classed as peatlands in the far future; data summarized for the PDC-closure (based on current public reclamation plans) indicate that non-treed peatlands will increase by 9,530 ha (56%) over the Base Case. This change is unexpected since it is generally accepted that the ability to

reclaim peatlands, particularly at such a large scale, has not been established. Shell (2007) has stated in the Project application that "current practices do not allow for reclamation of fens and bogs" and that the loss of peatlands is irreversible and long-term "due to the current inability to reclaim peatlands". Fens and bogs account for the peatlands in this region of the boreal forest and FTSA.

The area occupied by peatland is expected to be 26% (29,420 ha) less in the PDC-closure (far future) when compared to the Pre-Development Scenario (***Appendix 7-1, Table 11***; 5.4–19). This decline would be more substantial but for the predicted increase in the area occupied by non-treed wetlands, as discussed above. The area covered by the treed bog/poor fen and treed fen classes decline by 36 and 34%, respectively in the PDC-closure as compared to Pre-Development conditions. Based on the assumption that reclamation of peatlands is not feasible, the net loss in the PDC –closure would be much greater if it were equivalent to the net loss in the Planned Development Case (-37%). The net loss would be 15% when compared to the Base Case.

Statement of Significance

- The effects of PDC are adverse and of high environmental significance to the peatlands when compared to the Base Case (a **red** situation). These effects are moderate in magnitude (15%), regional, far future, irreversible and of medium frequency. When compared to Pre-Development, the PDC also has an effect of high environmental significance (a **red** situation), which is of high magnitude (37%), regional, far future, irreversible and of medium frequency.
- In the PDC-closure, the slight increase in peatlands predicted for PDC-closure results in a low environmental consequence if the outcome, as suggested by the compilation of reclamation data, is valid. Fort McKay maintains that reclamation will not be effective in mitigating the loss of peatlands. Since losses are considered irreversible an increase in the resource cannot occur. Therefore the adverse, highly significant effect experienced in the PDC will continue through PDC-closure. When PDC-closure is compared to the Pre-Development Scenario a negative, high magnitude (26%), regional, long-term, irreversible, medium frequency effect of high environmental significance to peatlands is observed (a **red** situation). It is important to note that the magnitude would be even greater if not for the unsupported assumption that certain peatland classes will be reclaimed at closure (compared to PDC).

Old Growth

Wetlands that support old growth are estimated to have covered about 7% of the FTSA in the Pre-Development Scenario (***Appendix 7-1, Table 2***) or about 39% of the total area occupied by old growth. This declines to 4% in both the PDC and PDC-closure cases, which represents a net loss of 35% (9,252 ha) and 34% (9,059 ha), respectively.

In the PDC, old growth found on wetlands is predicted to decrease by about 14% (2,879 ha) when compared to the Base Case. The proportion of old growth found on wetland classes is expected to decline by 13% (2,686 ha) in the PDC-closure case compared to the Base Case.

Statement of Significance

- The effects of the PDC are adverse and of moderate significance to old growth when compared to the Base Case (a **yellow** situation). These effects are moderate in magnitude (14%), regional, far future, partially reversible (some forested non-peatland wetlands may be established) and of medium frequency. When compared to Pre-Development, the PDC also has an adverse effect of moderate environmental significance (a **yellow** situation), which is of moderate magnitude (13%), regional, far future, partially reversible and of medium frequency.
- In the PDC-closure, the decrease predicted in old growth wetlands results in an adverse effect of high environmental significance (high magnitude (34%), regional, far future, partially reversible and medium frequency) when compared to Pre-Development conditions (a **red** situation)]. The decrease in area that occurs in the PDC-closure when compared to the Base Case is an adverse effect of moderate environmental significance (a **yellow** situation) [moderate magnitude (13%), regional, far future, partially reversible, medium frequency)].

Timber Productive Forest

It is not possible to determine the amount of wetlands that support timber productive forest by using the broad ecological land cover classes (Landsat) since productive types (i.e., swamps) are not differentiated. However, it is possible that a small amount of wetland that supports timber productive forest will be lost in the PDC-closure case (see discussion of the Application Case based on AVI data).

Riparian Areas

Riparian areas occupied by wetlands decrease by 15% (2,256 ha) and 32% (6,164 ha) in the PDC when compared to the Base Case and Pre-Development Scenario, respectively. Riparian wetland areas occupied about 5% (18,983 ha) of the FTSA in the Pre-Development Scenario and 3% (12,819 ha) in the PDC (***Appendix 7-1, Table 4***; 5.4–18). Riparian wetlands represent about 46% of the total riparian area present in the Pre-Development Scenario and 42% in the PDC.

An assessment of the PDC-closure was not possible due to the limitations of the data available.

Statement of Significance

- The decrease in riparian areas in the PDC compared to the Base Case results in a moderate magnitude (15%), regional, far future, partially reversible, medium

frequency adverse effect of moderate environmental consequence (a **yellow** situation).

- When compared to the Pre-Development Scenario, the PDC results in an adverse effect of high environmental consequence (a **red** situation) due to the high magnitude (32%) decrease in area.

Rare Plant Potential

The area occupied by wetlands with high rare plant potential decreases from 28% of the FTSA in the Pre-Development Scenario to 21% in the Base Case and 18% in the Application Case. In the PDC-closure, the area of wetlands with high rare plant potential is predicted to increase over the PDC to 22%. The net loss of wetlands with high rare plant potential between the PDC and the Base Case is 15% (12,266 ha) while the net loss between the PDC and Pre-Development Scenario is 38%.

In the PDC-closure, the net loss of wetlands with high rare plant potential is 9% (7,313 ha) when compared to the Base Case and 19% (20,755 ha) when compared to Pre-Development (***Appendix 7.1, Table 5***; 5.4–22 adapted). The change would be much greater if not for the increase in non-treed wetlands predicted at closure. While these non-treed wetlands have all been rated as having high rare plant potential (due to the coarse resolution of the regional mapping) it has not been shown that these reclaimed, non-treed wetlands will actually have the same potential to contain rare plant species as the wetlands that exist prior to disturbance. Several of the wetlands that have high rare plant potential belong to the fen class (see ***Appendix 7-1, Table 11***). The majority of these fens have organic soils (and are considered peatlands), which cannot be reclaimed with confidence at this time.

Treed bogs and poor fens are ranked with moderate rare plant potential in the FTSA. These wetlands cover about 64,280 and 47,644 ha in the Pre-Development and Base Case scenarios in the FTSA. In the PDC, the area of moderate ranked wetlands decreases by 14% (6,529 ha) when compared to the Base Case and by 36% (23,165 ha) when compared to the Pre-Development Scenario. Closure and reclamation have very minimal effect on the moderate ranked wetland class. As a result, the net loss of lands with moderate ranked potential remains at 14% for the PDC-closure compared to the Base Case and at 36% for the PDC-closure compared to Pre-Development.

No wetland classes used in the regional mapping and classification are ranked with low rare plant potential.

Statement of Significance

- The net loss of high ranked wetland in the PDC will result in an adverse effect of high environmental significance to the resource (a **red** situation; change of moderate magnitude (15%), regional, far future, irreversible, and medium

frequency). When compared to the Pre-Development Scenario, the PDC will also have an adverse effect of high environmental significance to wetlands with high rare plant potential (i.e., high magnitude change of 38%; a **red** situation).

- In the PDC-closure, the loss (9%) of wetland with high rare plant potential results in moderate consequence (5+1+3+3+1 = 13) to the resource (low magnitude, regional, far future, irreversible, medium frequency; a **yellow** situation). When compared to the Pre-Development Scenario, the loss of wetland with high rare plant potential is considered as an adverse effect of high environmental significance (moderate magnitude (19%), regional, far future, irreversible, medium frequency; a **red** situation).
- The net loss of moderate ranked wetlands in the PDC will result in a moderate magnitude (14%), regional, far future, irreversible, and medium frequency adverse effect of high significance when compared to the Base Case (a **red** situation). The PDC will result in a high magnitude, regional, far future, irreversible, medium frequency adverse effect of high significance when compared to Pre-Development (a **red** situation).
- At PDC-closure, the loss of moderate ranked wetland results in an adverse effect of high significance (a **red** situation) when compared to both the Base Case and Pre-Development conditions.

7.4.4 Conclusions

A summary of the environmental consequences of the Projects (Application) as well as the PDC on wetlands and wetland indicators is provided in Table 7-5.

Land occupied by wetlands (muskeg) will decline in the FTSA both during the construction and operation phases of the Projects (Application Case) and after Closure. The incremental effects of the Projects are scored as high (adverse and significant) for the direct loss of total wetland, and peatland areas associated with wetlands and the high rare plant potential class for wetlands. The incremental consequence of the Projects is negligible for old growth associated with wetlands and low for productive forest associated with wetlands. The effects of the wetland loss will be experienced into the far future for both the resource and the Community of Fort McKay.

A significant adverse effect is demonstrated for all wetland indicators when the cumulative changes predicted in the Application Case are compared to conditions in the late 1990s. Cumulative losses in all wetland indicators of 26% to 37% have occurred since the later part of the 1990s.

The net change and associated environmental consequences associated with the PDC are considered as adverse and high (i.e., significant effect) when compared to the Base Case for the wetland area, peatland and high rare plant potential indicators. The effects are adverse and significant for all indicators in the PDC when

Table 7-5: Summary of Effects to Wetlands (Muskeg)

Wetland Indicator	Net Change Application Case to Base Case		Net Change Application Case-Closure to Base Case		Net Change Application Case to Late 1990s		Net Change PDC to Base Case		Net Change PDC to Pre-Development		Net Change PDC-Closure to Base Case		Net Change PDC-Closure to Pre-Development	
	%	Consequence	%	Consequence	%	Consequence	%	Consequence	%	Consequence	%	Consequence	%	Consequence
Distribution of Wetlands	-12	high	-12	high	-35	high	-15	high	-37	high	<1	negligible	-25	high
Peatlands	-14	high	-14	high	-35	high	-15	high	-37	high	-15	high	-26 to -37	high
Old Growth associated with Wetlands	<-1	negligible	<-1	negligible	-27	high	-14	moderate	-35	high	-13	moderate	-34	high
Timber Productive Forest associated with wetlands	-4	low	-4	low	-26	high	-	-	-	-	-	-	-	-
Riparian wetlands	-12	moderate	-12	moderate	-32	high	-15	moderate	-32	high	-	-	-	-
Rare Plant Potential – High-12	-14	high	-14	high	-37	high	-15	high	-38	high	-9	moderate	-19	high
Rare Plant Potential – Moderate	-4	moderate	-4	moderate	-26	high	-14	high	-36	high	-14	high	-36	high
Rare Plant Potential - Low	-7	moderate	-7	moderate	-30	high	-	-	-	-	-	-	-	-

compared to Pre-Development conditions; net loss in the wetland area and the other indicators ranges between 32% and 38% when the Projects and other planned developments (PDC) are compared to Pre-Development conditions in the FTSA. During the construction and operation phases of the Projects and other planned developments, these significant losses will negatively affect the Community's ability to carry traditional activities that support its values and culture.

The assessment of the PDC-closure scenario is predicted to result in losses of high environmental consequences (significant effect) for peatlands when compared to the Base Case. Losses of moderate significance are predicted for old growth associated with wetlands and high rare plant potential areas. Wetland area at closure is predicted to be 25% less at PDC-closure when compared to pre-development conditions. Significant adverse effects are observed for all indicators in the PDC-closure when compared to the Pre-Development Scenario. As previously noted, wetland loss at closure is likely greater than indicated, especially for peatlands. Confidence in wetland reclamation, especially of peatlands, is very low.

7.5 Traditional Plants Impact Assessment

7.5.1 Stressors on Traditional Use Plants

Stressors on traditional use plants are similar to those identified for upland forest and wetlands. Clearing of vegetation and removal of soil have the most significant direct affects to traditional use plants. This assessment only considers the biological potential of land to contain traditional use plants. As a result, the assessment of significance does not consider factors such as proximity to other types of traditional use sites, present use by Fort McKay Community members or whether Community members can or will use individual sites in the future.

7.5.2 Fort McKay Baseline Conditions

7.5.2.1 Pre-Development Scenario

Traditional Use Plant Potential (Landsat)

Traditional plant potential rankings are based on plot data compiled from several projects in the region (Golder 2007). This list includes 71 traditional plant species of which eight are not linked to a western scientific name or do not have data; moss is included as species on the list but actually represents eight or more individual species as classified by western science. Each traditional use species was assigned an abundance score, based on frequency of occurrence and percent cover, for each of the vegetation types used in the mapping. In this ranking system, greater weight is assigned to species common in the landscape (i.e., common in frequency and with high cover). No weight is assigned to species that are found infrequently and have low cover (see 0). The individual scores for each species associated with a

vegetation type were then summed to create an overall score for the vegetation type. The overall score was used to assign a traditional use potential ranking (i.e., high, moderate, low) to each of the vegetation types. Traditional Use Plant Potential in the FTSA for the Pre-Development Scenario is illustrated in Figure 7-11.

About 30% of the total FTSA is ranked as having high traditional plant potential in the Pre-Development Scenario (***Appendix 7-1, Table 12***; Table 5.4–23 in Golder 2009). Four of the six terrestrial regional land clover classes have been ranked as having high potential to contain traditional plants (28 species/genus/guilds). An additional 46% of the FTSA is rated as moderate potential. Regional cover classes included in this moderate ranked group include two wetland classes, one terrestrial type and burns. Twenty-three percent of the FTSA is ranked a having low traditional plant potential in the Pre-Development Scenario. Low ranked regional land cover classes include one terrestrial class, one wetland class (non-treed wetlands), cutblocks, disturbances and water.

Traditional Use Plants (Berry Sites)

Many plant species including trees, shrubs, forbs, graminoids, mosses, lichens and fungus are used in traditional ways for food, medicine and ceremony by the Community. Locations of some sites used for the gathering of traditional use plants, especially berry producing species, has been documented by Fort McKay (FMFN 1994; McKillop 2002). The number of traditional use berry sites recorded for species studied by Fort McKay (1994) is provided in Table 7-6.

Table 7-6: Number of Traditional Use Berry Sites Located within FTSA as Recorded by Fort McKay

Berry Type	No. of Traditional Use Sites
Blueberry	23
Bunchberry	2
Chokecherry	5
Cloudberry	2
Cranberry	24
Hazelnut	5
High-bush cranberry	3
Kinnickinnik	17
Low-bush cranberry	2
Pincherry	4
Raspberry	19
Saskatoon	6
Strawberry	2

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
McClelland Lake
Calumet River
Lillian Lake
Calumet Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
Dover River
MacKay River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Pre-Development Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

TRADITIONAL PLANT POTENTIAL

- HIGH
- MODERATE
- LOW

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
TRADITIONAL PLANT POTENTIAL IN THE FORT MCKAY 40 TOWNSHIP BLOCK (LANDSAT)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	AA	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

FIGURE 7-11

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One hundred and fourteen traditional use berry sites, as documented by Fort McKay First Nation (1994), occur within the FTSA. It is not possible to apportion these berry producing sites to land cover classes in the Pre-Development Scenario since Ducks Unlimited wetland mapping was used for this analysis.

7.5.2.2 Late 1990s Scenario

Traditional Use Plant Potential (AVI)

Traditional Use Plant Potential for the Late 1990s Scenario is shown in Figure 7-12. Based on ranking of the ecosite phase and wetland types, about 37% of the FTSA was ranked as having high traditional plant potential in the Late 1990s Scenario (***Appendix 7-1, Table 13***; Table 5.4–6 in Golder 2009). According to this ranking system, all of the high ranked vegetation units consisted of upland vegetation. Approximately 26 and 37% of the FTSA was ranked with moderate and low potential, respectively. Moderate ranked areas consisted of wetlands, upland ecosite phases, burns, shrubland and cutblocks. Land cover classes included in the low ranked category include wetlands, terrestrial ecosite phases, meadows, and a number of sparsely or non-vegetated cover classes including disturbances.

Ranking of traditional use plant potential, according to the system used by Golder (2007), is completed through a two-step process. Firstly, a species abundance score is developed for each traditional use species based on percent species cover and frequency of occurrence from the Project plot data. Individual ecosite phases, wetland types or land cover classes are then ranked as having high, moderate or low traditional use plant potential based on the cumulative score of all traditional use plants found in map unit. As a result, ecological land cover classes (map units) that contain several species with high abundance and percent cover values are ranked as having high potential. While it is helpful to rank traditional use plant potential for assessment purposes, the criteria used in this ranking system may not coincide with the values or experiences of community members harvesting traditional use plants. Therefore results of this ranking system might not meaningfully articulate areas that traditional land users would consider of high value. For instance, plants that have low frequency and percent cover in the landscape [such as rat root (Acorus americanus)] may be of significant value to the community. In the system used by Shell (2007), these species do not influence the ranking system, and ecosites in which they occur may get a low TU potential ranking but are indeed of high significance to the Community.

Traditional Use Plants

The location of berry producing sites (FMFN 1994) has been overlain on FTSA subset of the Ducks Unlimited Enhanced Wetland Classification for the Al-Pac Boreal Conservation Project (Ducks Unlimited 2008) to show relationships between traditional use berry sites with the land cover class. Due to the scale of the Fort

McKay First Nation's data capture some of the site locations are associated with unexpected Ducks Unlimited cover classes (i.e., wetland species overlay with upland site); however, the data has been used to provide an indication of the effects of development on traditionally used sites at the regional level. Even with the different modes, and refinement, of data capture between Fort McKay's traditional land use study and the Ducks Unlimited mapping, we are still able to gain insight into the general trends of development effects on some key culturally used sites.

Disturbance scenarios used to assess the various scenarios/cases for the Projects have also been applied to the two data sets to evaluate the effects of the Projects and other planned developments on these known berry producing sites. The distribution of the berry producing sites by wetland classes in the FTSA for the Base, Application and PDC development cases are presented in ***Appendix 7-1, Table 14***.

Some traditional use plants species are strongly associated with specific ecosite phases or wetland types. Bog cranberry (*Oxycoccus microcarpus*) is generally associated with treed bogs (and treed poor fens), cloudberry (*Rubus chamaemorus*) is associated with treed bogs, tamarack (*Larix laricina*) is found in treed fens, red birch/bog birch (*Betula glandulosa, Betula pumila*) is most common in fens (and in some bogs), and rat root is found in swamps and open wetlands with water. Several mosses with traditional uses are associated with bogs and fens. Sphagnum mosses (*Sphagnum* spp.) are common to abundant in peatlands such as the treed bog, shrubby bog, open bog, treed poor fen, shrubby poor fen and graminoid poor fen classes. *Aulacomnium palustre* and *Tomenthypnum nitens* might be present in bogs but are typically most abundant in treed poor fen, shrubby poor fen, graminoid poor fen, treed rich fen, shrubby rich fen and graminoid rich fen wetland classes (Golder 2007; Ducks Unlimited 2008). Disturbance of wetlands within the FTSA will affect the availability of these traditional use species or groups of plants.

Approximately 41 (36%) of the 114 traditional use berry sites (FMFM, 1994; McKillop 2002) were associated with wetlands in the late 1990s to early 2000s while 60 (53%) were found on upland ecosystems. Twelve sites (11%) had been disturbed by the time the Ducks Unlimited mapping was generated from late 1990 and early 2000 imagery. The distribution of berry traditional use berry sites in the FTSA in the late 1990s is illustrated in Figure 7-13.

Appendix 7-1, Table 15 summarizes the distribution of land cover types, as defined by Ducks Unlimited mapping (2008), based on imagery from the late 1990s to early 2000s. About 43% and 51% of the FTSA was covered by wetland and upland land cover types. Approximately 4% was classified as anthropogenic influenced (disturbed) while 3% of the area was not classified.

Rg. 13 W4M
Rg. 12
Rg. 11
Rg. 10
Rg. 9
Rg. 8
Rg. 7
N
Tp. 100
Tp. 99
Tp. 98
Tp. 97
Tp. 96
Tp. 95
Tp. 94
Tp. 93
Oakley Lake
Athabasca River
Firebag River
Pierre River
Calumet River
Lillian Lake
Calumet Lake
McClelland Lake
Muskeg River
Wapasu Creek
Fort McKay Indian Reserve No. 174C (IR 174C)
Kearl Lake
Joslyn Creek
Ells River
Fort McKay
Fort McKay IR 174
MacKay River
Dover River
Mildred Lake
Saline Lake
Jackpine Creek
North Steepbank River

Late-1990s Scenario

LEGEND

- FORT MCKAY 40 TOWNSHIP BLOCK
- TERRESTRIAL LOCAL STUDY AREA
- INDIAN RESERVE
- OPEN WATER
- PUBLIC ROADWAY

TRADITIONAL PLANT POTENTIAL

- HIGH
- MODERATE
- LOW

DISTURBED

- DISTURBANCE AREA
- LINEAR DISTURBANCE

REFERENCE

Alberta digital data obtained from AltaLIS Ltd. (September 2004), IHS Energy Ltd. (August 2006), used under license.
Projection: UTM Zone 12 Datum: NAD 83

5 0 5
SCALE 1:250,000 KILOMETRES

PROJECT
JACKPINE MINE EXPANSION &
PIERRE RIVER MINE PROJECT

TITLE
TRADITIONAL PLANT POTENTIAL IN THE FORT MCKAY 40 TOWNSHIP BLOCK (AVI)

PROJECT No. 08-1346-0006.5722			SCALE AS SHOWN	REV. 0
DESIGN	JG	26 Jan. 2009		
GIS	JH	26 Jan. 2009		
CHECK	MJ	27 Feb. 2009		
REVIEW	TC	02 Mar. 2009		

FIGURE 7-12

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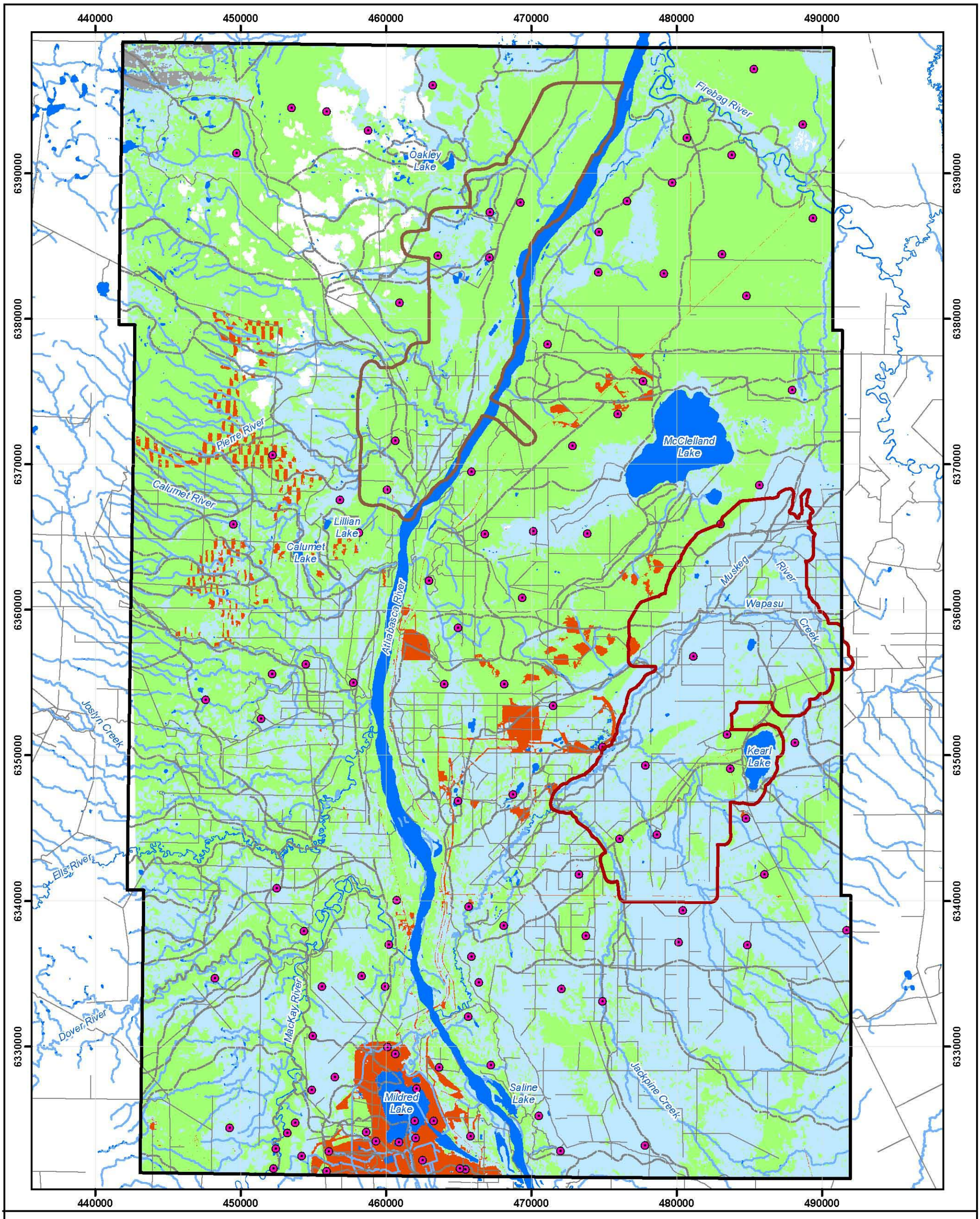

Legend

- Traditional Use Berry Site
- Trail
- Road
- River
- Lake
- 40 Township Study Area
- Pierre River Mine LSA
- Jackpine Mine Expansion LSA

Land Classification

- Upland
- Wetland
- Open Water
- Anthropogenic Influenced
- Burned Area
- Unclassified

N

0 5 10 15

Kilometres

Scale 1:250,000

Source Data: 1) Land Classification-Ducks Unlimited, 2008
2)Traditional Use Berry Sites - Fort McKay First Nation, 1994

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Traditional Use Berry Sites in the FTSA (Ducks Unlimited Classification) - Late 1990's

PROJECTION: UTM - Zone 12 N	DRAWN BY: L. Sherman
DATUM: NAD 83	CHECKED BY: S. Parker
DATE: December 14, 2009	FIGURE NO.: 7-13

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Base Case

Traditional Use Plant Potential (Landsat)

The area covered by the units ranked with high potential for traditional use decrease in the Base Case to 27% from the 30% present in the Pre-Development Scenario while moderate ranked area decrease to 29% from 46% (***Appendix 7-1, Table 12***). Areas ranked with low potential to contain traditional use plants increase from 23% in the Pre-Development Scenario to 44% in the Base Case, due to the increase in area of land included in the disturbed category.

Traditional Use Plant Potential (AVI Data)

Land ranked with high traditional plant potential decreases from 37% in the Late-1990s Scenario to 31% in the Base Case (***Appendix 7-1, Table 13***). Moderate ranked areas also experience a decrease from 26% to 20% over the same period. The total area ranked with low potential to contain traditional use plants increases substantially from 37% in the Late 1990s Scenario to 49% in the Base Case. Again, this increase is a result of an increase of "disturbed" land contained in the low category.

Traditional Use Plants

Disturbance layers developed by Golder Associates for assessment of the Pierre River and Jackpine Mine Projects were overlain on the Ducks Unlimited wetland mapping and locations of traditional use berry sites for the FTSA to determine changes in distribution. Fifty-three (46%) of the berry sites documented by Fort McKay First Nation (1994) have been disturbed (lost) between the Pre-Development and the Base Case development scenarios. Comparison to the Ducks Unlimited mapping indicate that an additional 21 berry producing sites (51%) associated with wetlands and 22 (37%) sites associated with uplands have been developed since the early 2000s (i.e., Late 1990s Scenario). This represents a loss of 43 known traditional use berry sites over a roughly eight year period or 38% of the original total. Traditional use berry sites disturbed in the Base Case are shown in Figure 7-14.

About 42% (160,508 ha) of the FTSA consisted of wetlands in the late 1990s/early 2000s as mapped by Ducks Unlimited (2008) (***Appendix 7-1, Table 15***). Excluding burned areas, the area occupied by wetlands, as delineated by Ducks Unlimited (2008) declined by about 44,150 ha (28%) over the same period to cover about 28% of the FTSA in the Base Case. Declines in area of all wetland types occurred over this period; these losses ranged between 17% and 31%.

7.5.3 Impacts to Traditional Use Plants

7.5.3.1 Application Case

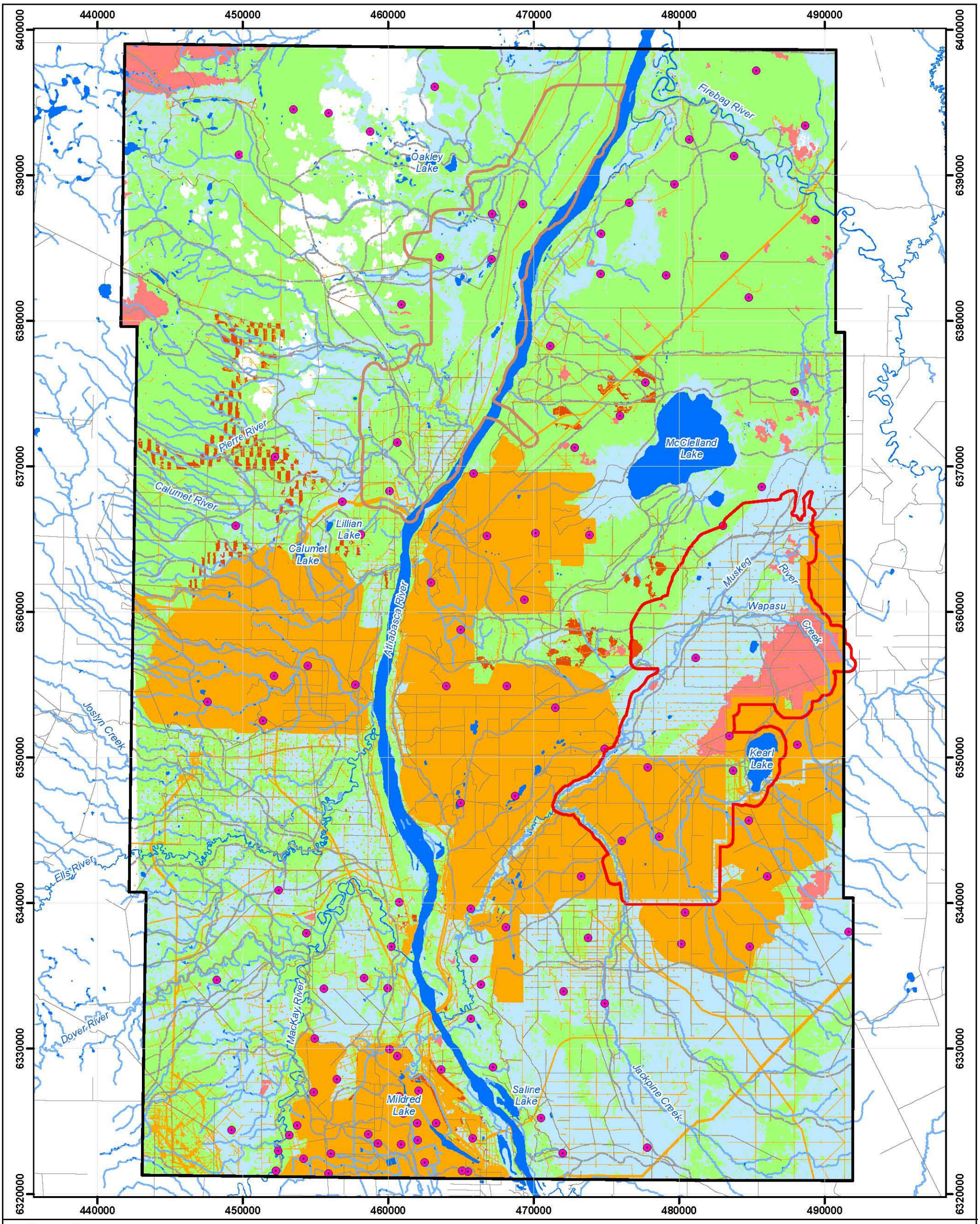
Changes in Traditional Use Plant Potential

Land with high traditional plant potential ranking will decline in area from 31% (116,373 ha) in the Base Case to 29% (110,236 ha) as a result of the Projects (Application Case) in the FTSA (***Appendix 7-1, Table 13***). This represents a decline of 5% in the resource. Moderate ranked area will decline by 13 from 20% (77,262 ha) to 18% (67,258 ha) while the low ranked areas will increase by 9% from 49% (185,999 ha) in the Base Case to 53% (202,141 ha) in the Application Case. The increase in low ranked sites is largely due to the construction and operation phases of the Projects as disturbances are ranked as having low potential. In all likelihood these low ranked sites will have no traditional value in the Application Case because they will have been disturbed by mining or be limited by constraints to access.

In comparison to conditions in the late 1990s, the area of land with high traditional plant potential will decline by 21% (30,090 ha) in the Application Case. Moderate ranked land will decrease by 32% (30,044 ha) in the Application Case while the area of low ranked land will increase by 44% (62,133 ha) over the time period. This increase in low ranked land occurs because disturbances are included in the low ranked class.

Based on the rating system utilized by Shell (2007), in the Application Case closure, the area of land occupied by ecosites phases and wetlands with high traditional plant potential will increase slightly (<1%) to 31% (116,504 ha) when compared to the Base Case. This occurs because closure will result in the reclamation of upland forested systems that have been rated with high traditional plant potential. However, this would only occur if reclamation can result in similar diversity and abundance as was present prior to disturbance. Many of the ecosite phases that obtained the high rank contain species that were common to very common in the field plots and/or contained a relatively large number of traditional plant species compared to the moderate and low ranked vegetation units. For instance, high ranked ecosite phases contained between 11 and 17 species while moderate ranked ecosites or wetlands contained between 7 to 10 traditional use species. The number of traditional use species found in the low ranked ecosite phases or wetlands ranged between 2 and 11.

Further, this assessment does not indicate the unique significance of wetland sites to support particular traditional use plants. Rather, it views all species as equal in significance and simply implies that if 11 to 17 species identified as having traditional use are present with moderate to high cover, then the site is of high value. Other factors, which may influence the selection of traditional use sites by the Fort McKay Community members, such as proximity to cabins, trails, or other



Legend

- Traditional Use Berry Site
- Trail
- Road
- River
- Lake
- 40 Township Study Area
- Pierre River Mine LSA
- Jackpine Mine Expansion LSA

Baseline Disturbance

- Development
- Burned Areas

Land Classification

- Anthropogenic Influenced
- Upland
- Burned Area
- Wetland
- Unclassified
- Open Water

Source Data: 1) Land Classification-Ducks Unlimited, 2008
2) Disturbance data-Golder Associates, 2009
3)Traditional Use Berry Sites - Fort McKay First Nation, 1994

N

0 5 10 15
Kilometres

Scale 1:250,000

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Traditional Use Berry Sites Disturbed in the FTSA (Ducks Unlimited Classification) - Base Case

PROJECTION: UTM - Zone 12 N	DRAWN BY: L. Sherman
DATUM: NAD 83	CHECKED BY: S. Parker
DATE: December 14, 2009	FIGURE NO.: 7-14

1033551_Fort_McKay_Berry_Base_Case_Fig_7_14.mxd

historical sites, are not considered in the assessment methodology. Traditional land use requires movement across the land and all ecosites and wetlands have relevance for the people that use the land and the species that occur there. People use different species at different times of the year, for different purposes. Replacing one type of area (e.g., peatlands) with another (e.g., upland forest) is not an equal exchange. The limitations of this assessment should be considered when interpreting this data.

Lands with moderate traditional plant potential will decrease by about 6% (4,903 ha) from 20% of the FSTA at the Base Case to 19% at closure. This decline largely occurs because of the loss of wetlands.

The area occupied by low ranked traditional plant lands will increase by about 3% (4,773 ha) at closure. These low ranked lands occupied about 49% of the FTSA in the Base Case and are predicted to occupy about 50% at closure.

If successful, reclamation will only provide partial mitigation (i.e., the effect of disturbance is partially reversible) for the moderate and low classes associated with upland areas since wetlands cannot be restored.

Statement of Significance

Based on Shell's assumption that reclamation will be successful, the Application Case, as compared to the Base Case, will have the following effects to traditional plant potential:

- The Application Case will result in a net decrease (5%) of sites ranked as high for traditional plant potential. This loss represents a low magnitude, local, far future, reversible, and low frequency effect of (5+0+3-3+0 = 5) of negligible significance (a **green** situation).
- The decrease (13%) in area covered by moderate ranked sites represents a moderate magnitude, local, far future, partially reversible and low frequency (10+0+3+0+0=13) adverse effect of moderate significance (a **yellow** situation).
- The 9% increase of low ranked rare plant potential sites represents a low magnitude, local, far future, partially reversible, low frequency adverse effect of low significance (a **green** situation).

The Application Case, as compared to conditions in the Late 1990s Scenario, will have the following effects to traditional plant potential:

- The decrease in high ranked lands represents a high magnitude (21%), regional, far future, reversible, medium frequency adverse effect of high significance (a **red** situation).

- The decrease in area classified as moderate traditional plant potential represents a high magnitude (32%), regional, far future, partially reversible, medium frequency adverse effect of high significance (a **red** situation).
- The increase in low ranked lands is a high magnitude (44%), regional, partially reversible, medium frequency adverse effect of high significance (a **red** situation). It is considered adverse because the increase is due to increase in land area disturbed over the time period.

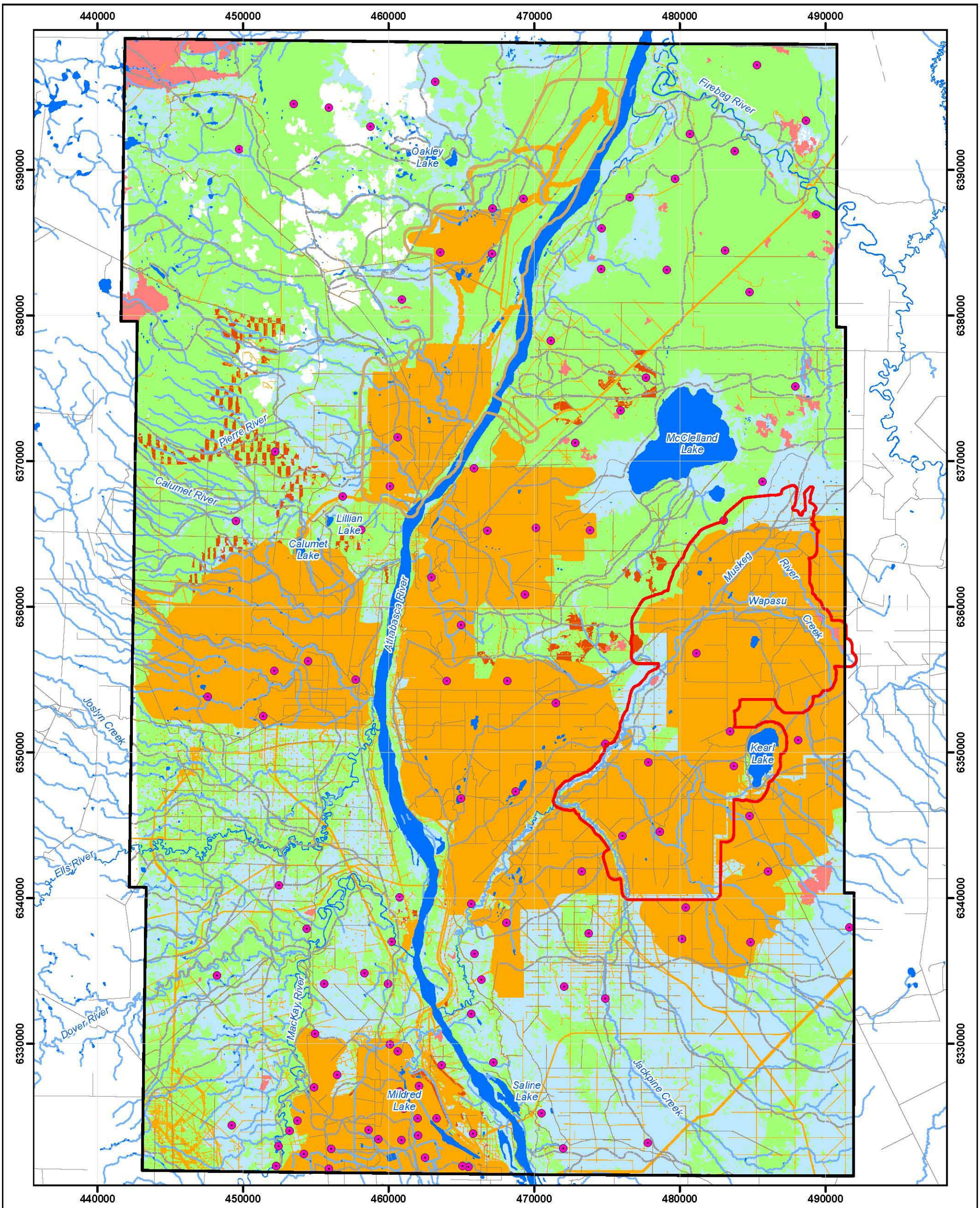
The Application Case closure, as compared to the Base Case, will have the following effects to traditional plant potential:

- In the Application Case closure, the slight increase in area of land ranked with high traditional plant potential represents a positive, negligible magnitude, local, far future, reversible and low frequency effect (+[0+0+3-3+0] = 0) of negligible significance (a **green** situation).
- The 6% decrease in moderate ranked lands results in a (5+0+3+0+0 = 8) low magnitude, local, far future, partially reversible, low frequency adverse effect of low significance (a **green** situation).
- The small increase (3%) in lands ranked with low potential results in a low magnitude, local, far future, partially reversible and low frequency adverse effect (5+0+3+0+0 = 8) of low significance (a **green** situation). Although the increase is positive in direction the effect is considered adverse since an increase in areas with the lowest traditional use potential is predicted.

Traditional Use Plants

An additional four traditional use berry sites will be lost as result of the Projects. This represents a loss of 4% when compared to the total number of sites that were present at pre-development and 7% of the number undisturbed (59) in the Base Case. A cumulative loss of 59 (52%) traditional use berry sites has occurred since pre-development. Comparison to the Ducks Unlimited mapping indicates that an additional one berry-producing site associated with wetlands and three sites associated with uplands will be disturbed by the Projects in the Application Case. In total, 43 (38%) known traditional use berry sites have been lost in the FTSA over a roughly 8-year period. Figure 7-15 illustrates the traditional use berry sites affected by the Application Case.

About 12% of the wetlands present in the FTSA in the Base Case, based on Duck Unlimited mapping, will be lost in the Application Case while an additional 5% of the uplands will be disturbed (***Appendix 7-1, Table 15***). The cumulative loss of wetlands in the FTSA between the Application Case and the late 1990s/early 2000s is approximately 58,000 ha or 36% of the resource. This loss of wetland area significantly reduces the area potentially available for use by the Community of Fort



Legend

- Traditional Use Berry Site
- Trails
- Road
- River
- Lake
- 40 Township Study Area
- Pierre River Mine LSA
- Jackpine Mine Expansion LSA

Application Disturbance

- Development
- Fire

Land Classification

- Upland
- Wetland
- Open Water
- Anthropogenic Influenced
- Burned Area
- Unclassified

Source Data: 1) Land Classification-Ducks Unlimited, 2008
2) Disturbance data-Golder Associates, 2009
3) Traditional Use Berry Sites - Fort McKay First Nation, 1994

N

0 5 10 15

Kilometres

Scale 1:250,000

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Traditional Use Berry Sites Disturbed in the FTSA (Ducks Unlimited Classification) - Application Case

PROJECTION: UTM - Zone 12 N	DRAWN BY: J Blyth
DATUM: NAD 83	CHECKED BY: S. Parker
DATE: December 14, 2009	FIGURE NO.: 7-15

1033551_Fort_McKay_Berry_Application_Fig_7_15.mxd

McKay for gathering of traditional use plants that are strongly associated with wetlands.

As stated previously, reclamation and closure will not be effective in mitigating the loss of wetlands. As a result, the area of wetlands that support a suite of species present in the typical boreal forest landscape is not expected to be present for gathering of traditional use species following closure.

Statement of Significance

- A 7% decrease in traditional use berry sites as a result of the Projects (Application Case) represents a negative, low magnitude, local, irreversible, far future, and low frequency effect with an overall rating of (5+0+3+3+0=11) of moderate significance as compared to the Base Case (a **yellow** situation). It is assumed that these traditional use berry sites will also be lost in the Application Case-closure.
- Including the Application Case, a total of 38% of the traditional use berry sites have been lost to disturbances since the late 1990s. This represents a high magnitude, regional, far future, partial reversible, and medium frequency adverse effect of high significance (a **red** situation).
- A 12% decrease in the area occupied by wetlands for gathering of traditional use plants as a result of the Projects represents a negative, moderate magnitude, local, far future, irreversible and low frequency effect with an overall rating of (10+0+3+3+0=16) high significance as compared to the Base Case (a **red** situation). This effect is also expected to continue in the Application Case closure since reclamation is not effective for wetland mitigation.
- The cumulative decrease in wetlands in the Application Case since the late 1990s represents a high magnitude (36%), regional, far future, irreversible, medium frequency, adverse effect of high significance for the gathering of traditional use plants associated with wetlands (a **red** situation). These significant changes have occurred in less than a decade.

7.5.3.2 Planned Development Case

Changes in Traditional Use Plant Potential

In the PDC, the area ranked as high and moderate traditional plant potential will decrease when compared to the Base Case while the low ranked area will increase. High ranked land decreases by about 19% (18,911 ha) in area when compared to the Base Case while moderate ranked land will decrease by approximately 16% (17,431 ha) in area. The amount of land ranked as low traditional plant potential will increase by 22% (36,342 ha) in the PDC when compared to the Base Case. Again, this is largely due to the increase in the area classified as disturbance.

In the PDC-closure (far future), the area ranked as high traditional plant potential will increase by 52% (53,492 ha) when compared to the Base Case. This is due to the predicted increase in land occupied by upland forest. Moderate ranked land will increase slightly (3%, 3,516 ha) in the PDC-closure compared to the Base Case. The amount of land occupied by the low ranked class is predicted to decrease by 34% (57,008 ha) in the PDC-closure when compared to the Base Case. This occurs as the lower ranked ecosites, wetlands and disturbances are replaced in the landscape with upland types that are ranked with high traditional plant potential.

The amount of land ranked as having high traditional plant potential will decrease by 28% (32,411 ha) in the PDC when compared to the Pre-Development Scenario. Moderate ranked land will decrease by 47% (82,613 ha) over the same period. The low ranked land will increase in area by 130% (115,091 ha) in the PDC when compared to pre-development conditions.

In the PDC-closure (far future), the land ranked as high traditional plant potential is predicted to increase by 35% (39,992 ha) when compared to the Pre-Development Scenario. However, land ranked with moderate potential is predicted to decrease by 35% (61,666 ha) in a comparison of these two scenarios. The increase in high ranked land and decrease in moderate ranked land is due to the predicted increase in certain upland ecosite phases commonly used in reclamation, which have higher traditional plant potential in the undisturbed state. Increases in high traditional plant potential sites at closure depend on successful reclamation. Establishment in a similar number and abundance of traditional use plants as where present in pre-disturbance (i.e., natural) conditions must be achieved to result in comparable ratings following closure. It is not yet certain that reclamation will be successful in achieving "equivalent capability" for traditional plant use by Fort McKay Community members.

Low ranked land is also expected to increase by 25% (21,741 ha) in the far future when compared to the Pre-Development Scenario. Fort McKay does not believe that the replacement of moderate ranked lands that occur in the natural landscape with low ranked, (reclaimed) non-treed wetlands and water bodies (i.e., pit lakes) is a positive effect.

Statement of Significance

The PDC is expected to have the following consequences to traditional plant potential rankings when compared to the Base Case:

- The area covered by land ranked with high traditional plant potential is expected to decrease by 19% when compared to the Base Case. This decrease results in a moderate magnitude, regional, far future, reversible, moderate frequency (10+1+3-3+1=12) adverse effect of moderate significance (a **yellow** situation). However, if the magnitude were one percent greater the consequence would be high (a **red** situation).

- The decrease (16%) in the moderate ranked land is considered as a moderate magnitude, regional, far future, (partially reversible), moderate frequency, adverse effect of (10+1+3+0+1=15) of moderate significance (a **yellow** situation).
- The increase (22%) in land ranked with low traditional plant potential results in a high magnitude, regional, far future, (partially reversible), moderate frequency, adverse effect of (15+1+3+0+1=20) of high significance (a **red** situation).

The PDC is expected to have the following effects on traditional land potential rankings when compared to the Pre-Development Scenario:

- Land area ranked as high traditional plant potential will have decreased by 28% in the FTSA. This decrease is considered as a high magnitude, regional, far future, reversible, moderate frequency adverse effect of high significance (a **red** situation).
- The decrease (-47%) in land ranked as moderate traditional plant potential results in a high magnitude, regional, far future, partially reversible, moderate frequency adverse effect of high significance (a **red** situation).
- The net increase in land ranked as low traditional plant potential results in a high magnitude, regional, far future, partially reversible, moderate frequency, effect in the positive direction of high significance. However, the effect is considered as adverse (a **red** situation) since naturally occurring ecosystems are being replaced with disturbed land (ranked as low potential) in this situation.

The PDC-closure is expected to have the following effects on traditional plant potential rankings when compared to the Base Case:

- Land ranked with high traditional plant potential is expected to increase (52%) in the far future as a result of the Projects and other developments. This increase is considered positive, high in magnitude, regional, far future, reversible, and of medium frequency. This results in a positive effect of high significance.
- The increase (3%) in moderate ranked land will result in a positive, low magnitude (3%), regional, far future, partially reversible, and medium frequency effect of (5+1+3+0+1=10) of low significance.
- The decrease (34%) in land occupied by the low ranked class is expected to result in a negative, high magnitude, regional, far future, partially reversible, high frequency effect of (15+1+2-0+2=20) of high environmental consequence. The effect should be considered positive, as compared to the Base Case, because disturbed land is being reclaimed that will have some potential to contain traditional plants.

The PDC-closure is expected to have the following effects when compared to conditions at pre-development:

- An increase (35%) in high ranked land may result in a positive, high magnitude, regional, far future, reversible, medium frequency effect of high significance.
- The decrease (35%) in moderate ranked land is considered a negative, high magnitude, regional, far future, partially reversible, medium frequency adverse effect of (15+1+3+0+1 = 19) high significance (a **red** situation).
- The increase (25%) in low ranked land is positive in direction, high magnitude, regional, far future, partially reversible, medium frequency effect of (15+1+3+0+1 = 20) of high significance. In this case the overall effect should be considered as negative and a **red** situation because the increase occurs in the lowest ranked class, which contains lower potential for traditional use plants when compared to undisturbed/natural conditions.

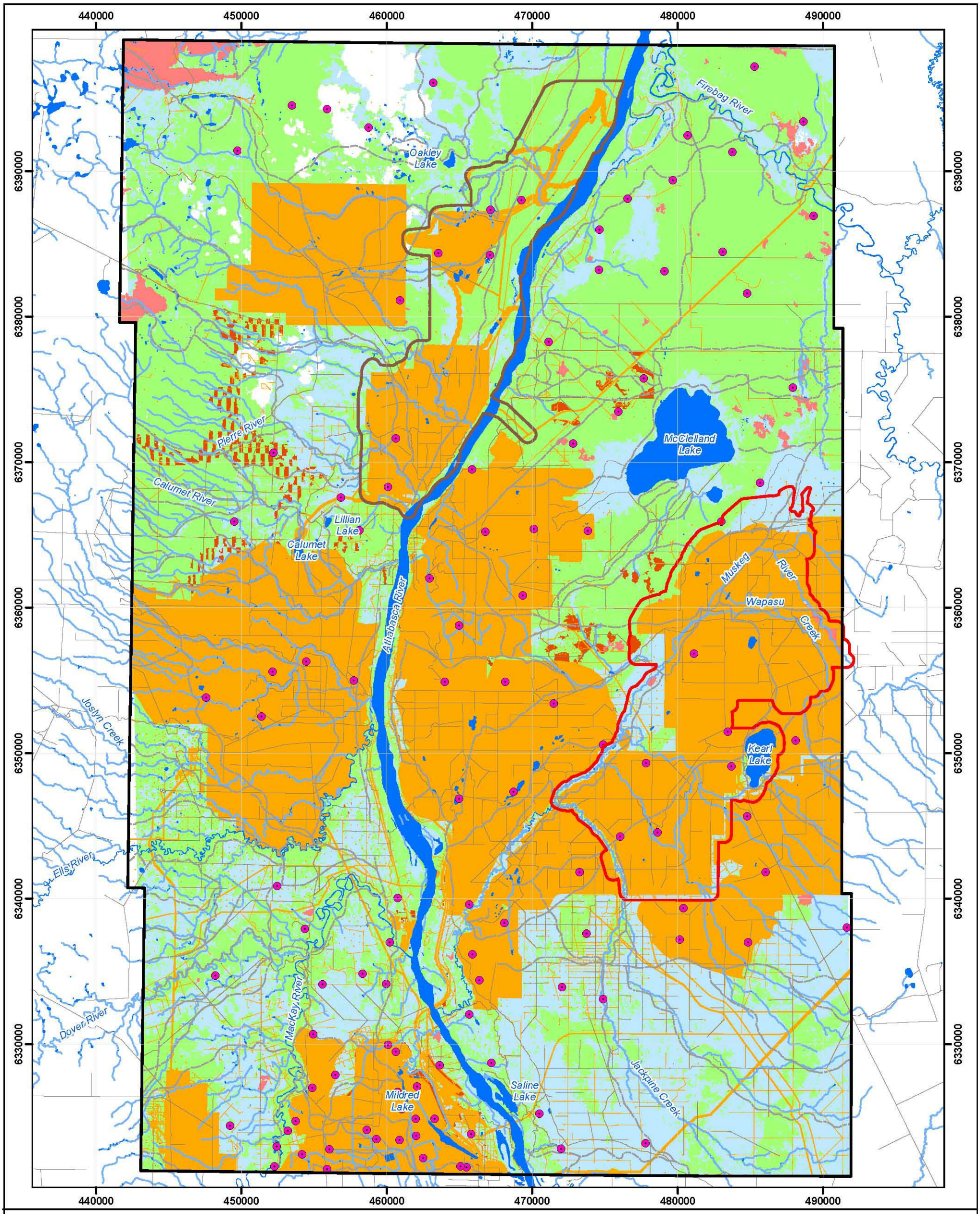
Traditional Use Plants

Seven traditional use berry sites will be lost as result of the Projects and other planned developments when compared to the number present in the Base Case; this represents a loss of 12%. However, the loss of 62 berry producing sites in the FTSA represents a cumulative loss of 54% of the total sites since pre-development. Comparison to the Ducks Unlimited mapping indicates that an additional two berry producing sites associated with wetlands and five sites associated with uplands will be disturbed by the Projects or other planned developments when compared to the Base Case (Figure 7-16).

About 18% of the wetlands present in the FTSA in the Base Case will be lost in the PDC while an additional 14% of the uplands will be disturbed (***Appendix 7-1, Table 15***). Planned projects will result in the loss of area available for use by the Community for the gathering of traditional use plants that are strongly associated with wetlands. As in the Application Case, reclamation and closure is not expected to mitigate the loss of wetlands, especially peatlands.

Statement of Significance

- A 12% decrease in traditional use berry sites as a result of the Projects and other planned developments (PDC) represents a negative, moderate magnitude, regional, far future, irreversible and moderate frequency adverse effect (10+1+3+3+1=18) of high significance as compared to the Base Case (a **red** situation).
- A 54% decrease in traditional use berry sites due to existing projects and the PDC compared to Pre-Development Scenario conditions represents a negative, high magnitude, regional, far future irreversible, and medium frequency effect (15+1+3+0+1=20) of high significance as compared to pre-development (a **red** situation).



Legend

- Traditional Use Berry Site
- Trails
- Road
- River
- Lake
- 40 township Study Area
- Pierre River Mine LSA
- Jackpine Mine Expansion LSA

PDC Watershed Disturbance

- Development
- Fire

Land Classification

- Upland
- Wetland
- Open Water
- Anthropogenic Influenced
- Burned Area
- Unclassified

Source Data: 1) Land Classification-Ducks Unlimited 2008
2) Disturbance data-Golder Associates, 2009
3) Traditional Use Berry Sites - Fort McKay First Nation, 1994

N

0 5 10 15
Kilometres

Scale 1:250,000

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V8L 5X4
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Traditional Use Berry Sites Disturbed in the FTSA (Ducks Unlimited Classification) Planned Development Case

PROJECTION: UTM - Zone 12 N	DRAWN BY: L. Sherman
DATUM: NAD 83	CHECKED BY: S. Parker
DATE: December 14, 2009	FIGURE NO.: 7-16

1033551_Fort_McKay_Berry_PDC_Fig_7_16.mxd

- An 18% decrease in the area occupied by wetlands for gathering of traditional use plants in the PDC represents a negative, high magnitude, regional, far future, irreversible and moderate frequency adverse effect of [15+1+3+3+1=23) high significance as compared to the Base Case (a **red** situation). This effect is expected to continue past closure (PDC-closure).
- The cumulative effect of all projects developed since the late 1990s in addition to the Projects and other planned developments results in an approximately 40% decrease in the area occupied by wetlands available for the gathering of traditional use plants. This represents a negative, high magnitude, regional, far future, irreversible, high frequency effect with an overall rating of (15+1+3+3+1=23) high significance (a **red** situation) as compared to the Late-1990's Scenario (i.e., approximate time of time of DU mapping).

7.5.4 Conclusions

A summary of the environmental consequences of the Projects (Application Case) as well as the PDC on traditional plant indicators is provided in Table 7-7.

Land ranked with high traditional use potential will decrease in both the Application and PDC cases. Although changes in high ranked land are moderate in the PDC they are very close to having a high adverse significant effect. Following closure, the area of lands with high traditional use potential is predicted to increase. This is due to an expected increase in the area covered by upland ecosites that have the potential to contain a high number of traditional use plants. There is moderate uncertainty associated with the assumption that the reclaimed landscapes will provide an equivalent traditional use potential. Returns to pre-disturbance levels of diversity on reclaimed area have not yet been demonstrated on the landscape level, nor has the Community of Fort McKay been able to access reclaimed land for traditional purposes. See ***Section 10 – Reclamation*** for further discussion of reclamation concerns.

Moderate consequences to moderate ranked lands are expected for the Application Case and PDC when compared to the Base Case. Low consequences are predicted for the Application Case closure compared to Base Case since reclamation has the potential to mitigate the effects. The effects to the moderate ranked land are expected to be significant in comparison of the PDC to pre-development and for PDC-closure to pre-development. The decrease in moderate ranked lands is largely due to the loss of wetlands and the inability of reclamation to mitigate these losses, especially in peatlands.

Land ranked with low traditional use potential increases in both the Application Case and PDC as vegetated landscapes (wetlands and upland ecosites) are lost and replaced with low ranked disturbed sites. The decrease in land ranked with low potential that occurs in the PDC-closure when compared to the Base Case occurs because disturbed lands are being replaced with higher ranked upland sites in the

Table 7-7: Summary of Effects to Traditional Use Plant Potential and Sites in the FTSA

Indicator	Net Change Application Case to Base Case		Net Change Application Case-Closure to Base Case		Net Change Application Case to Late 1990s		Net Change PDC to Base Case		Net Change PDC to Pre-Development Scenario		Net Change PDC-Closure to Base Case		Net Change PDC-Closure to Pre-Development Scenario	
	%	Significance	%	Significance	%	Significance	%	Significance	%	Significance	%	Significance	%	Significance
Changes in Traditional Use Plant Potential														
High Class	-5	Negligible	<1	Negligible	-21	High	-19	Moderate	-28	High	+52	High[3]	+35	High
Moderate Class	-13	Moderate	-6	Low	-32	High	-16	Moderate	-47	High	+3	Low	-35	High
Low Class	+9	Low	+3	Low	+44	High	+22	High	+130	High	-34	High	+25	High
Traditional Plants														
Berry Sites	-7	Moderate	-7	Moderate	-38	High	-12	High	-54	High	-12	High[1]	-54	High[1]
Wetlands and Traditional Plants	-12	High	-12	High	-36	High	-18	High	-40	High[2]	-18	High	-	-

Notes:
[1]Since mitigation will not restore traditional use berry sites to pre-development conditions it is assumed that number of traditional use berry sites lost due to the PDC at closure will reflect the number of sites lost when measured against either the Base Case or Pre-Development Scenario.
[2] This is effect is based on changes since the late 1990s since pre-development mapping is not available in the Ducks Unlimited format.
[3] Consequences with a positive direction have not been color coded in this table but are included for the sake of completeness. While an increase in the area occupied by an indicator may result in a positive change (i.e. increase in area) based on Shell's assumptions regarding mitigation/reclamation at closure, the rating does not consider the potential uncertainties associated with reclamation. While upland sites can be reclaimed, the ability of these sites to restore equivalent capability for Fort McKay traditional use (*Section 10*) has not been proven.

reclaimed landscape. However, a significant adverse effect is demonstrated in the PDC-closure when compared to the Pre-Development Scenario. Fort McKay believes this is a negative effect since naturally occurring boreal wetland and upland ecosystems are replaced with a larger area of low ranked sites (i.e., reclaimed non-treed wetlands and water bodies).

The loss of traditional use berry sites is rated a moderate effect for the Application Case (7% loss, irreversible), when compared to the Base Case. The irreversible loss of 12% of the sites in the PDC compared to the Base Case is rated as highly significant. While Fort McKay acknowledges that berry producing sites may be created with reclamation these historical traditional use sites cannot be re-created to pre-development conditions. The cumulative loss of 54% under the PDC of the traditional use berry sites since development began is highly significant to the Community.

The loss of wetlands for traditional use is highly significant for all cases considered in the assessment. As previously discussed, reclamation has not been proven as effective mitigation for the loss of wetlands, especially peatlands.

7.6 Shell's Proposed Mitigation

Reclamation is the key mitigation measure proposed by Shell to minimize the effects of the Projects on terrestrial vegetation resources and wetlands (Shell 2007). The Closure, Conservation and Reclamation (C,C&R) Plan, prepared for each of the Jackpine Mine Expansion and Pierre River Mine Projects, provides the details of closure and reclamation activities. The basic goals of the C,C&R Plans are to:

- Reclaim the landscape to an equivalent capability with the purpose of optimizing certain values in consultation with key stakeholders. The values mentioned include watershed, forest productivity, fish and wildlife habitat, or traditional use;
- design reclaimed landforms to include diversity and microtopographic relief;
- undertake progressive reclamation and revegetation; and
- undertake reclamation according to the guidelines established by the CEMA Reclamation Working Group (RWG). One of the goals is to create self-sustaining ecosystems that will mature naturally without significant risks to plants or other resources.

Shell indicates that final reclamation design will be completed in consultation with ASRD, forestry rights stakeholders and local stakeholders. Fort McKay or other aboriginal stakeholders are not mentioned specifically. A program designed to monitor the effects of surficial aquifer drawdown on wetlands adjacent to the Projects is to be implemented by Shell; this wetlands monitoring program is to include monitoring of the lenticular patterned fen southeast of McClelland Lake.

Shell has also stated a commitment to continued and active participation in CEMA Working Groups and to involvement in research programs such as Canadian Oil Sands Network for Research and Development (CONRAD).

While reclamation is intended to provide mitigation for some effects to vegetation resources in the far future, there is no mitigation proposed for the project specific and cumulative loss of traditional land use sites and vegetation that will be lost to the two to three generations of Fort McKay Community members during the time it will take to construct, operate, close and reclaim these mines.

7.7 Fort McKay's Overall Conclusions and Recommendations

7.7.1 Conclusions

Diverse and naturally vegetated landscapes are a critical component of the "land" that contribute to and support Fort McKay's cultural values. Upland and wetland ecosystems provide the land base upon which the Community of Fort McKay undertakes traditional activities.

This Fort McKay Specific Assessment has demonstrated that adverse significant effects will occur to specific vegetation indicators for wetlands and traditional plants as a result of the Projects in the Application Case, even with the assumption that the mitigation (reclamation) proposed by Shell will be successful. The development of Pre-Development and Late 1990s Scenarios for the Fort McKay Specific Assessment has proven to be an important tool for Fort McKay as it has allowed for the cumulative assessment of development in the FTSA. The use of these scenarios has confirmed many of the negative changes that Fort McKay community members have observed on their Traditional Lands since the 1960s. Significant adverse effects to several vegetation indicators have been demonstrated when the Project and Planned Development Cases are compared to the late 1990s and pre-development. A summary of some of the key findings is as follows:

- The Jackpine Mine Expansion and Pierre River Mine Projects will result in the direct disturbance and loss of 22,284 ha of land. This includes the loss of 7,337 ha of upland forest over 28 ecosites phases and 11,942 ha of wetlands across as many as 18 wetland types.
- The incremental effects of the Projects are negligible or low for all upland vegetation indicators in the Application Case – closure, except for moderate adverse effect for the low ranked rare plant potential class, when compared to the Base Case.
- Effects of moderate and high significance are observed on upland vegetation indicators when cumulative effects of the Projects and all developments that have occurred since the late 1990s are compared to the Late 1990s Scenario.

- Effects of moderate and high environmental significance are observed for upland forest when the PDC is compared to the Base Case except for the moderate ranked rare plant potential indicator. The cumulative effects on upland forest and related indicators are considered of high environmental significance in the PDC when compared to Pre-Development conditions except for the moderate ranked rare plant potential indicator.
- The assessment of the PDC-closure cases is predicted to result in high magnitude changes in the positive direction for upland forest and associated indicators since reclamation and closure will result in the net increase in the land area occupied by upland forest. The net increase in upland forest ranked with low rare plant potential when compared to Pre-Development conditions is also considered as a negative consequence by Fort McKay.
- The incremental effects of the Projects as compared to the Base Case are adverse and highly significant for the direct loss of total wetland and peatland areas, as well as the high rare plant potential class for wetlands.
- A significant adverse effect is demonstrated for all wetland indicators when the cumulative changes predicted in the Application Case are compared to conditions in the Late 1990s. Cumulative losses in all wetland indicators of 26 to 37% have occurred since the later part of the 1990s.
- The net change and associated environmental consequences associated with the PDC are considered as adverse and high (i.e., significant effect) when compared to the Base Case for the wetland area, peatland and high rare plant potential indicators. The effects are adverse and significant for all indicators in the PDC when compared to Pre-Development conditions.
- The assessment of the PDC-closure case demonstrates adverse, significant effects for the losses of peatlands and moderate rare plant potential areas when compared to the Base Case.
- Wetland area at PDC-closure is predicted to be 25% less when compared to Pre-Development conditions. Significant adverse effects are observed for all wetland indicators in the PDC-closure when compared to Pre-Development.
- Land with high traditional use potential will decrease in both the Application and PDC cases. The cumulative decreases in land with high traditional plant potential that are observed when the Application is compared to the Late 1990s and PDC to Pre-Development are considered adverse and significant. Following closure, the area of lands with high traditional use potential is predicted to increase. This is due to a predicted increase in the area covered by upland ecosites that have the potential, if successfully reclaimed to pre-disturbance equivalency, to contain a high number of traditional use plants with moderate to high covers.

- The effects to the land with moderate traditional use plant potential are expected to be significant in comparison of the PDC to the Pre-development Scenario and for PDC-closure to the Pre-Development Scenario. The decrease in moderate ranked lands is largely due to the loss of wetlands and the inability of reclamation to mitigate these losses, especially in peatlands.
- Land ranked with low traditional use potential increases in all closure scenarios. In some cases this is due to the reclamation of disturbed land; however, the net increase in low ranked land in PDC-closure compared to pre-development conditions may be significant. Fort McKay believes this is a negative effect since naturally occurring wetlands and uplands are replaced with a larger area of low ranked sites (i.e., reclaimed non-treed wetlands and water bodies).
- The irreversible loss of four traditional use berry sites is rated a moderate for the Application Case and the loss of 12% of the sites in the PDC compared to the Base Case is rated as highly significant. The cumulative losses of traditional berry sites are found to be adverse and significant when compared to the late 1990s or pre-development. While Fort McKay acknowledges that berry producing sites may be created with reclamation these historical traditional use sites cannot be re-created to pre-development conditions or to a modified form for at least two to three generations. The cumulative loss of 54% of the traditional use berry sites under the PDC since development began is highly significant to the Community.
- The loss of wetlands for traditional use is highly significant for all cases and scenarios considered in this assessment.

Collectively, these effects demonstrate that significant changes in the FTSA landscape will occur to vegetation resources following reclamation and closure of the existing and approved developments. The landscape will consist of far more upland, less wetland (muskeg) and a greater number of large water bodies (i.e. pit lakes). Because of uncertainties and assumptions associated with reclamation the far future effects to certain indicators, such as rare plants and traditional plant use plants species, is difficult to predict.

Reclamation, while necessary, does not fully mitigate the effects to vegetation resources for a number of reasons. Firstly, there is a substantial time-lag (approximately 40 years) between disturbance and closure. In addition, substantial amounts of time will be required following closure for reclaimed sites to develop full function and structure (e.g. it takes a minimum of 100 years to develop old forest characteristics). The loss of vegetated landscapes associated with mining disturbance in the LSAs will negatively affect the Community's ability to carry on traditional activities that support its values for several decades.

While upland sites will be lost during operation phases, reclamation is expected to result in an increase of upland ecosites at closure for all development scenarios. However, significant changes in the balance of upland ecosites and wetland types

from that which occurred in the FTSA landscape at pre-development will occur in all closure scenarios since the impact to wetlands is largely irreversible. Peatlands, which comprise the largely majority of wetland types in the FTSA, cannot be replaced with reclamation. Significant effects to several wetland indicators are observed in all assessment scenarios. Fort McKay recognizes the importance of all wetland ecosystem types, which contribute to species, ecosystem and landscape level diversity, contain a number of rare and traditional use plants and support traditional uses. The effects of the wetland loss will be experienced into the very far future for both the resource and the Community of Fort McKay.

There is also a moderate degree of certainty associated with the assumption that reclaimed landscapes will provide an equivalent traditional use. Returns to pre-disturbance levels of diversity on reclaimed areas have not yet been demonstrated at the ecosystem or landscape level, nor has the Community of Fort McKay been able to access reclaimed land for traditional purposes.

Lastly, reclamation does not effectively mitigate for the loss of historic traditional use sites, such as known berry harvesting sites. Fort McKay considers these losses as permanent once the sites have been disturbed for mining purposes.

7.7.2 Recommendations

The following recommendations are proposed by Fort McKay to at least partially mitigate and manage the effects of the Projects and future disturbances within Fort McKay's Traditional Lands:

7.7.2.1 Project-Specific Recommendations

- If this project is approved, areas be identified and designed within the proposed mine plan that could potentially support the development of peatlands (fens or bogs) over the very long term. Shell should be required to undertake research and development work on its Jackpine Mine site on peatland reclamation.
- Reclamation techniques for landscapes and upland forests should be futher developed and improved.
- Reclamation criteria for Shell's mine sites incorporate successful establishment of traditional plants within the disturbed areas, with monitoring and progress reporting to the regulators and Fort McKay. Design and implementation of a program to monitor the potential effects of surficial aquifer drawdown in wetlands adjacent to the Projects, including the lenticular patterned fen near McClelland Lake.
- The development and implementation by Shell of a program to salvage and relocate known occurrences of rare (vascular) species to areas outside of the Project footprints. This program should also evaluate the potential to re-introduce rare species into reclaimed areas.

7.7.2.2 Cumulative Effects Recommendations

- Establishment of enforceable criteria for the measurement of success and reclamation for all end land uses, including for wildlife habitat, traditional land use and forestry. There is uncertainty with respect to ability of current reclamation practices and objectives to restore equivalent ecosystems that provide a range of functions including species diversity, full range of traditional use plants, or rare plants. This uncertainty needs to be addressed and resolved.
- The establishment of criteria to assess disturbance of ecosystems and landscapes with thresholds established for disturbance of key vegetation indicators in Fort McKay's Traditional Lands and the oil sands region, in consultation with Fort McKay
- Establishment of limits on the amount of development necessitating ground disturbance that can occur within Fort McKay's Traditional Lands and the oil sands region, in consultation with Fort McKay.
- Establishment of Protected areas to preserve traditional land use opportunities and associated resources in proximity to the Community, in consultation with Fort McKay.
- Further mitigation measures and accommodation strategy be developed in consultation with Fort McKay: reclamation does not provide effective mitigation for the Project specific or cumulative loss of Traditional Lands and resources upon which Fort McKay's culture depends.

7.8 References

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