Pit 2018 South Extension Environmental Impact Statement

Submitted to:
Ministry of Environment
Environmental Assessment Branch

Submitted by:

Prairie Mines & Royalty Ltd.

December 2009

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1.0 Introduction

1.1 BACKGROUND DISCUSSION

Prairie Mines & Royalty Ltd. (PMRL) is proposing to extend its Bienfait Mine operations. The Bienfait Mine is an approved coal mine (Permit to Operate File #N2-4-3) located in southeastern Saskatchewan, approximately 3 km southeast of the Town of Bienfait (Figure 1.1).

This Environmental Impact Statement / Application is being submitted for the Pit 2018 South Extension area to Ministry of Environment – Environmental Assessment Branch (MOE) in accordance with the *Saskatchewan Environmental Assessment Act* and *Saskatchewan Environmental Management and Protection Act, 2002*.

The purpose of this Application is to describe PMRL's intention to expand its existing Approval to include 304 ha of additional land, located southwest of the Bienfait Mine. The application area required will be within Section 7 and the NW 8 Twp 2, Rge 6 W2M, (Figure 1.2).

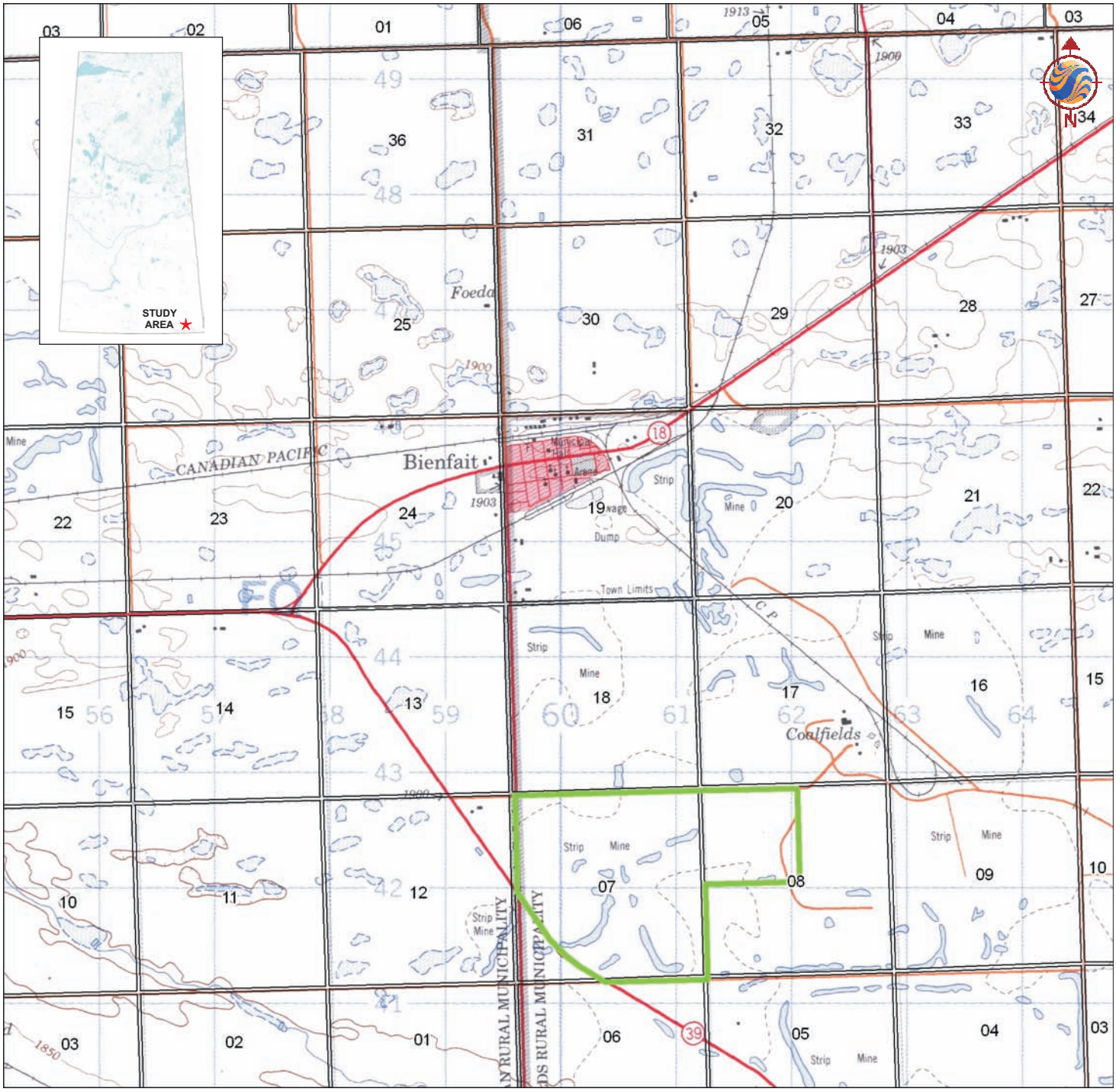
PMRL proposes the Pit 2018 mining area to be completed in three phases. The submittal of this Environmental Impact Assessment / Application is the first phase that outlines all the potential environmental impacts and proposed mitigation measures. The second phase involves project approval that will outline all operating conditions and requirements. And the last phase is the incorporation of the Pit 2018 area into the existing Bienfait Mine Permit to Operate.

This Application describes the mine development, the biophysical and socioeconomic environments in which the development will occur, and the potential environmental impacts and the mitigation measures that will be implemented to avoid or reduce any adverse effects associated with the proposal.

1.2 THE PROPONENT

Sherritt International Corporation directly holds 100% of Royal Utilities Income Fund (the "Fund"), which directly holds 100% of Prairie Mines & Royalty Ltd. (the "Company"). The Fund is an unincorporated, open-ended, limited purpose trust established under the laws of the Province of Alberta. The Company is the largest thermal coal producer in Canada, and owns and operates the Paintearth, Sheerness, Genesee (50% joint venture interest), Poplar River, Boundary Dam and Bienfait mines and operates the Highvale and Whitewood mines under contract. A total of 36.1 million tonnes of coal was produced by the Company in 2007. The Company also holds a portfolio of mineral rights located in Alberta and Saskatchewan on which it earns royalties from the production of coal and potash.

The Bienfait Mine produces approximately 0.7 million tonnes of coal annually and supplies coal to Ontario Power, domestic customers and also produces approximately 120,000 tonnes of char



1:50,000 Scale

UTM 13U

Legend:

- Study Area Boundary
- Road
- Railroad
- Contour Interval
- Watercourse
- Waterbody

Client/Project:

PRAIRIE MINES AND ROYALTY LTD
PIT 2018

Figure No.:

1.1

Title:

SITE LOCATION

Stantec

1132.53525

Silo &
Load Out

Activated
Carbon

Char
Stockpile

Lignite
Stockpile

Rail Loop

Sewage
Lagoon

Existing Bienfait Mine Permit to
Operate S25010-50/BO/03/0

Oil
Lease

Application Area

Oil
Lease

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ESTEVAN, SASK

Prairie Mines & Royalty Ltd.

2018 South
Application Area

DESIGN BY: BMR	DWN BY: BMR
SCALE:	DATE: NOV 2009
FIGURE 1.2	

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annually for the manufacture of barbecue briquettes. In addition the Bienfait Mine is in the process of constructing an Activated Carbon Plant that will produce approximately 15,000 tonnes of carbon for mercury capture at coal fired power stations.

PMRL also operates the Boundary Dam Mine (Permit to Operate File: S25010-50/BO/03/O) in the Estevan area. The Boundary Dam Mine produces approximately 6.3 million tonnes of coal annually and supplies coal to SaskPower's Boundary Dam and Shand Power Stations.

1.3 PROJECT SETTING

The Bienfait Mine is located in southeastern Saskatchewan, approximately 3 km southeast of the Town of Bienfait. The location of the Pit 2018 South Extension (7, NW 8-2-6 W2M) Application area can be seen in Figure 1.2. The current Bienfait Mine and the Pit 2018 Application area are located in the Rural Municipality (R.M.) of Coalfields #4.

The Souris River located south of the application area is the only major watercourse located near the application area.

The west edge of the mining will parallel Highway 39.

1.4 PROJECT RATIONAL

Mining has been ongoing in the Bienfait area for over 100 years. Currently PMRL employs over 350 workers in the Estevan area, and to date have delivered over 250 million tonnes of coal to the market place (domestic and local). This has had a significant long term positive effect on the local and provincial economy.

The coal reserves located in close vicinity to the Bienfait plant site are almost exhausted, with only approximately 1 year of reserves left in permitted area.

The Pit 2018 application area is located adjacent to the existing Bienfait mining area with a strip ratio of approximately 11:1 consisting of 12.5 million tonnes of coal.

Approval of the Pit 2018 area will allow PMRL:

- Secure a long term coal supply for continued operation of the Bienfait Mine; and
- To develop and utilize the coal resources in the Bienfait area.

Development of the Pit 2018 area will continue to provide benefits to the region including receipt of revenue in the form of production royalties and taxes by municipal, provincial and federal governments.

1.5 SCOPE OF THE PROJECT AND THE ASSESSMENT

This environmental assessment focuses on the Pit 2018 South Extension development located in 7, NW8-2-6 W2M. References to the "study area" or "application area" refer to Section 7, and NW8 and all activities within the section. The report also includes reference to the "mine disturbance area"; which represents the actual pit and any stockpiled areas associated with the pit. The mine disturbance area is where vegetation and soils will be completely removed by the mining activities. Any reference to a regional study area represents an area encompassed by an approximately 3 km radius around Pit 2018.

Temporally, the study focuses on the mining period from 2010 to 2039.

1.6 REPORT STRUCTURE

The following sections provide a description of the project (Section 2); a description of the biophysical (Section 3) and socioeconomic (Section 4) setting in which the project will occur; a discussion of the public consultation completed for this proposal (Section 5); and an identification and discussion of potential environmental effects and their mitigation (Section 6). Appendices provide details on soils (Appendix A), vegetation (B), site photos (C), geology and hydrogeology (D), and PMRL's domestic water policy (E).

2.0 Project Description

2.1 MINE DEVELOPMENT

2.1.1 Mine Plan

The stripping plan for Pit 2018 is shown in Figure 2.1. This plan is based on a coal release of approximately 755,000 tonnes annually over 30 years. Mine development is scheduled to start in the fall of 2010 and be complete 2039. The pit will be mined using a 1570B dragline, which is a walking dragline with a bucket size of 70 cubic yards.

Mining in the Pit 2018 area will start along the north side of the pit where it will tie into the existing mined out area north of the mine access road. Mining will continue south with the cuts running in an east west orientation.

2.1.2 Infrastructure

The following infrastructure is required for the development of Pit2018:

- A haul road for the transport of coal from the pit to the Bienfait Plant site (Figure 2.1);
- Overhead power line and transformers to supply power to the dragline and pit pumps (Figure 2.1); and
- Water management system.

2.1.3 Coal Loading and Hauling

Coal will be loaded in pit by front end loaders. Coal will be hauled out of pit by 150-tonne trucks along the haul road.

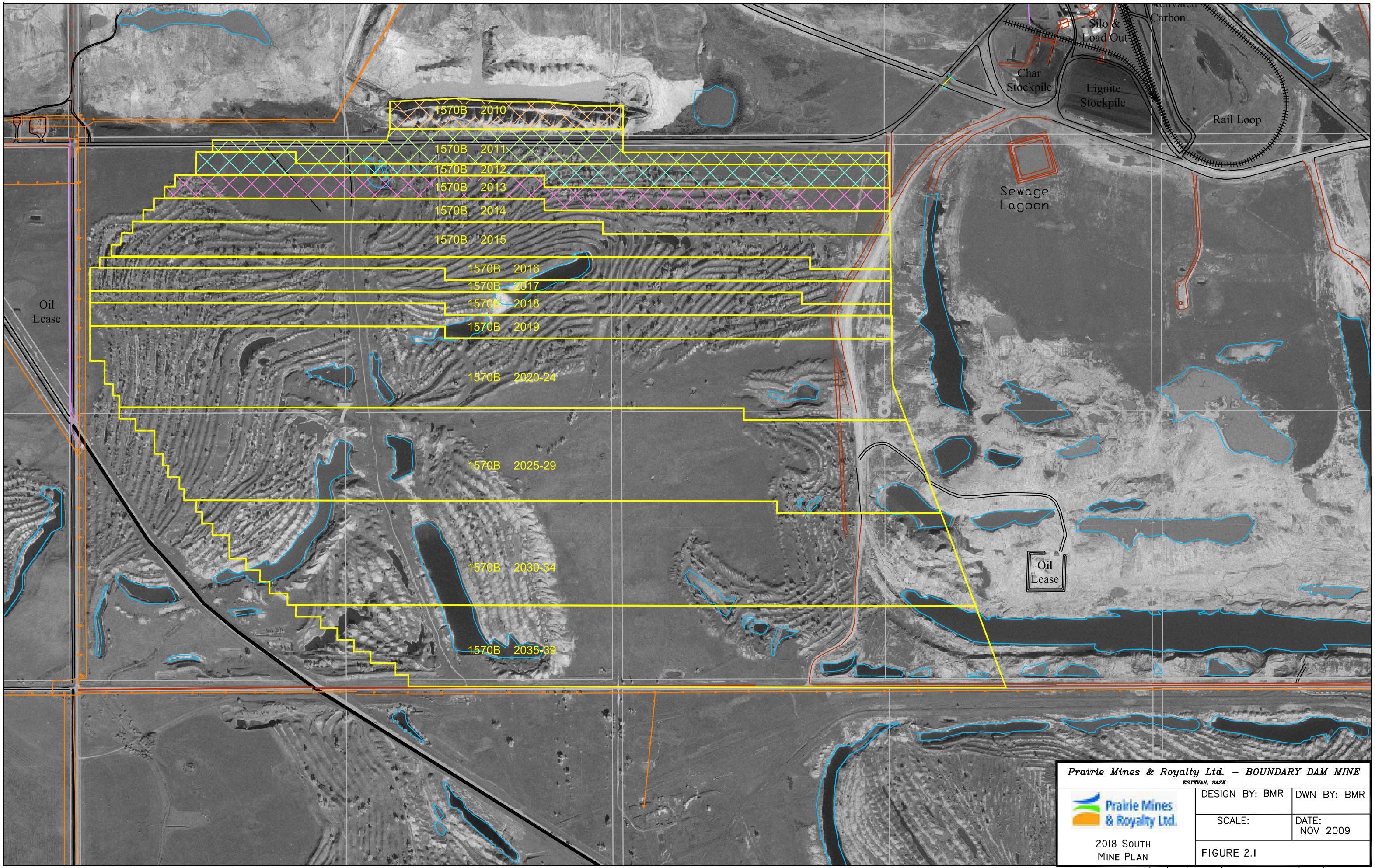
2.1.4 Equipment and Manpower

The manpower requirements for Pit 2018 will be dependent on production; however, the size of the workforce at Bienfait Mine is not expected to increase because of this pit extension.

2.2 ENVIRONMENTAL PROTECTION PLANS

2.2.1 Reclamation

The mining method that will be employed in Pit 2018 will be open pit strip mining. Figure 2.2 illustrates the strip mining sequence and shows that mining and reclamation is an integrated operation. The sequence begins with the soils salvage in advance of mining. The overburden is then removed to expose the underlying coal seams and placed in the adjacent pit. The coal



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ESTEVAN, SASK

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2018 SOUTH MINE PLAN

DESIGN BY: BMR	DWN BY: BMR
SCALE:	DATE: NOV 2009
FIGURE 2.1	

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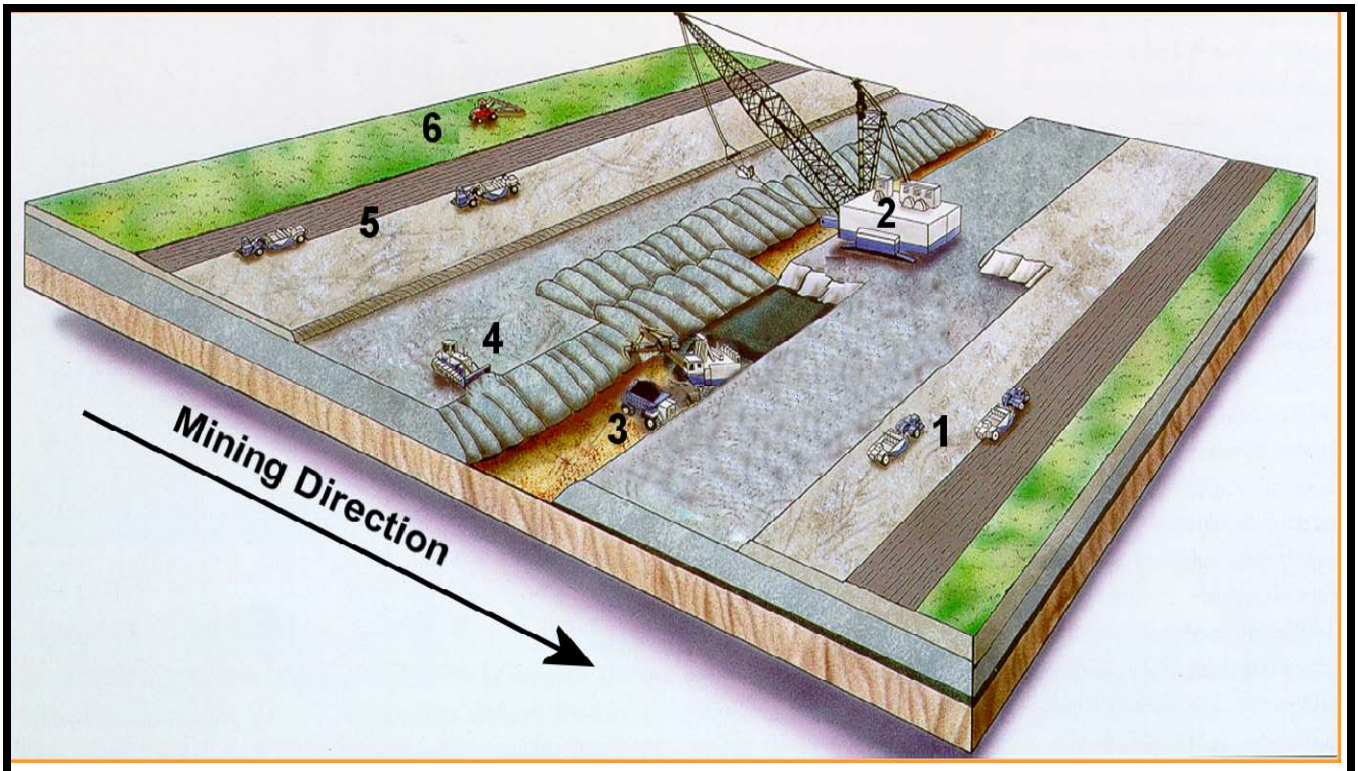

1. Before mining begins all suitable soils are salvaged and hauled to areas undergoing reclamation or retained in stockpiles for future use.
2. The dragline removes the overburden to expose the coal seam. The overburden is placed in the adjacent mined-out cut. The coal seam is uncovered.
3. Coal is loaded into large-capacity trucks for transport to the power station.
4. Bulldozers re-contour the overburden removed by the dragline. This step is the first stage in land reclamation.
5. Soils salvaged prior to mining is replaced on the re-contoured overburden.
6. The land is re-vegetated and returned to agriculture production or other acceptable land use as defined in the operating approvals.

Figure 2.2 – Typical Mining Process

Prairie Mines & Royalty Ltd.

is removed and the subsequent open pit is backfilled with the overburden from the next open cut. Spoil piles are then recontoured and the salvaged cover soils are replaced on the recontoured spoil piles and revegetated to predetermined end land use. All conservation and reclamation activities for Pit 2018 will follow the requirements set out in the Reclamation and Approvals Guidelines, Saskatchewan Strip Mined Coal Lands (Saskatchewan Environment 2007).

This reclamation plan was developed in accordance with the Reclamation and Approval Guidelines (Saskatchewan Environment 2007). It is based on the pre- and post-mining land uses, native prairie assessment, soil quality, soil salvage, final reclamation topography, soils replacement, and vegetation re-establishment.

Land uses

The pre-mining land use within the Pit 2018 Permit Application Area is a combination of spoil piles from previous historic mining activities and perennial forage production. Further details on the vegetation within the study area can be found in Section 3.4.

Based on the soil survey conducted in May 2009, the pre-mining soil capability for agriculture ranged from soils having no capabilities (Class 7) to severe limitations (Class 4) for agriculture (Environment Canada 1972). Agricultural capability is further described in Section 3.3. Soil capabilities for agriculture within the post-mining landscape will be similar or of higher quality to that of the pre-mining landscape.

In accordance with the Reclamation and Approvals Guidelines (Saskatchewan Environment 2007), the post-mining land use will be similar or of higher quality to that of the pre-mining land use. Overall, lands (perennial forage production, mine spoil piles) and wetlands will be reclaimed, at a minimum, to a soil quality that is similar to that which existed prior to mining.

Soils Salvage and Replacement

In accordance with the Reclamation and Approvals Guidelines for Saskatchewan Mined Coal Lands (Saskatchewan Environment 2007), soils meeting the soil quality criteria for reclamation of Good, Fair, or Poor should be salvaged prior to the commencement of mining operations. Based on the analytical results from our soil survey, the surficial soils in the study area were found to be fair to poor for use as either topsoil or subsoil during reclamation (Table 2.1). See Appendix A for more details on the soil survey results.

When mining operations have ceased, it is recommended that the following basic reclamation sequence occur at the study area:

- Spread FgBk5 and Rb1 salvaged surficial soil to an approximate depth of 27 cm on approximately 17% of the study area and contour.

- Spread MSp-till salvaged surficial soil to an approximate depth of 20 cm on approximately 83% of the study area and contour.

Following soil placement, the study area will be revegetated with a suitable seed mix.

Table 2.1 Soil Thickness and Reclamation Quality of Surficial Soils

Soil Unit	Soil Thickness (m)	Reclamation Quality	
		Rating	**Limiting Factor**
FgBk5	0.41		
topsoil		Poor	TOC
subsoil		Fair	EC
Rb1	0.18		
topsoil		Fair	TOC
subsoil		Poor	Consistency
MSp-till	0.20[1]		
topsoil		Poor	Consistency
subsoil		Fair	Consistency, pH
MSp-cret	n/a		
topsoil		Poor	EC, stoniness, TOC, $CaCO_3$
subsoil		Poor	EC

[1] The MSp-till soil thickness does not necessarily indicate the depth at which surficial soil will be salvaged but rather the depth of coversoil that will be placed during reclamation.
TOC = total organic carbon, EC = salinity.

Leveling/Re-contouring

Leveling practices at Pit 2018 will be consistent with those currently being utilized at Bienfait Mine. All areas with the exception of ramps, or end pits will be graded to a gently rolling slope consistent with the surrounding topography (less than 10%). Contouring will develop suitable drainage patterns that promote positive drainage. Once leveling and contouring have been completed, cover soil will be replaced and the area revegetated.

Box Cut Spoil and End Pit Reclamation

Overburden from the turnover cuts will be placed by the dragline into the previous adjacent mined out cuts. Cover soil will then be placed on the contoured spoil and the newly created soil profile revegetated.

The final cut of the mining sequence will leave an open end pit with spoil piles on one side and the pit highwall on the other. Both the spoil and highwall slopes will be contoured to a maximum 20% grade. This endcut depression in the reclaimed topography will probably become permanent water bodies since they will receive surface water runoff and could possibly intersect the post-mining water table. This endcut depression will provide a permanent water source for livestock and wildlife, and a habitat for waterfowl and amphibians. Cover soil will be placed only above the expected high-water line of the contoured endcut depression and the area then revegetated.

Revegetation

Following the replacement of cover soil material on mined lands, revegetation operations will closely resemble standard farm management practices. Consistent with the Reclamation and Approvals Guidelines (Saskatchewan Environment 2007), emphasis will be placed on quickly establishing a vegetation cover to control erosion and achieve a self-sustaining plant cover.

Revegetation operations will normally take place in the same growing season in which cover soil is replaced. Once the cover soil has been replaced, surface rock and debris will be removed and the seedbed prepared (i.e., cultivated to loosen and level).

The disturbance area will be seeded to a forage/tame pasture mix with a cereal cover crop (Table 2.2). A recommended seed mix will be included as part of the reclamation plan that will be submitted to MOE for approval as outlined in the Reclamation and Approval Guidelines for Saskatchewan Strip Mined Coal Lands.

Table 2.2 Forage\Pasture seed mix

Species	*Seeding Rate*
Crested Wheat Grass	6.7 kg\ha
Slender Wheat Grass	3.4 kg\ha
Russian Wild Rye Grass	4.5 kg\ha
Brome Grass	6.7 kg\ha
Tall Wheat Grass	5.6 kg\ha
Yellow Sweet Clover	4.5 kg\ha
Alfalfa	4.5 kg\ha
Rye	94 kg\ha (Cover Crop)
Fertilizer – 28-28-0	112 kg/ha

2.2.2 Surface Water Management

Surface water drainage within the Pit 2018 disturbance area is poorly developed with a number of permanent water bodies within the development area that are associated with the old mine spoils in the area.

In Pit Water Control

Any groundwater seepage and surface water encountered during development of Pit 2018 will be managed through a series of pit ditches, sumps, pipelines, and surface drainages (Figure 2.3). This will allow flexibility in the timing and rate of discharge.

Past mining experience in the area indicates that the quantity of groundwater seepage and surface runoff intercepted will be minimal. The pit water will be managed using pit pumps and pipelines and directed to the end cut located to the east where it will contained.

2.2.3 Air Quality

Most dust generated during mine operations is attributed to the transportation of coal from the pit to the power generating stations or stockpiles. Coal dust generation during the hauling process is minimal. The major source of dust emission comes from trucks driving along haul road.

Major sources of dust include:

- Dust generated by vehicles traveling on haul roads;

Disturbance Limits

Under Ground Pipelines

Oil Lease

Char Stockpile

Silo & Load Out

Activated Carbon

Lignite Stockpile

Rail Loop

Sewage Lagoon

Oil Lease

7

8

Prairie Mines & Royalty Ltd. – BOUNDARY DAM MINE

ESTEVAN, SASK

Prairie Mines & Royalty Ltd.

2018 South Water Management Plan

DESIGN BY: BMR	DWN BY: BMR
SCALE:	DATE: NOV 2009
FIGURE 2.3	

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- Generation of dust by the handling of overburden;
- Soil salvage and replacement activities;
- Cultivation, seeding operations and tilling of reclaimed areas;
- Wind erosion of exposed overburden and soil surfaces; and

PMRL is a member of the Southeast Saskatchewan Airshed Association. The concept of this airshed is a geographic region sharing the same air quality characteristics. The association is a non-profit, multi-stakeholder, consensus driven organization providing regional management of an air quality monitoring program. The objectives are to:

- Monitor ambient air quality and evaluate collected data to better understand contributing factors and evaluate trends.
- Communicate air quality data and information to stakeholders and the public;
- Develop a voluntary, locally sponsored strategy for the protection of public health and the local environment;
- Involve industry, government, and the public in the development of visions and goals for managing regional air quality; and
- Meet regulatory ambient air quality reporting requirements.

2.2.4 Noise

Noise from the project will be generated 24 hours a day corresponding to its hours of operation. Sound levels will vary with wind conditions. Sources of noise from the mine include:

- Current operations;
- Coal haul trucks, water truck and other truck traffic;
- Draglines – bucket produces thuds in the bottom of the pits and cold weather causes bearings to squeak; and
- Dozers, graders and scrapers.

2.2.5 Coal Rights and Surface Ownership

2.2.6 Coal Rights

All coal rights for the Section 18 are owned by MCI, and are in the process of being acquired by to PMRL. Prior to the removal of any coal from the Pit 2018 expansion this transaction needs to be completed.

2.2.7 Surface Ownership

Ownership of the surface rights within the mine expansion area in Section 18 is controlled by MCI (Figure 2.4). PMRL is in the process of obtaining from MCI the rights for land access to mine the coal. All required agreements with the landowners will be in place prior to any mine development.

Town of Bienfait

PRAIRIE MINES & ROYALTY

Shops
Office

Silos

Activated Carbon

Clay Stockpile

Lignite Stockpile

Rail Loop

Sewage Lagoon

Oil Lease

Oil Lease

Gress

MINE DISTURBANCE AREA

PIT 9

MANCAL COAL

B

H

Smart

Hesketh

Prairie Mines & Royalty Ltd. – BOUNDARY DAM MINE
ESTEVAN, SASK

Prairie Mines & Royalty Ltd.

2018 South
Land Owership

DESIGN BY: BMR | DWN BY: BMR

SCALE: | DATE: NOV 2009

FIGURE 2.4

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3.0 Biophysical Setting

3.1 INTRODUCTION

This chapter provides information on the biophysical characteristics of the study region. Information is based upon a review of relevant literature, maps, and databases in addition to field investigations of soils, vegetation, wildlife, and hydrogeology. The chapter includes a general overview of the biophysical setting. Further site-specific details are then provided for soils, vegetation, wildlife, geology, and hydrogeology.

3.2 BIOPHYSICAL OVERVIEW

3.2.1 Moist Mixed Grassland Ecoregion

The study area is located within the Griffin Plain Landscape Area of the Moist Mixed Grassland Ecoregion. Acton et al. (1998) description of this landscape area is provided below:

> *The Griffin plain is a large, nearly level till plain that extends from Weyburn, east to Oxbow. Elevations drop gradually from 640 m at the edge of the Moose Mountain upland to 590 m in the southern part of the area. Surface drainage is limited to the northwestern part of the area, with flow to the Souris River.*
>
> *Native mixed-grass vegetation is limited to soils with strong Solonetzic development, especially in the PFRA community pasture, where salt-tolerant grasses, pincushion cactus, gumweed, and greasewood represent the characteristic vegetation.*
>
> *Most of the area is an undulating till plain with a dominance of loamy Dark Brown Solonetzic soils formed in glacial till. A band on the south side of the area has a moderately sloping hummocky morainal landscape. Dark Brown loams formed in glacial till are the most common soils in this area.*
>
> *Nearly all of this area is cropland, but strong development of Solonetzic soils, with associated salinity, limits the cropland area somewhat. Cereals are the major crop and nearly 40% of the cropland area is summerfallow. A PFRA community pasture occupies some of the pastureland in the area.*

3.2.2 Climate

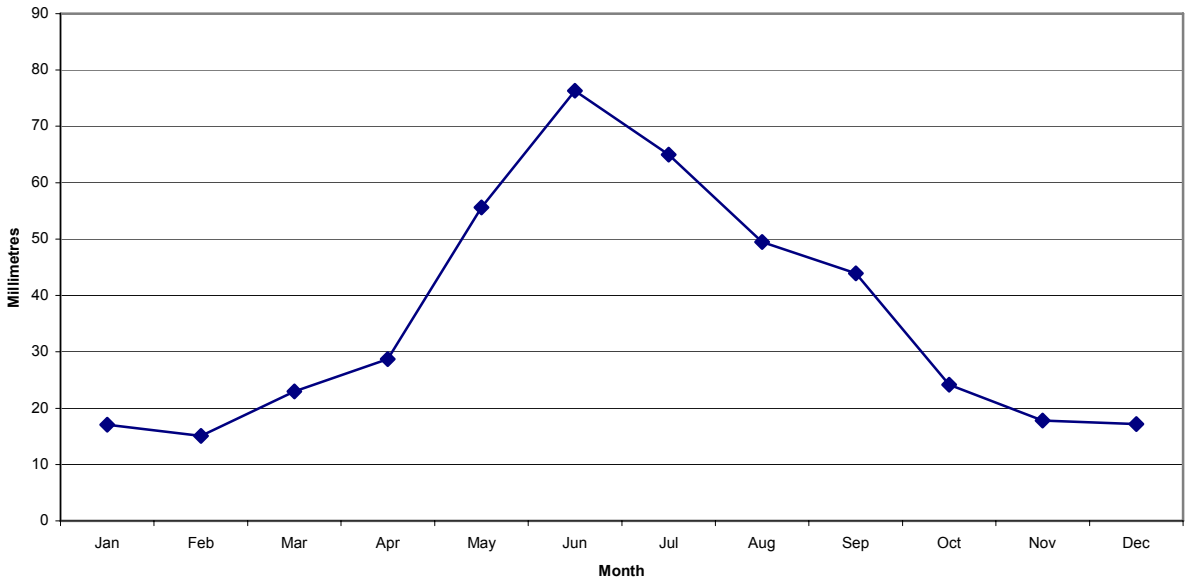
The study area lies within a humid continental climate having cold winters and warm summers.[1] Seasonal and daily temperature variations are typical of a continental climate. January, the coldest month has a daily average temperature of –14.8 ^{o}C, and July, the warmest month, has an average of 19.5 ^{o}C, making the Estevan area one of the warmest locations in Saskatchewan

[1] The climate is classified as Dfb under the Köppen Classification system.

during the summer.[2] The average temperatures for the April to October period are above freezing, while the five other months are below freezing. The yearly mean temperature is approximately 3.8 ^{o}C. Estevan also holds the provincial record for number of hours of bright sunshine (2,701 hours recorded in 1980).

Total annual precipitation is approximately 418 mm with the majority falling during the summer months as rain. June is the wettest month, with an average value of 76.3 mm (Figure 3.1).

FIGURE 3.1: Average Monthly Precipitation



Winds are most frequently from the east for the March to August period, and from the west or northwest for the remainder of the year.[3] Table 3.1 illustrates the average monthly wind speed, which indicates that the July and August months are marginally calmer than the other months. Average monthly velocities vary from 20 km/h (January) to 15.9 km/h (August).

[2] Environment Canada, Canadian Climate Normals 1971-2000, Estevan A Station.
[3] Environment Canada, Canadian Climate Normals 1971-2000, Estevan A Station

Table 3.1 Average Monthly Wind Speed

Month	*Wind Speed (km/h)*
January	20.0
February	19.6
March	18.9
April	19.2
May	19.4
June	18.3
July	16.1
August	15.9
September	17.5
October	18.8
November	18.2
December	19.3

3.3 SOILS

A detailed soil survey of the study area was completed on May 19-22, 2009. This report describes the soil types and provides information on soil capabilities for agriculture and reclamation. The complete soil survey report, with accompanying maps and tables, is provided in Appendix A.

The study area was divided into 4 dominant soil types (Table 3.2; Figure 3.1 in Appendix A).

Table 3.2 Soil Types within the Pit 2018 Study Area

Soil Type
Orthic Forget (FgBk5)
Orthic Roughbark (Rb1)
Mine Spoil – till (MSp-till)
Mine Spoil – cretaceous (MSp-cret)

In general, orthic forget soils are well-drained and occur on gently sloping to nearly level lands, and on the concave slopes of steeper slopes. The soil profile of orthic forget soils is typically

characterized by a 20 to 100 cm layer of loamy sand to fine sandy loam overlying glacial till. In general, orthic roughbark soils are well to rapidly drained soils, with relatively thin A and B horizons. This soil type occurs on level to undulating lands, and on gently sloping sides of some drainage ways. Mine Spoil (MSp) soils are characterized as mined material stockpiled as tailing piles. Two types of MSp soils were identified within the study area: MSp-till was characterized as mined material consisting of either glacial or alluvial till mixed with coal, and MSp-cret was characterized as mined material consisting of original Cretaceous formation material mixed with soft bedrock and coal.

The study area was not classified on the Canada Land Inventory (CLI) map (Shields and Clayton 1972), likely due to its mining history and presumed low capability for agriculture. Based on observations made during the soil survey and the analytical results, the flat areas (FgBk5 and Rb1) of the study area were determined to have severe limitations that restrict the production of perennial forage crops and the mine spoil piles (MSp-till and MSp-cret) on the study area were determined to have no capability for arable culture or permanent pasture.

Specifically, the following CLI soil capability for agriculture classes were determined for the soil map units in the study area:

- FgBk5 (7% of the study area) – Class 4 (severe limitations), Subclass m (low water holding capacity).
- Rb1 (10% of the study area) – Class 4 (severe limitations), Subclass m (low water holding capacity).
- MSp-till (70% of the study area) – Class 7 (no capability), Subclass t (steep topography and presence of coal).
- MSp-cret (13% of the study area) – Class 7 (no capability), Subclass t, n, p, m (steep topography, excess salinity and stoniness, and low water holding capacity).

Using the analytical results provided in the soil report, we compared those values to the guidelines provided in Soil Quality Criteria for Reclamation (Saskatchewan Environment 2007) to determine the reclamation suitability of the soil. These guidelines provide qualitative ratings (Good, Fair, Poor, Unsuitable) for surficial soils to be used during reclamation (Table 3.3) based on selected quantitative physical and chemical characteristics (Table 3.4). The overall soil quality rating for evaluating reclamation suitability is based on the most limiting soil parameter.

In general, the surficial (undisturbed) soils in the study area were found to be fair to poor for use as either topsoil or subsoil during reclamation (Tables 5.1 and 5.2 in Appendix A).

Table 3.3 Soil Quality Criteria for Reclamation Categories

Category	*Description*
Good (G)	None to slight soil limitations that affect use as a plant growth medium.
Fair (F)	Moderate soil limitations that affect use but which can be overcome by proper planning and good management.
Poor (P)	Severe soil limitations that make use questionable. This does not mean the soil cannot be used, but rather careful planning and very good management area required.
Unsuitable (U)	Chemical or physical properties of the soil are so severe, reclamation would not be economically feasible or in some cases impossible.

Table 3.4 Soil Quality Criteria for Reclamation

	pH	*EC dS/m*	*SAR*	*Sat. %*	*Stoniness*	*Texture*	*Consistency*	*TOC %*	*$CaCO_3$ Equiv. %*
Topsoil									
Good (G)	6.5 – 7.5	<2	<4	30 – 60	S0, S1	FSL, VFSL, L, SL, SiL	Very friable, friable	>2	<2
Fair (F)	5.5 – 6.4 & 7.6 – 8.4	2 – 4	4 – 8	20 – 30, 60 – 80	S2	CL, SCL, SiCL	Loose	1 – 2	2 – 20
Poor (P)	4.5 – 5.4 & 8.5 – 9.0	4 – 8	8 – 12	15 – 20, 80 - 120	S3, S4	LS, SiC, C, S, HC	Firm, very firm	<1	20 – 70
Unsuitable (U)	<4.5, >9.0	>8	>12	<15, >120	S5	-	Extremely firm	-	>70
Subsoil									
Good (G)	6.5 – 7.5	<3	<4	30 – 60	<3%	FSL, VFSL, L, SL, SiL	Very friable, friable	-	-
Fair (F)	5.5 – 6.4 & 7.6 – 8.5	3 - 5	4 – 8	20 – 30, 60 – 80	3 – 25%	CL, SCL, SiCL	Loose, firm	-	-
Poor (P)	4.6 – 5.4 & 8.6 – 9.0	5 – 10	8 – 12	15 – 20, 80 – 120	25 – 50%	S, LS, SiC, C, HC	very firm	-	-
Unsuitable (U)	<4.5, >9.0	>10	>12	<15, >120	>50%	Bedrock	Extremely firm	-	-

3.4 VEGETATION

3.4.1 Vegetation Study Methods

A vegetation survey was conducted across the study area from June 9-11, 2009. Prior to conducting the surveys, the study area was stratified based on general habitats and topographical areas, and transects were pre-selected to eliminate surveyor bias in the field. During the survey, transects (approximately 300 m in length) were walked along pre-determined routes and all species observed were recorded. In addition, wetland perimeters were walked and all species observed were recorded. Particular focus was on the identification of rare species during the surveys.

Percent canopy cover measurements of vegetation species, litter, and bare ground were made at 100 m intervals along transects using a 0.5 m x 0.2 m quadrat. Overall, 21 transects were surveyed within the study area for species composition and percent cover (Figure 3.2).

Incidental observations of rare flora species were also recorded while traveling across the study area between vegetation transects and while conducting wildlife surveys.

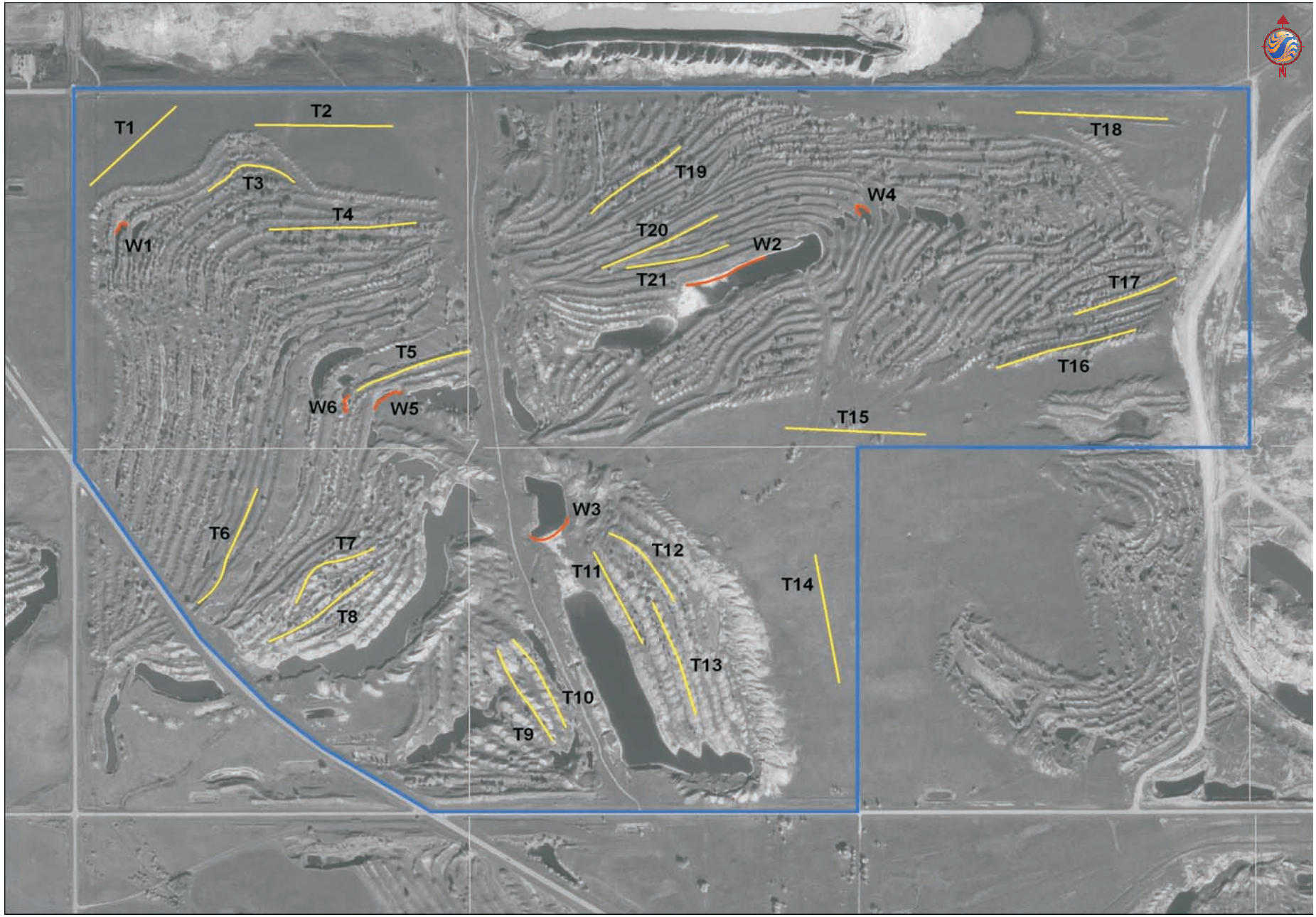
3.4.2 Study Results

Vegetation throughout the study area is dominated by Kentucky bluegrass and smooth brome with no undisturbed native vegetation communities existing. There are noticeable variations, which are based upon the topography and soil types. For reporting purposes we describe three dominant vegetation communities that are based upon three soil and topographic variations noted within the study area: 1) flat disturbed areas (perennial forage production); 2) mine spoil - Cretaceous soils; and 3) mine spoil - till soils (Figure 3.3). Vegetation surrounding wetlands was also surveyed. A detailed list of the plant species found within each vegetation community is presented in Appendix B. Representative photographs are presented in Appendix C.

The study year was a late growing season due to the cold spring weather. As such, the survey may have missed some June flowering species. The late flowering season also meant that some plants could not be identified to species, but only to the genus, as flowers were not present (e.g. *Aster* sp. and *Solidago* sp.). Late flowering species (i.e., late July - August) were also not observed as it was too early in the season for identification.

<u>Flat disturbed areas (perennial forage production)</u>

Five transects were surveyed in flat areas of perennial forage production located along the perimeter of the mine spoils in the northwest and southeast corners of the study area. Kentucky bluegrass (*Poa pratensis*; 42.4%), smooth brome (*Bromus inermis*; 14.7%), and alfalfa (*Medicago sativa*; 12.5%) were the most dominant species, with litter production accounting for 10.1% and bare ground for 0.3% of the cover. The rest of the ground cover was divided



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Legend:

- Pit 2018 Mine Boundary
- Vegetation Transects
- Wetland Transects

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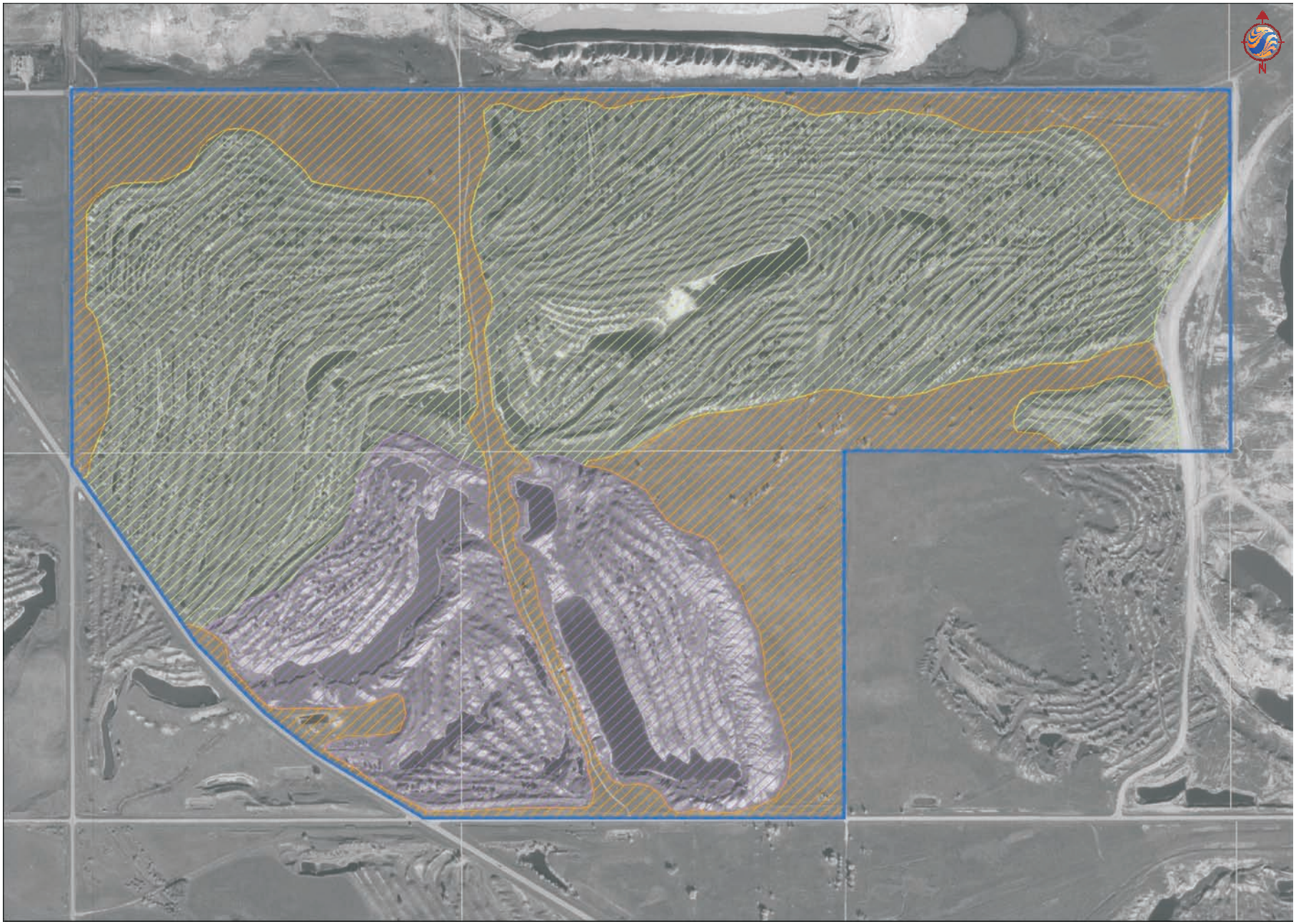
Figure No.:
3.2

Title:
Vegetation and Wetland Transects



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Legend:

- Pit 2018 Mine Boundary
- Flat Disturbed Areas
- Mine Spoil Pile - Cretaceous Soils
- Mine Spoil Pile - Till Soils

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Figure No.:
3.3

Title:
Vegetation Communities

between other grasses, such as crested wheatgrass (*Agropyron cristatum*), and numerous forbs species, such as pasture sage (*Artemisia frigida*), low everlasting (*Antennaria aprica*), dandelion (*Taraxacum officinale*), *Aster* sp., mouse-eared chickweed (*Cerastium arvense*), yarrow (*Achillea millefolium*), golden bean (*Thermopsis rhombifolia*), narrow-leaved milk-vetch (*Astragalus pectinatus*), three-flowered avens (*Geum triflorum*), and goat's-beard (*Tragapogon dubius*). Western snowberry (*Symphoricarpos occidentalis*) was very common in moist depressional areas.

Mine spoil - Cretaceous soils

Seven transects were surveyed in the cretaceous zone: 3 located on mid slopes, 2 located on valley bottoms, and 2 located on the top of spoil piles. The mine spoils that were characterized by cretaceous soils were not well vegetated. Overall, bare ground and litter made up 53.6% and 27.1% of the cover, respectively. The valleys in between the spoil piles had the most vegetation with smooth brome (13%), *Aster* sp. (9.2%) and Kentucky blue grass (5%). Mid-slopes had less vegetation with smooth brome (6.3%), crested wheatgrass (3.8%) and common snowberry (2.3%). The top of spoil piles had the least amount of vegetation with vegetation being dominated by crested wheatgrass (8.3%) and pasture sage (2.5%).

Other species observed on the cretaceous spoil piles included greasewood (*Sarcobatus vermiculatus*), quackgrass (*Agropyron repens*), leafy spurge (*Euphorbia esula*), dandelion, kochia (*Kochia scoparia*), pasture sage, rock cress (*Arabis retrofracta*), wild blue flax (*Linum lewisii*), and prickly rose (*Rosa acicularis*). Large cottonwood trees (*Populus deltoides monilifera*) and silver buffaloberry (*Shepherdia argentea*) were present in valley bottoms throughout the area.

Mine spoil - till soils

Nine transects were surveyed in the till soil zone: 5 on mid-slopes (3 south facing slopes and 2 north facing slopes), 2 on valley bottoms, and 2 on the top of spoil piles. The mine spoils that were characterized by till soils were much more vegetated than the cretaceous zone. Overall, litter production and bare ground accounted for 33.2% and 4.7% of the cover, respectively.

The top of spoil piles had the least amount of vegetation and were dominated by smooth brome (22.5%), rose sp. (4.3%), crested wheatgrass (4.2%) and common snowberry (3.3%). Mid-slopes were dominated by smooth brome (21.9%), Kentucky blue grass (12.5%), common snowberry (9.7%), quackgrass (4.0%) and rose sp. (3.5%). The valleys in between the spoil piles were heavily vegetated with Kentucky blue grass (42.3%) and smooth brome (15.8%). Western snowberry (5%) and rose sp. (2%) were also present in the valleys. Wet areas in valley bottoms were often vegetated with sandbar willow (*Salix exigua*), cattails (*Typha latifolia*), and sedge species. Large cottonwood trees (*Populus deltoides monilifera*) and silver buffaloberry (*Shepherdia argentea*) were present in valley bottoms throughout the area.

Other species observed on the cretaceous spoil piles included pasture sage, *Aster* sp., rock cress, yarrow, leafy spurge, greasewood, dandelion, common groundsel (*Senecio vulgaris*), kochia, field horsetail (*Equisetum arvense*), American vetch (*Vicia americana*), pincushion cactus (*Mamillaria vivipara*) and sweet clover (*Melilotus officinalis*).

Wetland areas

Six wetland transects were surveyed. Prairie bulrush (*Schoenoplectus maritimus*), common cattail, baltic rush (*Juncus balticus*) and beaked sedge (*Carex rostrata*) were present at the water's edge. The banks were often dominated by seaside buttercup (*Ranunculus cymbalaria*). In more saline areas, red samphire (*Salicornia rubra*) was dominant along with seaside arrowgrass (*Triglochin maritima*), dead kochia litter, and Nuttal's alkali grass (*Puccinellia nuttalliana*). Common reed grass (*Phragmitis communis*) was found in patches along pond edges.

3.4.3 Rare and Endangered Species

Saskatchewan Conservation Data Centre

A search of the Saskatchewan Conservation Data Centre database revealed the following vegetation species of potential concern within the vicinity of the study area (Table 3.5). None of these species are protected by the federal *Species at Risk Act* (SARA).

Rare Plant Survey

During the vegetation survey in June 2009, no rare plant species were observed within the study area. The lack of rare species is not surprising as the spoil mounds have revegetated over the last several decades by wind dispersal alone; therefore, vegetation cover is dominated by exotic grasses, agricultural weeds, and other pioneering forbs species.

Table 3.5 Rare flora species within the regional study area (RM of Coalfields)

Latin Name	*Common Name*	*Provincial Rank*
Big Bluestem	*Andropogon gerardii*	S3S4
Silky Milkweed	*Asclepias syriaca*	S1
Tall Beggar's-tick	*Bidens frondosa*	S2S3
Tall Grama	*Bouteloua curtipendula*	S3
Fox Sedge	*Carex vulpinoidea*	S2
Climbing Bittersweet	*Celastrus scandens*	S1
Clustered Oreocarya	*Cryptantha celosioides*	S1
Hairy Panic-grass	*Dichanthelium acuminatum var. fasciculatum*	S2
Sand-millet	*Dichanthelium wilcoxianum*	S1
Carolina Whitlow-grass	*Draba reptans*	S1S2
Narrow-leaved Purple Coneflower	*Echinaceae angustifolia*	S3
White-top	*Erigeron strigosus*	S2S3
Jerusalem Artichoke	*Heliantus tuberosus*	S2
Canada Wood Nettle	*Laportea canadensis*	S2
White-flowered Meadow-parsley	*Lomatium orientale*	S1
Prairie Bird's-foot-trefoil	*Lotus unifoliolatus var. unifoliolatus*	S2
Western False Gromwell	*Onosmodium molle var. occidentale*	S2
Stemless Point-vetch	*Oxytropis lambertii*	S2
Western Smooth Cliff-brake	*Pellaea glabella spp. occidentalis*	S2
Blue Wild Phlox	*Phlox alyssifolia*	S2
White Milkwort	*Polygala alba*	S3
Great Solomon's Seal	*Polygonatum biflorum var. commutatum*	S2
Self-heal	*Prunella vulgaris spp. lanceolata*	S1
American Plum	*Prunus americana*	S2
Pale Bulrush	*Scirpus pallidus*	S2
Mad Dog Skullcap	*Scutellaria lateriflora var. lateriflora*	S3
Indian-grass	*Sorghastrum nutans*	S1
Northern Dropseed	*Sporobolus heterolepis*	S3
Blue Vervain	*Verbena hastata*	S1S2
Nannyberry	*Viburnum lentago*	S2
Crowfoot	*Viola pedatifida*	S3

3.5 WILDLIFE

3.5.1 Field Survey Methods

Wildlife surveys were conducted in late spring 2009 (June 9-11) when breeding activities were occurring. Incidental observations of wildlife were also made during the May 19-22, 2009 soil

survey. Prior to the surveys, locations within different habitat types (disturbed fields, mine spoil-till, mine spoil-cretaceous) were randomly chosen. During the wildlife surveys, each location was visited for a minimum of 10 minutes and any observations of wildlife were noted. Distinct tree stands were also examined during the surveys and when traveling between locations. A total of 10 locations were visited during the wildlife surveys (Figure 3.4). Representative photographs of study area can be found in Appendix C.

Amphibian observations were made during the May and June field visits. Wetlands and dugouts throughout the study area were visited and audible and visual observations were recorded.

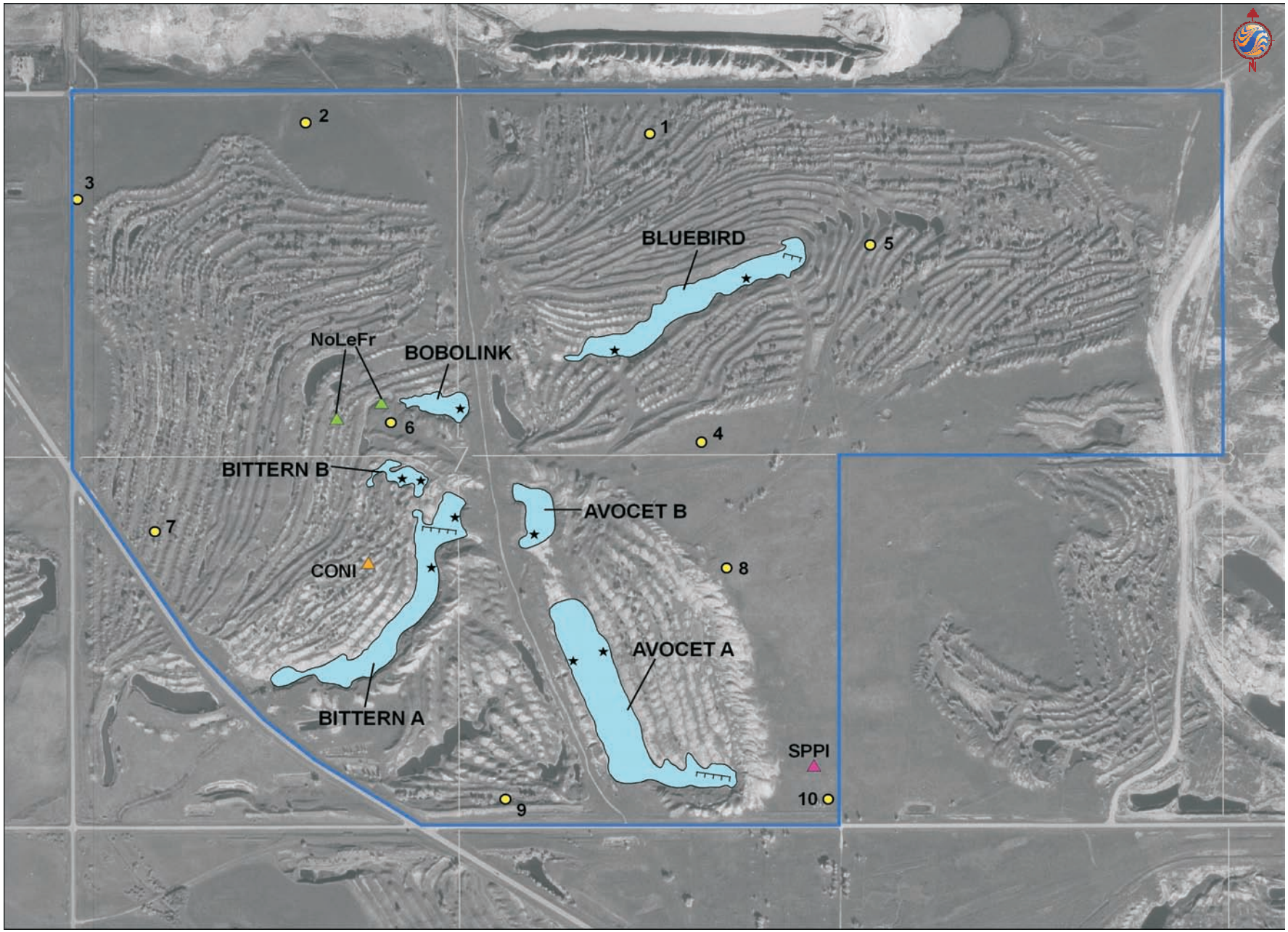
3.5.2 Wildlife Habitat

The entire study area is composed of disturbed habitats due to the fact that it has been previously mined. The study area has since revegetated, creating wildlife habitat. Small areas of open fields are present in the northwest and southeast corners of the study area. The remainder of the study area consists of old mine spoil piles creating a unique landscape of valleys and tall, steep hills. A number of water bodies are present within the study area, which are the result of previous mining activities.

According to the Canada Land Inventory, the study area is primarily comprised of Class 5 lands, which have moderately severe limitations to wildlife production. Although the vegetated spoil piles in the study area provide rough terrain that attracts wildlife species such as deer, good quality wildlife habitats are located in the Souris River Valley, located approximately 2 miles south of Pit 2018.

3.5.3 Study Results

As noted in Table 3.6, 48 bird species, 9 mammal species and 1 amphibian species were observed within the study area.



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Legend:

- Pit 2018 Mine Boundary
- Wildlife Point Count Locations
- SPPI - Sprague's Pipit
- CONI - Common Nighthawk
- NoLeFr - Northern Leopard Frog
- Ponds
- Minnow Nets
- Gill Nets

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PIT 2018 ENVIRONMENTAL IMPACT STATEMENT

Figure No.:

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Title:

Species at Risk Observations, Wildlife Point Counts and Fisheries Sampling Locations

Table 3.6 Rare flora species within the regional study area (RM of Coalfields)

Common Name	Scientific Name
BIRDS	
Double-crested Cormorant	*Phalacrocorax auritus*
Great-blue Heron	*Ardea herodias*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Northern Shoveler	*Anas clypeata*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Sora	*Porzana carolina*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Willet	*Tringa semipalmata*
Spotted Sandpiper	*Actitis macularia*
Wilson's Phalarope	*Phalaropus tricolor*
Common Snipe	*Gallinago gallinago*
Black Tern	*Chlidonias niger*
Red-tailed Hawk	*Buteo jamaicensis*
Swainson's Hawk	*Buteo swainsoni*
Gray Partridge	*Perdix perdix*
Mourning Dove	*Zenaida macroura*
Common Nighthawk*	***Chordeiles minor***
Northern Flicker	*Colaptes auratus*
Eastern Kingbird	*Tyrannus tyrannus*
Western Kingbird	*Tyrannus verticalis*
Least Flycatcher	*Empidonax minimus*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Barn Swallow	*Hirundo rustica*
Bank Swallow	*Riparia riparia*
American Crow	*Corvus brachyrhynchos*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
Sprague's Pipit*	***Anthus spragueii***
Warbling Vireo	*Vireo gilvus*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
LeConte's Sparrow	*Ammodramus leconteii*
Vesper Sparrow	*Pooecetes gramineus*
Savannah Sparrow	*Passerculus sandwichensis*

Common Name	Scientific Name
Clay-coloured Sparrow	*Spizella pallida*
Lincoln's Sparrow	*Melospiza lincolnii*
Lark Sparrow	*Chondestes grammacus*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Baltimore Oriole	*Icterus galbula*
American Goldfinch	*Carduelis tristis*
MAMMALS	
Mule deer	*Odocoileus hemionus*
Coyote (tracks)	*Canis latrans*
Racoon	*Procyon lotor*
Muskrat	*Ondatra zibethicus*
American badger (holes)	*Taxidea taxus*
Long-tailed weasel	*Mustela frenata*
Richardson's ground squirrel	*Spermophilus richardsonii*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
Jack Rabbit	*Lepus townsendi*
AMPHIBIANS	
Northern Leopard Frog*	***Rana pipiens***

*Names in bold indicate species that are protected under the Species at Risk Act.

Three species (two birds and one amphibian) protected under the Species at Risk Act (SARA) were observed during the field surveys and are described further in Section 3.5.4.

The site had an abundance of wildlife species. This is likely due to the fact that the site has been well revegetated with several trees present among the old spoil piles thereby providing nesting habitat for songbirds. A clay-coloured sparrow nest and a Baltimore oriole nest were found during the surveys. A red-tailed hawk pair was observed; their behaviour suggested that they had a nest nearby, although a nest was not directly observed. Swainson's hawks were observed outside of the study area. Although there were a few solitary trees near open fields in the southeast corner of the study area, no ferruginous hawks were observed within the study area.

Several mule deer were observed throughout the study area, mainly amongst the spoil piles. Due to its topography and density of vegetation, this area represents suitable deer habitat year-round providing adequate shelter and foraging habitat. Richardson's and thirteen-lined ground squirrels, a long-tailed weasel and badger holes were observed in the open grassland fields located in the northwest and southeast corners of the study area, particularly in the latter corner.

The man-made mine end cut ponds and the natural wetlands that have developed along valley bottoms provide suitable habitat for amphibians. The northern leopard frog sightings were confined to the northwest corner of the study area; these sightings are discussed further in Section 3.5.4.

3.5.4 Rare and Endangered Species

A search of the Saskatchewan Conservation Data Centre database and the SARA registry revealed the following species of potential concern within the regional study area (Table 3.7).

Table 3.7 Rare faunal species within the regional study area (RM of Coalfields)

Species	*Latin name*	*Provincial Rank*
Ferruginous hawk	*Buteo regalis*	S4B
Burrowing owl	*Athene cunicularia*	SARA
Common nighthawk	*Chordeiles minor*	SARA*
Sprague's pipit	*Anthus spragueii*	SARA
Smooth green snake	*Liochlorophis vernalis*	S3
Northern leopard frog	*Rana pipiens*	SARA
Plains Spadefoot	*Spea bombifrons*	S3
Olive-backed pocket mouse	*Perognathus fasciatus*	S3

* The common nighthawk is currently Threatened (COSEWIC, 2007)

Federally listed species that are known to exist within the regional study area include burrowing owl (*Athene cunicularia*), Sprague's pipit (*Anthus spragueii*), common nighthawk (*Chordeiles minor*) and northern leopard frog (*Rana pipiens*). These species are protected under Schedule 1 of SARA, although the common nighthawk listing under Schedule 1 is pending. Observations of all of these species, with the exception of the burrowing owl, were made within the study area during the June 2009 surveys. These observations are described further in the next two sections.

Rare Bird Survey

Two SARA protected bird species were observed during the field surveys: Sprague's pipit and common nighthawk (Figure 3.4). One Sprague's pipit was heard in SE-7-2-6-W2M in the open field habitat. No direct observations were made of a Sprague's pipit nest. However, Sprague's pipits have small territories (ca. 2.5 hectares) and the male bird sings during flight displays that are high above its nesting habitat. Given these facts, it is very likely that there was an active Sprague's pipit nest within the study area.

Two common nighthawks were observed within SW-7-2-6-W2M during the vegetation survey and were exhibiting territorial behaviour. Although no nests were directly observed, the

behaviour of the birds led to the conclusion that a nest was most likely present within the vicinity of the common nighthawk sighting.

Amphibians

Three northern leopard frogs were observed at two locations within the study area (Table 3.8 and Figure 3.4).

Table 3.8 Northern Leopard Frog Observations

Quarter Section	*UTM (Easting, Northing, Zone)*	*No. of frogs*
NW-7-2-6-W2M	660293E 5442122N 13U	1
NW-7-2-6-W2M	660200E 5442097N 13U	2

The local abundance of northern leopard frogs was also noted in field studies completed by Stantec Consulting Ltd. for the Shand South Mine Extension Area EIS and the Pit 17 EIS located west of Pit 2018. Field data from both areas noted sightings of northern leopard frogs in farm dugouts and reclaimed mine end pit water bodies, with some water bodies having up to 40 frogs being observed. The number of frogs on the Pit 2018 site was significantly lower; this may be due to the high salinity of the local water bodies.

3.6 FISHERIES

A fisheries assessment was conducted on May 19-20, 2009 on six small mine pit ponds in the study area: Avocet A, Avocet B, Bittern A, Bittern B, Bluebird, and Bobolink (Figure 3.4). Stocking records were available for four of the six named ponds. Bluebird Pond was stocked with rainbow trout by Saskatchewan Environment in 1983. Avocet A pond was stocked with rainbow trout (*Oncorhynchus mykiss*) in 1983 and grayling (*Thymallus thymallus*) in 1986 by Saskatchewan Environment. Other agencies stocked Avocet A pond in 1983, as well as Bittern A and Bittern B in 1986, with other species including white sucker (*Catostomus commersonii*), ninespine stickleback (*Pungitius pungitius*) and other unidentified minnow species. There were no records of Bobolink pond or Avocet B pond having been stocked in the past.

3.6.1 Field Survey Methods

The surveys were conducted by setting minnow traps and gill nets for approximately 24 hours. Electrical conductivity, pH, dissolved oxygen, and water temperature were recorded in each pond.

Gill nets were set on May 19, 2009 in Avocet A, Bittern B and Bluebird ponds. A gang of gill nets consisting of 10 meters each of 1 ½", 2", 3", 4", 5", and 5 ½" mesh sizes was used. Water depths in Avocet A ranged from 3 m to 6 m and the gill net was set from 3 m at the shallow end to 6 m at the deeper end. Water depths in Bittern B ranged from 3 m to a maximum depth of 7.5 m and gill nets were set in those depths. Water depths in Bluebird were generally shallow with a maximum depth of 2.8 m; the gill net was set from 1.5 m to 2.8 m depths. Gill nets in Avocet A, Bittern B, and Bluebird ponds were lifted on May 20, 2009 after set times of approximately 23 hours, 24 hours and 20 hours, respectively.

Two minnow traps were set in each of Avocet A, Bittern A, Bittern B, and Bluebird ponds and one minnow trap was set in each of Bobolink and Avocet B ponds on May 19, 2009. The traps were lifted on May 20, 2009 after approximately 20 to 24 hours.

No seine hauls were completed in any of the ponds due to the fact that littoral zones were generally steeply sloped with very soft clay substrate.

3.6.2 Study Results

Water quality results are presented in Table 3.9. No fish were caught in either the minnow traps or the gill nets. This is likely due to the extremely high conductivity levels (ranging from 14,400 µS/cm (10.1 ppt) to 25,900 µS/cm (18.1 ppt)). These high values place all ponds into the mesosaline category (5–18 ppt) and well beyond the 150 to 500 µS/cm levels normally attributed to good fisheries waters. Recorded values for pH were also quite high, ranging from 8.9 to 9.5.

Table 3.9 Water Chemistry of Mine Pit Ponds assessed for Fisheries

Pond	Maximum depth (m)	Water Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)
Avocet A	6	11.9	9.1	16600	10.2
Avocet B	n/a	13.8	9.1	25900	10
Bittern A	7.5	n/a	n/a	n/a	n/a
Bittern B	n/a	11	9.5	14400	10.9
Bluebird	2.8	12.5	8.9	25100	9.8
Bobolink	n/a	11.4	9.3	15200	10.7

3.7 SURFACE HYDROLOGY

There are six ponds that have previously been used for fish stocking (Section 3.6) and several small wetlands throughout the study area that are either man-made endcut water bodies or have developed naturally in valley bottoms. There are no stream channels within the study area and therefore no significant drainage to and from the numerous ponds.

The ponds within the region vary from Class 2 to Class 5 (Stewart and Kantrud classification system). The fisheries study examined the larger Class 4 and 5 ponds and noted that water quality is extremely saline.

3.8 GEOLOGY

Beckie Hydrologeologists Ltd., in conjunction with the hydrogeologic assessment, provided a general description of the geology in the study area. The full geological assessment can be found in Appendix D, within the hydrogeologic assessment report.

The proposed Pit 2018 South Extension is situated within a complex geological environment, although the area which will be affected by the proposed mining is relatively small. The proposed mine area is located south of the Town of Bienfait, in an area where the overlying coal seam (the Souris Seam) was previously mined. The ground surface over much of the proposed mining area consists of disturbed glacial till, which ranges from approximately three to six metres in thickness throughout the proposed mining area.

The glacial till unconformably overlies the Ravenscrag Formation, which is comprised of interbedded layers of fine grained sand, silt, clay and lignite coal. The Estevan Coal Seam, which is the intended target zone of the proposed mine, is one of many lignite coal seams which have been identified in the Estevan area. The top of the Estevan Coal Seam within the Pit 2018 area occurs at an approximate elevation of 540 masl in the north and 530 masl in the south, and has an approximate total thickness of five metres. The ground surface elevation in the proposed mine area ranges between approximately 575 and 580 masl.

The Ravenscrag Formation in the study area extends to a depth of approximately 240 metres, where it conformably overlies the Frenchman Formation of Cretaceous age. It should be noted that the Souris Coal Seam (the upper most coal seam in the study area) has already been removed (and therefore the overburden above that coal seam has been disturbed) through previous mining activity over much of the proposed mining area.

3.9 EXISTING HYDROGEOLOGIC ENVIRONMENT

In August 2009, Beckie Hydrogeologists Ltd. (BHL) conducted a hydrogeologic investigation within the study area. This report outlines the hydrogeologic survey methods, describes the aquifer systems in the Bienfait region, and provides monitoring requirements and recommendations for mitigating any potential impacts caused by mining activities. The

complete hydrogeologic assessment report, with accompanying maps and tables, is provided in Appendix D.

3.9.1 Survey Results

PMRL proposes to commence strip mining operations of Pit 2018, with the Estevan Coal Seam as the mining target. Strip mining of the Estevan Coal Seam is already occurring at locations immediately adjacent to the proposed Pit 2018 South location (east half of Section 13-02-07-W2 and west half of Section 18-02-06-W2). The Souris Coal Seam, which overlies the Estevan Coal Seam, was previously mined from the proposed Pit 2018 South location in the 1950s and 1960s.

Several existing regional piezometers (installed in 1996 and 1997 under BHL direction) were identified as locations to be monitored prior to and for the duration of the proposed Pit 2018 South mining and reclamation. Nine of these piezometers are located such that they will also be suitable for monitoring water level and water quality changes (if any) during the course of the mining activity in Pit 2018 South. PMRL measure these piezometers on an approximate monthly basis and this monitoring should continue through the course of the Pit 2018 South mining.

A total of six private water wells were identified at five different farm sites. A field inventory was conducted to obtain pre-mining baseline data (water level and water quality) of existing water resources. The field portion of this study (piezometer sampling and farm well inventory) was completed by BHL personnel on August 18 and 19, 2009. Based on the completion depths and locations of these wells, it is anticipated that the inventoried wells will not be adversely affected by mining in Pit 2018 South.

3.9.2 Regional Aquifers

For the purposes of this study and to maintain consistency with prior studies completed by Beckie Hydrogeologists Ltd. (BHL) for similar hydrogeologic assessments in the Estevan area, the regional aquifers have been grouped into three major systems. These include the Glacial Drift Aquifer System, the Bienfait Aquifer System and the Bedrock Valley Aquifer System. A brief description of each system follows.

3.9.2.1 Glacial Drift Aquifer System

The group of aquifers which would be included in this system include all glacially derived surficial, intertill and subtill granular (sand and gravel) units, the alluvial sediments in the present day drainage system of the Souris River and the confining (aquitard) units within the glacial till.

Based on the available geologic information, the glacial drift aquifers in the study area appear to be comprised of thin lens deposits of sand and gravel with limited areal extent and with only

limited hydraulic connection with other similar deposits. Because of the limited till thickness in the study area, it is expected that most of the potential drift aquifers in the area would either be unsaturated if they outcrop along the Souris River Valley or would have limited production potential due to perched water table conditions and minimal recharge.

3.9.2.2 Bienfait Aquifer System

Because of their regional tendency to act hydraulically as a single unit, Meneley (1983) grouped all of the bedrock units above the top of the Pierre Shale into a common aquifer unit referred to as the Bienfait Aquifer System. This aquifer system includes all of the sand, silt, clay and lignite coal layers associated with the Ravenscrag Formation (Tertiary age) as well as the Frenchman Formation and where present, the Whitemud and Eastend Formations. For the geographic reference, Meneley defined the limits of the Bienfait Aquifer System by the actual northern and western areal extents of the named geologic units and by the 104th meridian to the east and by the Canada - United States border to the south. In the study area, this aquifer system extends to a depth of approximately 240 metres (base of the Frenchman Formation).

There are numerous sand units within the Bienfait Aquifer System, although because of the fluvial-deltaic depositional nature of the Ravenscrag and Frenchman Formations, the individual sand lenses within the larger units can often not be correlated for more than 100 metres. The sand units tend to be semi-consolidated and as a result of this and their fine grain size, pumping capacities from water wells developed in the sand units are generally limited to 1.52 litres per second (lps) or less.

Many of the lignite coal seams identified in the Estevan area have considerable areal extent and can be correlated over areas in excess of several kilometres. Where these coal seams are fractured, there is good potential for the development of domestic water supplies. Analyses of available data suggests that the Estevan Coal seam within the study area is mainly unfractured and that water wells installed in that seam would have limited production capacity.

The Ravenscrag Formation and the glacial deposits (where present) which overly the Estevan Coal Seam have been disturbed and the original hydrogeologic regime within those sediments has been altered during previous and current mining activities. The same type of local alteration is expected as a result of the proposed mining at Pit 2018 South.

Due to the disruptive nature of the strip mining process and the spoil mixing during reclamation, the local pre-mining groundwater flow patterns that were controlled by the original stratigraphic deposits will likely not be re-established following reclamation. It is expected that once mining and reclamation has been completed, a modified hydrogeologic regime will be established within the mined area and that a hydrogeologic regime similar to that which existed outside of the mined area will be re-established, as has occurred in the previously mined and reclaimed areas in the vicinity of Pit 2018 South.

Except for possible fractured or faulted coal seams, the most permeable units within the Bienfait Aquifer System likely occur within the bedrock channel sand deposits which are found throughout the system and which often have large and continuous areal extents. Two such channel deposits are found in the vicinity of the proposed mine area. The largest of the two, the Souris Channel, which is located on the south side of the Souris River approximately three to four kilometres southwest of the proposed mine area, trends generally east to west and has a known length of approximately 20 kilometres. The second, smaller deposit is known as the Costello Channel. This is a northwest to southeast trending channel system which is found in the general vicinity of the PMRL operated Costello Mine, located approximately two kilometres northwest of the proposed mine area.

The bedrock channel deposits described above are typically comprised of fine to very fine grained sand which has been locally cemented (sandstone concretions). Where present with fractured coal layers, pumping capacities from water wells installed in these deposits can be relatively high. Dewatering wells installed under the supervision of BHL in the Costello Channel in 1997 commonly had capacities in the range of 1.51 and 2.27 lps. Bedrock channel sand deposits have not been identified in the immediate vicinity of the proposed mining area.

3.9.2.3 Buried Bedrock Valley Aquifer Systems

Unlike the bedrock sand channels described in section 3.9.2.2 above, which are buried channels formed and infilled with fine grained bedrock sand during the deposition of the Ravenscrag Formation, bedrock valley aquifers refer to valleys in the bedrock surface which have been infilled with granular (sand or gravel) Tertiary material. The two major bedrock valley aquifer systems which occur in the Estevan area are known as the Tableland Aquifer System and the Estevan Valley Aquifer System. Neither of these aquifers are present in the immediate vicinity of the proposed mine area and as such will not be discussed in further detail in this report. However, more detailed descriptions are included in a February 26, 1997 BHL report titled “Prairie Coal Ltd. - Costello Mine Expansion Hydrogeological Evaluation”.

4.0 Socioeconomic Setting

4.1 SOCIOECONOMIC ENVIRONMENT

4.1.1 Population and Economic Characteristics

The broad study region includes the City of Estevan, the communities of Bienfait and Roche Percee, and the rural municipalities of Estevan No. 5 and Coalfields No. 4. Selected population characteristics are provided in Table 4.1. The table also includes similar information for the Province of Saskatchewan. The community of Roche Percee (pop. 162, 2001 Census) is not included as information was incomplete.

The regional population is approximately 12,279 (2006 Census), with the great majority (10,084) living within the City of Estevan. Generally, the characteristics of the study region are very similar to the provincial characteristics, with a few exceptions. The following points highlight some of the similarities and differences:

- The Saskatchewan population declined by 1.1% between the 2001 and 2006 census and the study region declined by 1.8%. Provincially, the decline matched the previous census period. However, the regional decline has improved from the previous census period when it was more than 4%. (Statistics Canada, 2007)
- Age characteristics of the study region and the province are very similar.
- The study region has slightly greater percentage of the population having trade certificates and diplomas than does the provincial average.
- The regional unemployment rate is less than the provincial average.
- Incomes in the study region (average earnings) are significantly higher than the provincial average (e.g., $43,497 per year compared to $35,461 per year).
- The study region has a higher proportion (25.1% vs. 18.3%) of the experienced labour force in agriculture and other resource-based industries. This likely represents the employment in the coal and the oil/gas industries.

4.1.2 Land Use

The regional land use is predominantly agriculture and coal mining. Pit 2018 is located within the RM of Coalfields No. 4, and approximately 1.6 km south of the limits of the Town of Bienfait and is immediately south of the active Bienfait mine.

Historically and currently, the surrounding region has been the focus of coal mining in addition to the agricultural land uses. An active coal mine (Boundary Dam Mine) is located to the west. Abandoned mines are also located throughout the region.

A total of six private water wells were identified at five different farm sites in the immediate vicinity of the proposed new mining area. Field inventories were conducted to obtain baseline (pre-mining water level and water quality) information. Based on the completion depths and locations of these wells, it is anticipated that the inventoried wells will not be adversely affected by mining in Pit 2018 South.

4.2 HERITAGE RESOURCES

Stantec Consulting Ltd. referred this project to the Heritage Resources Branch of the Ministry of Tourism, Parks, Culture and Sport. They responded (Heritage Resource Review Referral Form Ref # 09-632) that a heritage resource impact assessment was not required for this project.

Table 4.1 Selected Population Characteristics

Population Characteristics		*Estevan*		*Bienfait*		*Estevan RM 5*		*Coalfields RM 4*		*Saskatchewan*		*Study Region*	
Population & Dwelling Counts	Population in 2006	10084		748		1051		396		968157		12279	
2006 Census	Population in 2001	10242		786		1055		415		978933		12498	
	2001 to 2006 population change (%)	-1.5		-4.8		-0.4		-4.6		-1.1		-1.8	
	Total private dwellings	4455		320		417		150		438621		5342	
	Population density per square kilometre	574.4		242.1		1.4		0.5		1.6			
	Land area (square km)	18		3		775		820		588276			
Age Characteristics			**%**		**%**		**%**		**%**		**%**		**%**
	Total - All persons	10085	100	750	100	1050	100	390	100	968160	100	12275	100
	Age 0-4	570	5.7	55	7.3	55	5.2	15	3.8	57495	5.9	640	5.2
	Age 5-14	1325	13.1	130	17.3	160	15.2	60	15.4	130200	13.4	1545	12.6
	Age 15-19	805	7.7	50	6.7	95	9.0	45	11.5	74900	7.7	945	7.7
	Age 20-34	2070	7.9	170	22.7	165	15.7	40	10.3	180425	18.6	2275	18.5
	Age 35-44	1445	14.3	120	16.0	135	12.9	50	12.8	127875	13.2	1630	13.3
	Age 45-64	2305	22.9	175	23.3	360	34.3	125	32.1	247955	25.6	2790	22.7
	Age 65-84	1250	12.4	40	5.3	80	7.6	55	14.1	125495	13.0	1385	11.3
	Age 85 and over	310	3.0	0	0	5	0.4	5	1.3	23820	2.5	320	2.6
	Median age of the population	37.1		32.1		40.7		42.2		38.7			
	% of the population ages 15 and over	81.1		76		80		81		80.6		76.1	
Highest Level of Schooling		**%**	**count**	**%**	**count**	**%**	**count**	**%**	**count**	**%**			**%**
	Total population aged 20-34		2030		205		135		60			2430	
2001 Census	less than a high school graduation certificate	23.9	485	12.2	25	29.6	40	41.7	25	21.8		575	23.7
	high school graduation certificate and/or some postsecondary	28.8	585	43.9	90	44.4	60	25	15	32.5		750	30.8
	trades certificate or diploma	20.4	414	14.6	30	18.5	25	16.7	10	13.7		479	19.7
	college certificate or diploma	11.6	235	7.3	15	0	0	16.7	10	15.4		260	10.7
	university certificate; diploma or degree	14.8	300	22	45	7.4	10	0	0	16.6		356	14.6
	Total population aged 35-44	1740		115		230		75				2160	
	less than a high school graduation certificate	27.6	480	30.4	35	37	85	20	15	25.5		615	28.5
	high school graduation certificate and/or some postsecondary	24.7	430	39.1	45	30.4	70	40	30	23.6		575	26.6
	trades certificate or diploma	22.7	395	8.7	10	13	30	0	0	17.3		435	20.1
	college certificate or diploma	14.4	251	21.7	25	13	30	26.7	20	17		325	15.1
	university certificate; diploma or degree	10.6	184	0	0	10.9	25	13.3	10	16.7		219	10.2
	Total population aged 45-64	1895		155		320		100				2470	
	less than a high school graduation certificate	37.5	711	45.2	70	35.9	115	40	40	34.0		936	37.9
	high school graduation certificate and/or some postsecondary	17.7	335	22.6	35	7.8	25	10	10	18.7		405	16.4
	trades certificate or diploma	19.5	370	19.4	30	26.6	85	10	10	15.1		495	20.0
	college certificate or diploma	13.2	250	9.7	15	21.9	70	20	20	13.7		355	14.4
	university certificate; diploma or degree	12.1	229	0	0	7.8	25	20	20	18.4		274	11.1

Earnings in 2000													
	All persons with earnings (counts)	5815		450		680		260		534355		7205	
	Average earnings (all persons with earnings ($))	32622		31699		35840		24786		25691			
	Worked full year; full time (counts)	3220		195		385		120		276420		3920	
	Average earnings (worked full year; full time ($))	43627		40851		46185		31386		35461		43365	
Income in 2000													
	Persons 15 years of age and over with income	7520		570		775		320		722760		9185	
	Median total income of persons 15 years of age and over ($)	25408		26438		27827		19014		19636			
	Composition of total income (100%)	100		100		100		100		100			
	Earnings - % of income	79.7		85.5		84.7		82.9		73.6			
	Government transfers - % of income	10.1		9.4		6.4		13.9		14.7			
	Other money - % of income	10.2		4.6		8.2		4.3		11.7			
Labour Force Indicators													
	Participation rate	70.1		73.3		79.3		78.5		67.8			
	Employment rate	68.6		70.8		78		76.9		63.5			
	Unemployment rate	2.2		3.4		1.5		0		6.3			
Industry			%				%		%		%		%
	Total - Experienced labour force	5455	100	440		645	100	255	100	504020	100	6795	100
	Agriculture and other resource-based industries	1260	23.1	95		245	38.0	90	35.3	92070	18.3	1690	24.9
	Manufacturing and construction industries	595	10.9	50		90	14.0	40	15.7	56615	11.2	775	11.4
	Wholesale and retail trade	800	14.7	70		105	16.3	35	13.7	73425	14.6	1010	14.9
	Finance and real estate	275	5.0	25		0	0.0	0	0.0	25290	5.0	300	4.4
	Health and education	850	15.6	70		75	11.6	30	11.8	92210	18.3	1025	15.1
	Business services	665	12.2	60		55	8.5	35	13.7	64880	12.9	815	12.0
	Other services	1015	18.6	70		90	14.0	20	7.8	99530	19.7	1195	17.6
Occupation			%				%		%		%		%
	Total - Experienced labour force	5455	100.0	445		650	100.0	255	100.0	504015	100.0	6805	100.0
	Management occupations	540	9.9	20		80	12.3	15	5.9	42630	8.5	655	9.6
	Business; finance and administration occupations	770	14.1	45		105	16.2	35	13.7	74715	14.8	955	14.0
	Natural and applied sciences and related occupations	235	4.3	10		15	2.3	0	0.0	19525	3.9	260	3.8
	Health occupations	205	3.8	15		15	2.3	0	0.0	29810	5.9	235	3.5
	Social science; education; government service and religion	400	7.3	15		15	2.3	35	13.7	38835	7.7	465	6.8
	Art; culture; recreation and sport	85	1.6	0		10	1.5	0	0.0	10210	2.0	95	1.4
	Sales and service occupations	1420	26.0	145		105	16.2	55	21.6	118255	23.5	1725	25.3
	Trades; transport and equipment operators and related occupations	1155	21.2	155		145	22.3	50	19.6	74545	14.8	1505	22.1
	Occupations unique to primary industry	450	8.2	35		140	21.5	55	21.6	79955	15.9	680	10.0
	Occupations unique to processing; manufacturing and utilities	200	3.7	10		15	2.3	15	5.9	15545	3.1	240	3.5

source: adapted from Census 2001 and 2006 data, Statistics Canada

5.0 Public Consultation

Public consultation for this project has been limited to direct contacts with the landowners in close proximity to the project.

The nearest residence to the proposed mining is the Gress home, located immediately west of the mining area. This residence has been located close to the active mining at Bienfait for a number of years, and PMRL has been meeting and talking to the Gress's regularly over this time. The last meeting with the Gress's was on May 14, 2009 and a general mine plan was shown to them. No major concerns were raised by the landowners. Communications between PMRL and the Gress's will continue on a regular basis.

On August 12, 2009, a letter was sent to the five closest residences to the mining indicating that PMRL was investigating the option of this mining area and a private water well survey was going to be completed as part of the Environmental Impact Assessment. On August 18 and 19, 2009, the private water well survey was completed at the five residences. No concerns were raised by any of the landowners.

6.0 Environmental Effects Analysis and Mitigation

6.1 INTRODUCTION

This chapter identifies potential direct and indirect environmental effects associated with the project. An environmental effect is defined as "any change that the project may cause in the environment, including any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance, and any change to the project that may be caused by the environment" (*Canadian Environmental Assessment Act*, 2004).

6.2 ASSESSMENT APPROACH

Potential environmental and socioeconomic effects are identified and discussed in Sections 6.3 and 6.4. The effects are discussed by examining the spatial and temporal boundaries of the project, in addition to the significance of the effects. Once the magnitude, frequency, duration, and significance of the effects are examined, mitigation measures are proposed. Finally, cumulative effects are assessed by considering potential residual effects, in addition to the potential impacts of past, current, and proposed activities within the project region.

6.2.1 Spatial Boundaries

The spatial boundaries of the project include the magnitude or geographic extent which can be measured at a local, regional, and extended scale:

- Local: related to an actual disturbance site (e.g. mine footprint).
- Regional: affects the environment within the surrounding Rural Municipalities.
- Extended: includes the Province of Saskatchewan and beyond the regional boundaries.

6.2.2 Temporal Boundaries

The temporal boundaries of the project include the duration (short, moderate, or long term) and frequency (constant, isolated, or accidental) of the effects.

Duration is categorized as short, moderate or long term:

- Short Term Duration: length of mining period or less.
- Moderate Term Duration: 3 to 5 year duration (e.g. time required to revegetate or stabilize disturbed landscapes after mining ceases).

- Long Term Duration: greater than 5 years. (i.e., could be a persistent effect lasting for many decades).

Frequency may be constant, occasional, isolated or accidental:

- Constant: frequency of the effect will occur continuously for the life of the project.
- Occasional: frequency of the effect will occur on and off for the life of the project.
- Isolated: frequency of the effect is associated with a specific construction or operation activity. NOTE: frequency may also be described in the following discussion by referring to the construction phase or the operation phase. Maintenance activities are considered part of the operation phase.
- Accidental: frequency is associated with unforeseen events such as accidents.

6.2.3 Significance of Effects

The significance of the effects may be negligible, minor or major:

- Negligible: the effect is extremely small or non-existent (i.e., too small to be of any concern).
- Minor: the effect has a low likelihood of occurrence or would affect a small area or population. Effects are normally of short duration. The effects are avoidable with appropriate mitigation measures. These are considered to be less significant effects.
- Major: the effect has a high likelihood of occurring or would affect a large area or population. Effects could be of short to long duration, depending upon the situation. The effect could have implications to regionally or nationally important populations or could affect the communities in very negative ways (e.g. loss of income, health issues, etc.). These are considered as significant effects and will require mitigation.

6.3 POTENTIAL BIOPHYSICAL EFFECTS AND THEIR MITIGATION

6.3.1 Noise

Mining activity consists of scrapers removing coversoil, dragline stripping of the overburden, coal loading, trucks hauling coal from the pits, dozers contouring the overburden, scrapers placing coversoil onto the re-contoured overburden and tractors revegetating the newly constructed soil profile. The environmental effects associated with the noise generated by these activities include disturbance to nearby residents and disturbance to wildlife populations.

These will be an inconvenience and a potentially annoying effect for local residents and will last for the duration of the mining activity. However, while the noise may be relatively constant,

there will be variations due to weather (e.g., may be more noticeable when very cold) and during particular activities.

Noise may adversely affect wildlife populations by scaring them away. Noise generated by mining equipment will be at a constant level rather than an intermittent disturbance. Many wildlife species are able to adapt to an increase in background noise if noise levels are constant, while infrequent loud events can cause a startle effect. This is particularly true for those generalist species such as deer and coyote that are found in disturbed areas. Although there is an abundance of wildlife within the study area, there are other activities (roads, nearby mining activities, etc.) that are already affecting the local wildlife populations. Therefore, no significant effect upon the wildlife population, due to noise, is anticipated.

Noise effects will be for the length of the mining period and will be generally local, although in some cold conditions the noise may travel for a few kilometres from the mine site. The noise effects will be similar to any other coal mining activity within the region and is related to the migration of mining activity from one location to a new location. There will be no regional cumulative effect.

To minimize the impacts of noise on residences and/or wildlife populations located around the Pit 2018 South Extension, the following specific mitigation and monitoring strategies will be used, which are a continuation of existing mining practices in the area:

- maintain standard, industry-accepted noise abatement devices on all equipment;
- maintain equipment in good repair to prevent unnecessary noise; and
- maintain contact with the RM of Coalfields No. 4 regarding potential noise concerns from residents.

The residual impacts of noise on residences and/or wildlife populations will remain for the duration of mining activity in the Pit 2018 area, but will be eliminated once mining has ceased in the area.

6.3.2 Air Quality

Mining activity will generate dust which is attributed to the transportation of coal from the pit; handling of overburden; soil salvage and replacement; cultivation and seeding; and wind erosion of exposed overburden and soils surfaces. Some of this dust will be generated throughout the mine life, while some instances will be associated with dry, windy conditions.

The effects will be potentially reduced air quality which may result in potentially adverse health and aesthetic effects for local residents. Local vegetation may also be adversely affected through the deposition of sediments. The effects of dust are usually local with over 95% of the dust settling out within 30 m of the source.

The effects will be local (a few hundred metres downwind), sporadic to occasional, and generally minor. Some severe wind conditions could produce more major, sporadic events.

The effects of dust deposition will be mitigated by watering haul roads to reduce dust deposition on adjacent vegetation and local residences, and the timely reclamation of the mined pit area.

6.3.3 Hydrogeology

The Estevan Coal Seam has previously been subjected to strip mining on the properties directly adjacent to the Pit 2018 South Extension area. Based on existing geologic information, the maximum anticipated depth of mining in the area is approximately 50 metres.

It is not anticipated that any of the six water wells within the vicinity of the mining area will be affected by mining activities.

Several existing regional piezometers (installed in 1996 and 1997 under BHL direction) were identified as locations to be monitored prior to and for the duration of the proposed Pit 2018 South mining and reclamation. Nine of these piezometers are located such that they will also be suitable for monitoring water level and water quality changes (if any) during the course of the mining activity in Pit 2018 South. PMRL measure these piezometers on an approximate monthly basis and this monitoring should continue through the course of the Pit 2018 South mining.

PMRL will continue to monitor aquifer(s) water levels in nine existing piezometers throughout the course of the Pit 2018 South mining so that any concerns expressed by private well owners can be fairly assessed and if necessary, mitigated in a timely manner.

6.3.4 Surface Hydrology

Pit 2018 South Extension development will require no modification to any surface drainage channels. Several ponds, which have been created in the valleys of the historic mine spoil piles will be drained, with water being directed to a water body (end cut) located in the adjacent mining area. This is illustrated in Figure 2.3. Groundwater and surface drainage encountered during the pit development will be pumped from the mine area to the existing pond. The water from this pond will be pumped to the Beinfait Activated Carbon plant for use as process water. In the unlikely event that the water supply will temporarily exceed the capacity of the plant (e.g., high rainfall filling the ponds), any surplus will be discharged from the existing pond to the environment through an existing license.

The net effect on existing surface drainage will be local, minor, and in effect for the life of the mine.

6.3.5 Soils and Terrain

Mining activity will completely remove or disturb the vegetative cover (see next section) and associated soil horizons within the disturbance boundary over the anticipated thirty year life of Pit 2018. Mining activity consists of the soils (coversoil and subsoil) removal (where possible), dragline stripping of the underlying overburden material (sand and glacial till), removing the 3 to 5 m thick coal seam, leveling the overburden material, replacing the salvaged cover soil onto the leveled overburden material and revegetating the newly constructed soil profile.

Dragline stripping of the overburden will result in alterations to the existing topography. The dragline-created turnover-cut spoil piles will be leveled to final slopes ranging from 0 to 10%. The boxcut and ramp areas will be leveled to slopes ranging from 0 to 15%, and the end cut slopes will vary from 0 to 20%. The objective is to re-contour the spoil piles so that they prevent erosion, enhance stability, eliminate hazardous slopes, provide adequate surface drainage and blend into the existing regional topography. Leveling, replacement of salvaged cover soil and revegetation will follow as closely behind mining activities as is feasible.

The mine disturbance area will be completely altered by mining activity, with soils (coversoil, subsoil) and vegetation being completely removed. Mitigation will begin immediately following the mining activity and will involve the replacement of soils, re-contouring of the landscape, and revegetation of the landscape. The effects on the landscape will occur throughout the mining phase. This is a major effect of moderate duration. The re-contoured landscape will have vegetation re-establishment to stabilize the soils. Therefore, the overall effects are considered minor.

6.3.6 Vegetation

The Pit 2018 application area covers approximately 310 hectares, with three dominant vegetation communities. Few native plants were found throughout the study area and the majority of the area was dominated by agricultural weeds and pioneering forbs. Development of the Pit 2018 South Extension will result in the loss of all vegetative cover within the disturbance area. The disturbed land will be reclaimed with a forage/pasture mix. As noted in Section 2.2.1 and Table 2.2, this seed mix has been used for many years in the successful revegetation of reclaimed mine land at the Boundary Dam mine.

No rare plants were identified within the Pit 2018 South Extension area during the June 2009 rare plant survey.

<u>Wetlands</u>

A number of small wetlands occur within the proposed Pit 2018 South Extension Disturbance area and all of these wetlands will be lost. Re-contouring of the mined area will result in permanent endcut water bodies similar to those developed in the reclaimed and revegetated

areas within the existing Boundary Dam Mine where wetland vegetation has been found to re-establish following reclamation. These wetlands will develop as permanent open water wetlands. Over time, semi-permanent wetlands will develop in the natural depressions of the re-contoured reclaimed landscape. Seeds of many wetland plants remain viable in the soil for decades (Huel 2000). As water collects in these shallow depressions most of the wetland plants will re-establish naturally.

The effects of vegetation loss are local, but long-term. Overall, the effect on vegetation at Pit 2018 is considered minor. Residual impacts include the fact that once the mining of Pit 2018 is complete, the land will be reclaimed to perennial forage production instead of being reclaimed to its current landscape of undulating, steep slopes and valleys. Therefore, there will be permanent loss of structural diversity and microhabitats which, in turn, reduces the potential for biodiversity of plant species.

6.3.7 Wildlife

The Pit 2018 South Extension Project is expected to completely disturb 310 ha of land. The current landscape, which consists of spoil piles and areas of perennial forage production, was created by previous mining activities which occurred decades ago at this site. Although the landscape is man-made, it provides very good wildlife habitat including important areas for breeding, denning, and foraging. The structural diversity of the landscape (i.e. ridge valleys) has created several microhabitats that are used by a variety of wildlife species, year-round (e.g. winter cover for ungulates and grouse).

Wildlife species will be displaced on a long-term basis during the development of the Pit 2018 South Extension. Wildlife communities that currently inhabit areas around existing mines located near the Pit 2018 site have likely adapted to the disturbances associated with mining activities. Therefore, it is expected that displaced animals will continue to use habitat where suitable forage and cover remains. There are other high quality wildlife habitats within the region, such as along the Souris River to the south of the proposed mine site.

Impacts to the movement patterns of wildlife during mining operations are expected to be low. Movement within the Pit 2018 environment that will be affected by the mine development are likely the result of random foraging patterns. Wildlife will learn to navigate around new disturbances to access food resources and/or shelter.

Impacts associated with mining activities (land disturbance and equipment noise) are expected to be low for wildlife because of the existing level of development and associated disturbances in the area. Most wildlife species present in the region have likely adapted to disturbance as a result of existing mine development in the area.

Of the 48 wildlife species detected during the survey, three of them are federally protected species. Therefore, there is the potential for species at risk to be adversely affected by the

mine. Northern leopard frogs that are dependent on the wetland habitats that exist within the study area could experience increased mortality as a result of development. However, due to the low numbers of northern leopard frogs detected within the study area and the presence of wetlands outside of the application area, the overall effect upon the northern leopard frog population at this site is considered small. Mitigation measures will be in place to minimize impacts to species most susceptible to disturbance. Confidence in this assessment is moderate because sensitive species may still occur within the Pit 2018 South Extension area and the reaction to disturbances varies between different species and individuals of the same species.

Due to the loss of wildlife habitat associated with the mine development, PMRL will initiate the following mitigation strategies to minimize the effects of the Pit 2018 South Extension Project on wildlife and their habitats:

- minimize the quantity of land disturbed at any one time;
- conduct reclamation concurrently, as close as possible behind mining;
- utilize and maintain standard, industry-accepted noise abatement devices on all equipment;
- vehicle speed limits in the range of 50 to 80 km/hr will be applied on PMRL operating roads to minimize vehicle/wildlife conflicts;
- dust control measures will be implemented on access roads and haul roads when necessary to protect forage and to ensure adequate visibility;
- vegetation removal will be conducted during the fall and winter period, where possible, to avoid the disruption of breeding birds;
- the existing no hunting/no firearm policy will be extended to include the Pit 2018 area once it is controlled by PMRL; and
- food and food wastes will be handled and stored in a manner to prevent wildlife habituation to project facilities and avoid the destruction of nuisance wildlife.

Adverse effects upon the wildlife resource will last for the life of the mine and are localized to the mine and adjacent lands. Although the mining activities will result in the permanent loss of wildlife habitat, the overall effect on wildlife within the study area will be minor as it will only affect a small area. The wetlands may be affected by pit development and/or surface water management. These activities may have adverse effects upon a small local population of northern leopard frogs. This local population may be reduced in size, or completely destroyed. While this is a federally protected species, the effect is considered minor. This conclusion is based upon results from other studies in the immediate area (e.g., in the Shand South Extension area south of the Souris River). It has been documented that the northern leopard frog populations are thriving in man-made water bodies including dugouts and reclaimed end pit ponds (Stantec 2007).

Residual impacts include the fact that the land will be reclaimed to perennial forage production instead of being reclaimed to its current ridge valley landscape. This will result in the permanent loss of structural diversity, microhabitats, and biodiversity. Some wildlife species will be permanently displaced from the site because the reclaimed site will no longer contain the appropriate type of habitat needed (e.g. tree-nesting birds).

6.4 POTENTIAL SOCIOECONOMIC EFFECTS AND THEIR MITIGATION

6.4.1 Heritage Resources

No heritage resource mitigation is required at this project site.

6.4.2 Job Creation

The Pit 2018 South Extension is not expected to increase the size of the workforce at the Bienfait Mine. There will however be temporary economic benefits resulting from the infrastructure construction (powerline and haul road)

6.4.3 Socioeconomic Summary

This small mine project is a continuation of coal mining activity within the Estevan area. The changes to the socioeconomic environment are considered to be negligible.

7.0 Conclusion

PMRL plans to extend its Bienfait Mine operations to include the Pit 2018 South Extension located in Section 7 and the NW 8 Twp 2, Rge 6 W2M. This site, located near the Bienfait mining operations, will provide 755,000 tonnes of coal annually for 30 years. The mining is scheduled to occur from 2010 to 2039.

Wildlife, vegetation, hydrogeology, and soils investigations have been completed for the site. Some wildlife habitats developed within historic mine spoil piles will be lost during mine development, and some northern leopard frog populations and habitat may be adversely affected. However, as outlined in the previous chapters, PMRL will use mitigation measures to reduce the magnitude of these effects. Northern leopard frogs, which are relatively abundant in the region, should experience negligible effects. A very small number of Sprague's pipits (one pair) and common nighthawks (one pair) may be displaced.

Public consultation with the nearest neighbours has been completed for this project and no concerns were identified. This site is in an active mining region and is taking only a small are of land out of forage crop production and does not adversely affect private wells.

In conclusion, PMRL is seeking environmental approval from MOE, allowing this project to proceed to the mining stage.

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