Sandhill Estates – Biophysical Assessment for SW¼ 24-039-27 W4M, Lacombe County, Alberta

Prepared for:
1842107 Alberta Ltd.

Prepared by:
Stantec Consulting Ltd.

July 2016
112849578

Sign-off Sheet

This document entitled Sandhill Estates – Biophysical Assessment for SW¼ 24-039-27 W4M, Lacombe County, Alberta was prepared by Stantec Consulting Ltd. ("Stantec") for the account of 1842107 Alberta Ltd. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

ALBERTA INSTITUTE OF AGROLOGISTS
BRENDA SHAUGHNESSY, P.Ag.
CIBUS AD OMNES
4683
MEMBER

Prepared by _____
(signature)

Brenda Shaughnessy, M.Sc., P.Ag.
Environmental Scientist

ALBERTA SOCIETY of Professional Biologists
Marc Obert
1398
PROFESSIONAL BIOLOGIST

Reviewed by _____
(signature)

Marc Obert, B.Sc., P.Ag., P.Biol.
Environmental Scientist

_____
(signature)

Elaine Little, B.Sc.
Associate

Stantec

Table of Contents

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

APPENDIX A

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by 1842107 Alberta Ltd. to conduct a biophysical assessment for Sandhill Estates, a residential development encompassed within the Burbank Development (Appendix A, Figure 1, Study Area). The Study Area is located within the SW ¼ 24-039-27 W4M, and is south of Highway 597, east of Range Road 271, and north of the Red Deer River, in Lacombe County, Alberta.

1.1 BIOPHYSICAL ASSESSMENT SCOPE AND PURPOSE

Lacombe County generally restricts multi-lot development to areas that have been designated for such use in an area structure plan. The *Burbank Area Local Plan* (County of Lacombe No. 14 1989) was adopted in 1989 to address the demand for more country residential development in the area southeast of Blackfalds and the Study Area is incorporated into that plan. This biophysical assessment was prepared to support the Outline Plan for the development of Sandhill Estates (SW ¼ 24-039-27 W4M) using the terms of reference in *Multi-Lot Development Proposals: Lacombe County's Guide to the Approval Process* (Lacombe County 2015). This document (Lacombe County 2015) is intended to identify natural features within the Study Area to provide input into planning for future development and served as the terms of reference for this biophysical assessment.

1.2 PROPOSED PROJECT AND STUDY AREA

The Study Area is approximately 10.5 hectares (ha) and current land use includes a building associated with a rural residence, agricultural land, and woodlots. Residences are located to the north, east, south, and west of the Study Area. Township Road 393A, which is a paved road, borders the Study Area to the north and east. A Canadian National (CN) railway line runs along the southeast portion of the Study Area, agricultural land borders the Study Area to the southwest, and a woodlot and residence border the Study Area to the west.

The Study Area will be developed in accordance with the *Sandhill Estates Outline Plan* (Stantec 2016a) as residential land. It is anticipated that development in the Study Area will be low density country residential lots, similar to the development in the neighboring community of Burbank.

2.0 REGULATORY CONTEXT

The protection, management, and development of the lands encompassed in the Study Area are subject to various municipal, provincial, and federal legislation, regulations, and policies. These are listed below and are intended to provide a summary of the most relevant regulatory documents, but should not be considered exhaustive.

Municipal

- Multi-Lot Development Proposals: Lacombe County's guide to the Approval Process (Lacombe County 2015)

Provincial

- *Environmental Protection and Enhancement Act* (R.S.A. 2000, c. E-12)
- *Municipal Government Act* (R.S.A. 2000, c. M-26)
- *Public Lands Act* (R.S.A. 2000, c. P-40)
- *Water Act* (R.S.A. 2000, c. W-3)
- *Weed Control Act* (S.A. 2008, c. W-5.1)
- Weed Control Regulations (Alta. Reg. 19/2010)
- *Wildlife Act* (R.S.A. 2000, c. W-10)

Federal

- *Fisheries Act* (R.S.C. 1985, c. F-14)
- *Migratory Birds Convention Act, 1994* (S.C. 1994, c. 22)
- Migratory Birds Regulations (C.R.C., c. 1035)

3.0 METHODS

The focus of this biophysical assessment is identification of natural features within the Study Area that should be considered for conservation during future development planning. To identify such areas, a desktop review and field assessment were conducted to identify and map natural features in the Study Area, as well as to identify areas of potential management concern. Data collected were used to complete an ecological integrity analysis that determines the network component status of each natural feature, its ecological connectivity, and its ecological value. Methods used in desktop review, field assessment, and ecological integrity analysis are provided below.

3.1 DESKTOP REVIEW

The desktop review included a review of available and relevant biophysical information, a search of provincial databases for species of management concern, and a review of historical aerial photographs. Methods used in the desktop review are summarized below.

3.1.1 Biophysical Environment

The biophysical components of the Study Area that were reviewed included:

- Vegetation
- Wildlife
- Climate
- Topography
- Geology
- Soils
- Hydrology and Hydrogeology

Information sources that were reviewed included publicly available databases and reports relevant to the biophysical components, as well as previous reports completed for the Study Area.

A search of the Alberta Conservation Information Management System (ACIMS) tracking and watch lists (AEP 2015b) was completed to identify known rare plant species and rare ecological community types potentially occurring in the Study Area.

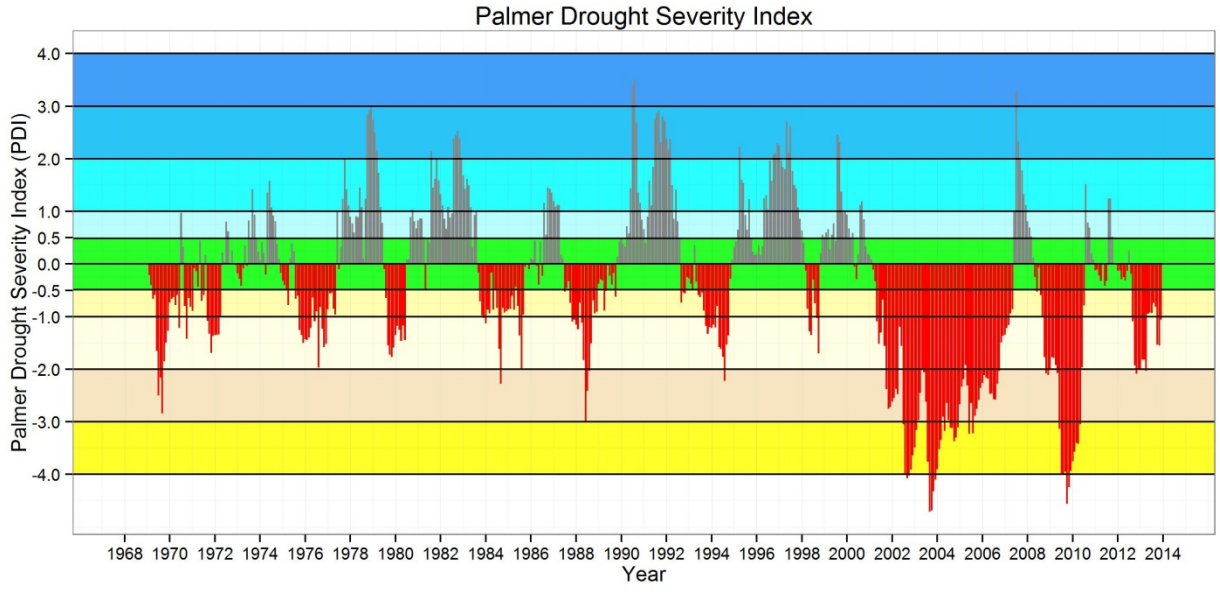
A search for occurrences of wildlife species of management concern within one km of the Study Area was completed through the Fish and Wildlife Information System (FWMIS) database (AEP 2016). A two km radius was used to capture species with larger home ranges (e.g., ungulates, raptors) that may be present in adjacent areas and whose ranges may overlap with the Study Area. Species of management concern were summarized and referenced to provincial and federal ranking.

3.1.2 Historical Aerial Photograph Review

Selected aerial photographs dating from 1962 to 2009 obtained from the Alberta Environment and Parks (AEP) Air Photo Distribution Office (Table 3-1) were reviewed to identify anthropogenic activities and changes to identified natural features within the Study Area over time. Photographs were chosen based on the Palmer Drought Severity Index (PDSI), which is calculated using precipitation, evapotranspiration, and soil storage and loss data from current and previous months (Palmer 1965). The PDSI is depicted in a graph that illustrates wet, average, and dry precipitation years (Graph 3-1). Aerial photographs that correspond to wet, average, and dry intervals were selected. The selected aerial photographs that were reviewed can be found in Appendix B.

Table 3-1 Historical Aerial Photograph Details

Date Taken	Roll, Line, and Photo Number	Scale of Photograph	Color or Black and White	Palmer Drought Index Conditions
1962	AS 824, Line 5209, Photo 184	1:31,680	B/W	-
June 25, 1979	AS 2999, Line 2, Photo 20	1:24,000	B/W Pan-2405	Wet
July 28, 1983	AS 2737, Line 12, Photo 191	1:30,000	B/W Pan-2405	Wet
1998	AS 4970, Line 23, Photo 19	1:30,000	B/W Agfa-50	Wet
June 3, 2009	AS 5469B, Line 14E, Photo 96	1:20,000	B/W Kodak-2405	Dry



Graph 3-1 Palmer Drought Severity Index

3.2 FIELD ASSESSMENT

The field assessment included preliminary mapping of potential upland and wetland features, a site visit to complete an upland characterization survey, a wetland survey, record incidental wildlife observations, and subsequent refinement of the preliminary mapping based on data obtained during the site visit. Methods used in the field assessment are provided below.

3.2.1 Preliminary Mapping

Prior to beginning the field assessment, the selected historical aerial photographs were reviewed for the presence of upland and wetland features within the Study Area. Uplands within the Study Area were identified, mapped, and classified in accordance with *A Preliminary Classification of Plant Communities in the Central Parkland Natural Sub-Region of Alberta* (Wheatley and Bentz 2002). Potential wetland features within the Study Area were identified and mapped following the *Alberta Wetland Identification and Delineation Directive* (AEP 2015a). Boundaries were drawn for each wetland and an estimated wetland class was assigned using the *Alberta Wetland Classification System* (AWCS) (ESRD 2015).

3.2.2 Upland Characterization Survey

Once preliminary mapping was completed, an upland characterization survey was completed by two ecologists on May 31, 2016 to identify and describe upland plant communities.

The upland characterization survey confirmed the mapped boundaries and the classification of upland plant communities within the Study Area. The upland characterization survey was also conducted to identify sensitive environmental conditions pertaining to upland vegetation, as well as allow for the development of appropriate mitigation, conservation, and natural feature management recommendations, as required.

During the upland characterization survey, information on plant species and ecological communities of management concern, if present, were collected. Species and communities of management concern include:

- Uncommon communities and/or those sensitive to watershed disturbance (e.g., old growth forest, wetlands) identified from upland ecosite phase and wetland class mapping
- Rare plants and rare ecological communities
- *Noxious* and *prohibited noxious* weeds (*Weed Control Act* [S.A. 2008, c. W-5.1])

Vegetation data gathered within the Study Area during the upland characterization survey included percent cover of characteristic tree, shrub, and herbaceous species. Additionally, general site information was recorded, including soil moisture regime, slope, aspect, slope position, structural stage, and overall stand health. At each survey site GPS coordinates were

recorded and representative site photos were taken. Notes on ecological communities or conditions that may require special consideration, if present, were also made.

A comprehensive species list was compiled from survey data, which was then referenced to the ACIMS tracking and watch lists (AEP 2015b) and *Species at Risk Act* (SARA) (*Species at Risk Act*. S.C. 2002, c. 29) to verify that all plants considered to be of management concern were identified. Species nomenclature within the comprehensive species list follows the Integrated Taxonomic Information System (2016) for scientific plant species names while common names conform to ACIMS (2015).

3.2.3 Wetland Survey

A wetland survey was completed by two ecologists on May 31, 2016 in conjunction with the upland characterization survey. The wetland survey was conducted to delineate and classify wetlands within the Study Area. Guided by the preliminary mapping, the soils, hydrology, and vegetation of potential wetlands within the Study Area were investigated to confirm that the identified areas were in fact wetlands and to confirm wetland classification according to the AWCS (ESRD 2015).

The following methods were used for the wetland survey:

Soils

- Using a shovel or hand auger, soils were examined to a depth of 29 centimeters (cm), which is the active rooting zone, in the outermost community of each potential wetland
- The depth, texture, color, structure, and abundance of redox features (i.e., gleying and mottles) in each soil horizon were recorded. Redox features in the upper soil profile develop under conditions of inundation or saturation over a long period of time and are therefore used to determine the extent of each wetland. The area was considered a wetland if redox features were observed within the top 29 cm and plant species characteristic of wet conditions were also observed

Hydrology

- Wetland hydrology indicators were assessed qualitatively by:
  - observing whether surface water was present at the site
  - looking for evidence of recent saturation or ponding
  - observing the topography of the site, including any landscape features that would lead to water accumulation
- Evidence of these features includes watermarks on woody vegetation or anthropogenic features, sediment or drift deposits, and algal crusts. Quantitative measurements of hydrological indicators include water depth and depth to saturation (i.e., depth at which soil pores are saturated) when water was present

Vegetation

- Vegetation communities larger than 10 m x 10 m (or equivalent) were sampled within each wetland using 1 m x 1 m subplots. Discontinuous communities were sampled by placing subplots in different patches of the same community. Each subplot was assessed for percent cover of dominant vascular species and percent cover of total vascular species, non-vascular species, litter, bare ground, and open water. Outside of the subplots, a random meander was conducted to document less common species. Unidentifiable species were collected for later identification.
- Regulated plant species (*noxious* and *prohibited noxious*) listed under the *Weed Control Act* (S.A. 2008, c. W-5.1) and Weed Control Regulation (Alta. Reg. 19/2010) were documented within each wetland assessed

The boundary of assessed wetlands was walked in the field. Global positioning system (GPS) tracks were collected (one point every m) and used to assist with mapping refinement.

3.2.4 Incidental Wildlife

Wildlife species observed incidentally (director indirect) during the field assessment were recorded. Direct evidence of wildlife use may include sightings. Indirect evidence of wildlife use may include scat, game trails, beds, browse marks, nests, dens, and tracks.

3.2.5 Mapping Refinement

Upon completion of the field program, historical aerial photographs and field data were reviewed to refine the extent of plant communities in the Study Area using a geographic information system (GIS). Mapping was completed at a scale of 1:2,500 with a minimum polygon size of 0.04 ha.

3.2.6 Species Nomenclature

Scientific species names for plants follow the Integrated Taxonomic Information System (ITIS) (2016). Where the *Species at Risk Act* (S.C. 2002, c. 29) or ACIMS (2015) has used a differing taxonomy for species on rare tracking and watch lists, or invasive species with different taxonomy as identified in the *Weed Control Regulation* (Alta. Reg. 19/2010), species names follow naming conventions used in those documents. Common names for plant species conform to ACIMS.

Wildlife species names used in this report are adopted from the American Ornithologists' Union (Banks et al. 2006) for avian species and ITIS (2016) for mammal species.

3.3 ECOLOGICAL INTEGRITY ANALYSIS

The ecological integrity analysis included as assessment of network components, ecological connectivity, and ecological value rating for each natural feature. Methods used in the ecological integrity analysis are provided below.

3.3.1 Network Components

All natural features observed within the Study Area were given one of the following network component identifiers adapted from the *Edmonton State of Natural Areas Report* (Spencer 2006) and *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation* (Bennett 2003).

Habitat Patches

Habitat patches are patches of vegetation greater than or equal to 1 ha that provide the necessary ecological resources for the support of small populations of plants and animals. Habitat patches can be separated by the surrounding background landscape (matrix) or connected through corridors (Spencer 2006).

Stepping Stones

Stepping stones can be considered patches of vegetation that provide some shelter and habitat, but are not of sufficient quality or size to provide the required ecological functions or to support all wildlife habitat requirements. Stepping stones are smaller in size than habitat patches and can be separated by the surrounding matrix or connected through corridors (Spencer 2006).

Corridors

Corridors are vegetated, often linear patches that facilitate movement from one area to another. They can be naturally vegetated or be of an anthropogenic nature and provide enough shelter from the surrounding matrix to allow movement between areas. However, corridors do not contain the necessary habitat or ecological properties to sustain wildlife populations (Spencer 2006).

Linkages

Linkages are contiguous units of manicured and naturalized vegetation that promote wildlife movement (e.g., vegetated right-of-way, other green space such as parks, golf courses) (Spencer 2006). Linkages, together with stepping stones, provide opportunities for wildlife movement between areas (Bennett 2003).

Barriers

Barriers are areas between natural features that prevent or deter wildlife movement between the patches (Bennett 2003). A barrier could be a large open expanse or a roadway between natural features. In some cases, roadways or highways have been shown to be more effective at preventing movement than a much wider expanse of low quality habitat, such as an agricultural area (Bennett 2003).

3.3.2 Ecological Connectivity

The ecological connectivity analysis included intra- (within the Study Area) and inter-connectivity (between the Study Area and adjacent properties). The connectivity of the Study Area was ranked using a graded ranking system (Table 3-2). Professional judgment is incorporated into the ranking to determine the importance of each natural feature in relation to the others.

Table 3-2 Ecological Connectivity Rankings

Rank	Characteristics
1 – High	• Distance between natural features less than 100 m • No significant barriers to movement present (e.g., no collector or arterial roads, walls, large pockets of development) • Land between natural features is suitable for movement of wildlife • Connected habitat that contains sufficient resources to support wildlife (e.g., are large enough) • Low anthropogenic disturbance
2 – Moderate	• Distance between natural features between 100 and 250 m; or distance between habitat patches less than 100 m but a barrier to movement is present • Moderate barriers to movement are present (e.g., collector road) • Land between natural features is moderately suitable for movement of wildlife • Connected habitat that contains a moderate amount of resources to support wildlife • Moderate anthropogenic disturbance
3 – Low	• Distance between natural features greater than 250 m; or distance between natural features is less than 250 m but a significant barrier to movement is present • Significant barriers to movement present (e.g., arterial road, undersized culvert) • Land between natural features is not suitable for movement of wildlife • Connected natural features do not contain resources to support wildlife • High anthropogenic disturbance

3.3.3 Ecological Value Rating

Ecological value ratings for each natural feature were determined on the basis of network component status, ecological connectivity, habitat size and shape, native species richness, weedy species richness and relative abundance, level of anthropogenic disturbance, and overall quality (Table 3-3).

Table 3-3 Ecological Value Ratings

Rank	Habitat Characteristics
1 – High	• Habitat patch • High degree of connectivity to natural features in the vicinity • No ecosystem fragmentation • High native species richness • Low or no weedy species richness • Low or no degree of anthropogenic disturbance • Provides significant habitat
2 – Moderate	• Stepping Stone • Moderate degree of connectivity to natural features in the vicinity • Moderate native species richness • Moderate weedy species richness • Moderate to low degree of anthropogenic disturbance • Provides moderate habitat
3 – Low	• Corridor, linkage, or barrier • Low degree or no connectivity to natural features in the vicinity • Low native species diversity • High weedy species diversity • Provides marginal habitat • High degree of anthropogenic disturbance

4.0 DESKTOP REVIEW RESULTS

The desktop review included a review of biophysical components of the environment that apply to the Study Area, a review of publicly available information and provincial databases, and a review of historical aerial photographs. Results of the desktop review are provided below.

4.1 BIOPHYSICAL ENVIRONMENT

Biophysical components of the environment that were reviewed as part of the desktop review included vegetation, wildlife, climate, topography, geology, soils, and hydrology and hydrogeology. The results for each of these components are provided below.

4.1.1 Vegetation

The Study Area is located in the Central Parkland Natural Subregion. This subregion is the most densely populated region in Alberta and, as such, the majority of its native vegetation has been altered by human development. It consists of groves of aspen and balsam poplar intermixed with grasslands and depressional wetlands (Natural Regions Committee 2006).

4.1.2 Wildlife

Wildlife typically found in the Central Parkland Natural Subregion of Alberta includes species that frequent the grassland regions to the south and the boreal forest regions to the north. Bird species include red-tailed hawk (*Buteo jamaicensis*), broad-winged hawk (*Buteo platypterus*), least flycatcher (*Empidonax minimus*), rose-breasted grosbeak (*Pheucticus ludovicianus*), red-eyed vireo (*Vireo olivaceus*), and yellow warbler (*Setophaga petechia*). Wildlife species include North American porcupine (*Erethizon dorsatum*), showshoe hare (*Lepus americanus*), whitetail deer (*Odocoileus virginianus*), and ground squirrels (AOE No Date).

4.1.3 Climate

The climate of the area is temperate, with daily average temperatures ranging from approximately -12°C to +16°C, 487 mm per year average precipitation, and an average of 120 frost free days per year (Government of Canada 2016).

4.1.4 Topography

The Study Area has rolling topography with elevations ranging from 859 m to 868 m for an overall relief of approximately 8 m with a gradual slope to the east and west at a typical angle up to 10% (Parkland Geo 2016). A ridge line runs north-south through the center of the Study Area at an elevation of 868 m. The southwest and northeast corners of the Study Area are also at higher elevations of 868 m and 866 m respectively. Concordantly, the Study Area has two low lying

areas in the west and east, both at elevations of 856 m. Overall, the landscape slopes generally towards the Blindman River.

4.1.5 Geology

The regional geology of the Study Area and surrounding area is comprised of fluvial and aeolian deposits of sand, silt, and gravel over bedrock of the Paskapoo Formation, which consists of sandstone, siltstone, mudstone, and occasional coal lenses (Stantec 2016c).

4.1.6 Soils

The soils within the Central Parkland Natural Subregion are dominated by Orthic Black Chernozems on upland sites (e.g., grasslands, forests), Solonetizic soils on lowland sites (e.g., low-lying areas), and Humic and Orthic Gleysols in wetlands (Natural Regions Committee 2006). Within the Study Area, the dominant soils are coarse textured Orthic Black Chernozem sediments deposited by wind or water (Alberta Agriculture and Forestry 2016).

Based on a review of the *Geotechnical Investigation, Burbank Subdivision, Portion of SW 24-039-27 W4M* (Parkland Geo 2016), the Study Area's general soil profile consists of topsoil, sand, sand and gravel, clay, and clay till. Topsoil in the Study Area ranged from 100 to 600 mm thick at all borehole locations completed during the geotechnical investigation. Layers of sand and clay were encountered in all boreholes and a layer of sand and gravel was encountered in four of the boreholes completed during the investigation. Sand extended to depths up to 8 m below grade and clay was located at depths between 1.6 m and 8.5 m below grade. Clay till was present in four of the boreholes below the clay and silt layers and extended beyond the drilling depth of 13 m (Parkland Geo 2016).

4.1.7 Hydrology and Hydrogeology

According to the *Burbank Subdivision Hydrogeologic Summary and Aquifer Potential Evaluation* (Stantec 2016c), the Study Area contains unconsolidated sediments above bedrock, which water well records in the vicinity indicate are dry and non-water bearing, suggesting they are not viable as an aquifer target. Most water well records in the area were completed in bedrock at depths 90 m to 110 m below ground surface in the Haynes Member of the Paskapoo Formation (Stantec 2016c). The groundwater potential indicated there is sufficient aquifer potential in the Paskapoo Formation to sustain 14 individual domestic wells totaling 48 m^3/day (Stantec 2016c).

As specified by the *Sandhill Estates Stormwater Management Report* (Stantec 2016b), post-development stormwater runoff will be collected in roadside swales and conveyed to a stormwater management facility (SWMF). The SWMF will be located in the southeast corner of the Study Area and constructed as a dry storm pond in accordance with Lacombe County and AEP guidelines. Runoff from the SWMF will flow overland through an existing drainage channel to

the Blindman River, which is a tributary to the Red Deer River. Stormwater will be discharged to the Blindman River through a culvert that is sized to pass a target flow of 25 L/s, based on water levels in the SWMF at the high water level (Stantec 2016b).

4.2 ACIMS AND FWMIS SEARCHES

Provincial databases that were searched as part of the desktop review included ACIMS and FWMIS. Results of each of these searches are provided below.

4.2.1 ACIMS Search Results

Two non-sensitive element occurrences were identified in the search results for the ACIMS database (Table 4-1). No sensitive element occurrences, protected areas, or Crown reservations/notations were included in the search results. ACIMS database search results are included in Appendix C.

Table 4-1 Results of ACIMS Database Search and Species Status Information

Species		Conservation Status			
Scientific Name	**Common Name**	**COSEWIC Status[1]**	**SARA Status[2]**	**AEP 2015 Status[3]**	**Wildlife Act Status[4]**
Poanes hobomok	Hobomok skipper	Not listed	Not listed	Undetermined	Not listed
Viola pedatifida	crowfoot violet	Not listed	Not listed	May Be At Risk	Not listed

Notes:

[1] Government of Canada. 2009. Wildlife Species Search. [Online]. Accessed July 2016. http://www.cosewic.gc.ca/eng/sct1/index_e.cfm

[2] *Species at Risk Act*. S.C. 2002. c. 29.

[3] Alberta Government. 2016. Element Occurrence Data. [Online]. Accessed July 2016. http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data.aspx#trackedWatch.

[4] Wildlife Regulation. Alta. Reg. 143/1997.

Hobomok Skipper

The Hobomok skipper (*Poanes hobomok*) is a North America species of butterfly that is distinguished by rounded wings that in the male are yellow-orange with irregular black borders and no stigma. The wingspan of this species ranges from 2.5 cm to 4.3 cm. This species typically inhabits openings and edges of damp woods and feeds on nectar from flowers (Butterflies and Moths of North America No Date).

To await receptive females, males perch about 6 feet above ground on vegetation in woodland clearings. Females deposit eggs singly on or near the host grass leaves, which are

eaten by caterpillars. One brood is produced between April and July (Butterflies and Moths of North America No Date).

Crowfoot Violet

Crowfoot violet (*Viola pedatifida*) is a rare vascular plant that receives its name from its deeply indented "crowfoot" shaped basal leaves. Due to the shape of the leaves, the plants often are not noticed in the grass until the flowers appear. This species generally begins blooming in early June and produce a few large flowers (Froelich No Date). Crowfoot violets are typically found in dry gravelly hills and prairie grassland (Moss and Packer 1994).

4.2.2 FWMIS Search Results

Two bird species and 14 fish species were identified in the search results for the FWMIS database (Table 4-2). FWMIS database search results are included in Appendix C.

Table 4-2 Results of FWMIS Database Search and Species Status Information

Species		Conservation Status			
Scientific Name	**Common Name**	**COSEWIC Status[1]**	**SARA Status[2]**	**Alberta Wild Species Status[3]**	**Wildlife Act Status[4]**
Ardea herodias	great blue heron	Not listed	Special Concern	Sensitive	Non-game animal
Progne subis	purple martin	Not listed	Not listed	Sensitive	Non-game animal
Catostomus catostomus	longnose sucker	Not listed	Endangered	Secure	Not listed
Catostomus commersonii	white sucker	Not listed	Not listed	Secure	Not listed
Coregonus clupeaformis	lake whitefish	Not listed	Not listed	Secure	Not listed
Couesius plumbeus	lake chub	Not listed	Not listed	Secure	Not listed
Esox lucius	northern pike	Not listed	Not listed	Secure	Not listed
Hiodon alosoides	goldeye	Not listed	Not listed	Secure	Not listed
Lota lota	burbot	Not listed	Not listed	Secure	Not listed
Moxostoma macrolepidotum	shorthead redhorse	Not listed	Not listed	Secure	Not listed
Percopsis omiscomaycus	trout-perch	Not listed	Not listed	Secure	Not listed
Perca flavescens	yellow perch	Not listed	Not listed	Secure	Not listed
Prosopium williamsoni	mountain whitefish	Not listed	Not listed	Secure	Not listed

Species		Conservation Status			
Scientific Name	**Common Name**	**COSEWIC Status[1]**	**SARA Status[2]**	**Alberta Wild Species Status[3]**	**Wildlife Act Status[4]**
Salmo trutta	brown trout	Not listed	Not listed	Exotic/Alien	Not listed
Sander canadensis	sauger	Not listed	Not listed	Sensitive	Not listed
Sander vitreus	walleye	Not listed	Not listed	Secure	Not listed

Notes:

[1] Government of Canada. 2009. Wildlife Species Search. [Online]. Accessed July 2016. http://www.cosewic.gc.ca/eng/sct1/index_e.cfm

[2] *Species at Risk Act*. S.C. 2002. c. 29.

[3] Alberta Government. 2016. Element Occurrence Data. [Online]. Accessed July 2016. http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data.aspx#trackedWatch.

[4] Wildlife Regulation. Alta. Reg. 143/1997.

Only those species identified in the FWMIS database search results that have been assigned a conservation status rank are discussed further in this report, because these are considered species of management concern. Species with the following status ranks are discussed below:

- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Government of Canada 2009): Data Deficient, Special Concern, Threatened, Endangered
- *Species At Risk Act* (S.C. 2002, c. 29): Special Concern, Threatened, Endangered
- Government of Alberta (2010): Undetermined, Sensitive, May Be At Risk, At Risk
- Wildlife Regulation (Alta. Reg. 143/1997): Endangered

Great Blue Heron

The great blue heron (*Ardea herodias*) is a large wading bird that can measure and weigh up to 160 cm tall and weigh 2.5 kg. It can be identified by its large size, blue body, and long neck.

Great blue herons forage in marshes, sloughs, along riverbanks, and in lakes (The Cornell Lab of Ornithology 2015). They primarily feeds on fish, but has been documented to consume amphibians, invertebrates, small mammals, and birds (Vennesland and Butler 2011).

Great blue herons are colonial birds and usually nest in groups in stick nests in trees, bushes, or on the ground within 6.5 km of a water body where they can forage (Vennesland and Butler 2011). The breeding range of great blue herons is mostly concentrated in the southern half of the central part of Canada and some northern States such as North and South Dakota, Nebraska, Montana, Wyoming, and Minnesota. The species is considered a year-round resident of the rest of the United States of the Canadian Pacific coast. Its wintering range is located in parts of Mexico and Central America (Vennesland and Butler 2011).

Purple Martin

The purple martin (*Progne subis*) is the largest swallow in North America and among the largest in the world. Males of this species are entirely glossy blue-black. Females resemble other swallow species in color pattern, but can be distinguished by their large size and brownish-grayish collar around the nape of the neck (Tarof 2013).

Purple martins are insectivorous and forage in flight. They presumably range over areas immediately surrounding the nest site, although there is no information on typical travel distance while foraging (Tarof 2013).

Purple martins are colonial nesters and have historically inhabited abandoned tree cavities in forest edges, but have increasingly inhabited man-made nesting houses and buildings (Snyman 2012).

Longnose Sucker

The longnose sucker (*Catostomus catostomus*) has an inferior mouth with no barbels and a broad, fleshy lower lip. Its body is usually dark olive, slate gray, or brown, changing to an abruptly white belly. This species is typically 30 cm to 45 cm long, but can be up to 60 cm in length (University of Wisconsin Sea Grant Institute 2013). This species prefers the bottom of lakes or streams on sandy, cobble, or boulder shorelines (Scott and Crossman 1973).

Sauger

Sauger (*Sander canadensis*) are identified by their large mouth with prominent canines, spotted dorsal fin, no white spot on their caudal fin, rough skin over their gill, and brassy color with large dark blotches on its sides (Alberta Fishing Guide 2016, Ontario Fish Species No Date). Sauger are typically found in murky lakes and large rivers with a variety of substrates, from soft mud bottoms to rubble or bedrock (Government of Ontario 2015). They prey on other fish, leeches, crustaceans, and insects (Alberta Fishing Guide 2016).

4.3 HISTORICAL AERIAL PHOTOGRAPH REVIEW

Selected historical aerial photographs were reviewed for the period from 1962 to 2009. Copies of the aerial photographs are included in Appendix B.

Two large woodlots in the southwest and central portion of the Study Area are present in each of the photographs reviewed, connect in the south-central portion of the Study Area, and increase in tree density over the period reviewed. A small area of trees at the connection point of the two woodlots appears to have been cleared between 1983 and 1998. Two pastures are present in each of the photographs that were reviewed and did not appear to change over time. The pastures are separated by the woodlot in the central portion of the Study Area and are the largest features within the Study Area. In 1962, which is the earliest photograph that was

reviewed, a driveway and building are present on the east side of the central woodlot. The building is removed between 1962 and 1979, and the driveway gradually disappears to when it is no longer visible and appears to be a part of the east pasture by 2009. Between 1979 and 1983 a small building appears in the northwest corner of the Study Area, and is present in the remainder of the photographs that were reviewed. In 1979 the Study Area appears to be fairly wet, especially in the east pasture; in all other years it appears to be dry.

5.0 FIELD ASSESSMENT RESULTS

Results of the upland characterization survey, wetland survey, and incidental wildlife observations are provided below.

5.1 UPLAND CHARACTERIZATION SURVEY

The Study Area is dominated by three upland woodlots, two tame pastures, and a disturbed/regenerating area. Each of these features is discussed below.

Woodlot WL1, which is approximately 0.4 ha, is located in the southwest corner of the Study Area on a steep northwest facing slope. WL1 contains a mixedwood canopy and subcanopy dominated by white spruce (*Picea glauca*) and aspen *(Populus tremuloides*). The shrub layer is dominated by aspen and saskatoon (*Amelanchier alnifolia*), and the herbaceous layer is dominated by small bedstraw (*Galium trifidum*) and fairybells (*Prosartes trachycarpa*). WL1 has structural variability with a healthy undergrowth layer, thick layer of litter, and appears to be in a healthy condition. Based on field data and observations, WL1 is classified as an Aspen Woodland Alliance (Wheatley and Bentz 2002). Photos of WL1 are included in Appendix D.

Woodlot WL2, which is approximately 1.7 ha, is located in the southwest corner of the Study Area, on a north facing slope, bordering the north edge of WL1. WL2 contains a coniferous canopy and subcanopy dominated by white spruce. The shrub layer is dominated by western mountain-ash (*Sorbus scopulina*) and prickly rose (*Rosa acicularis*), and the herbaceous layer is dominated by wild sarsaparilla (Aralia nudicaulis). WL2 contains a dense layer of litter, is on a steep slope, has sparse undergrowth, and appears be in a healthy condition. Based on field data and observations, WL2 is classified as a White Spruce Woodland Alliance (Wheatley and Bentz 2002). Photos of WL2 are included in Appendix D.

Woodlot WL3, which is approximately 1.5 ha, is located in the central portion of the Study Area, and bisects the Study Area along the north-south ridgeline. WL3 contains a deciduous canopy and subcanopy dominated by aspen. Saskatoon, aspen, prickly rose, and pin cherry (*Prunus pensylvanica*) dominate the shrub layer, and wild sarsaparilla and bluejoint (*Calamagrostis canadensis*) dominate the herbaceous layer. WL3 contains a dense layer of litter and some standing dead wood, and appears to be in a healthy condition. Based on field data and observations, WL3 is classified as an Aspen Woodland Alliance (Wheatley and Bentz 2002). Photos of WL3 are included in Appendix D.

Tame Pastures TP1 and TP2 are approximately 3.2 ha and 3.6 ha, respectively. The largest features within the Study Area, both are present on the west and east side of WL3, respectively. These features are both dominated by the gramminoid species smooth brome (*Bromus inermis*), fowl bluegrass (*Poa palustris*), Kentucky bluegrass (*Poa pratensis*), and common dandelion (*Taraxacum officinale*). Creeping thistle (*Cirsium arvense*), which is a *noxious* weed under the

Weed Control Regulations (Alta. Reg. 19/2010), was observed in low densities in both tame pastures. A photo of TP1 is included in Appendix D.

Disturbed/Regenerating Area DR1, which is approximately 0.2 ha, is located between the east end of WL2 and the south end of WL3. This area appears to have been cleared of vegetation at least 10 years prior to the survey, and contains exposed sandy soils and shrubby vegetation. DR1 is dominated by white spruce and balsam poplar (*Populus balsamifera*) in the canopy; by balsam poplar, saskatoon, aspen, and prickly rose in the shrub layer; and by Kentucky bluegrass in the herbaceous layer. A photo of DR1 is included in Appendix D.

Crowfoot violet, which was identified in the results of the ACIMS database search, was not observed during the field assessment.

5.2 WETLAND SURVEY

One ephemeral wetland (Wetland WT1) was identified during the field assessment on the north edge of WL2, in a slight depressional area. WT1 is dominated by herbaceous species, including timothy (*Phleum pratense*), Kentucky bluegrass, alsike clover (*Trifolium hybridum*), and common dandelion. Based on the AWCS (ESRD 2015), WT1 is classified as ephemeral. A photo of WT1 is included in Appendix D.

5.3 INCIDENTAL WILDLIFE

Incidental wildlife observations (i.e., species, location observed, and evidence observed) that were made during the field assessment are included in Table 5-1. The majority of observations were made within the woodlots, and included direct (i.e., sightings) and indirect (i.e., scat, calling) observations. In addition, several trails observed within the woodlots appeared to have been used by horses, and may also have been used by wildlife moving through the Study Area.

Species of management concerns identified in the results of the ACIMS and FWMIS database searches (i.e., Hobomok skipper, great blue heron, purple martin, longnose sucker, and sauger) were not observed during the field assessment.

Table 5-1 Incidental Wildlife Observations

Species		Location Observed	Evidence Observed
Scientific Name	**Common Name**		
Lepus sp.	rabbit	WL3 DR1	Scat
Odocoileus sp.	deer	DR1	Visual
Corvus brachyrhynchos	American crow	WT1	Visual
Empidonax alnorum	alder flycatcher	WL1 WL2	Calling

Field Assessment Results
July 2016

Species		Location Observed	Evidence Observed
Scientific Name	**Common Name**		
Poecile atricapillus	black-capped chickadee	WL1 WL2 WL3 DR1 WT1	Calling
Sitta carolinensis	white-breasted nuthatch	WL1 WL2	Calling
Tachycineta bicolor	tree swallow	TP1	Calling
Turdus migratorius	American robin	WL1 WL2 WL3 DR1	Calling

6.0 ECOLOGICAL INTEGRITY ANALYSIS RESULTS

The ecological integrity analysis on the Study Area included determining the network component status of each natural feature, the ecological connectivity of each natural feature, and the ecological value rating of each natural feature. Results of the ecological integrity analysis are provided below.

6.1 NETWORK COMPONENTS

The Study Area contains one collective habitat patch (i.e., WL1, WL2, WL3 and DR1), and one stepping stone (i.e., WT1). Each of these features is illustrated on Figure 2 (Appendix A). No barriers to movement are present within the Study Area; however, one road and one railway line border the Study Area and may provide a barrier to movement.

Two agricultural fields, TP1 and TP2, create a matrix between the identified natural features within the Study Area. TP1 and TP2 are large expanses of open ground with no shrub or tree cover to facilitate wildlife movement, a lack of native plant species, and low species richness. However, they may provide habitat for small mammals and avian species that utilize grassland habitats.

6.1.1 Habitat Patches

WL1, WL2, and WL3 and DR1 create one large habitat patch. Due to their contiguous nature, large size, relatively high species richness, and lack of weedy species, WL1, WL2, and WL3 are suitable habitat for a variety of wildlife species, such as songbirds, small mammals, and ungulates. However, DR1 has low species richness and ground cover, and appears to have been historically disturbed. These attributes, plus the small size of this feature, renders it less suitable as habitat and more suitable for wildlife movement.

6.1.2 Stepping Stones

WT1 provides a stepping stone between WL2 and the matrix of TP1. WT1 had low species richness, is dominated by non-native species, and provides marginal habitat due to the species composition and lack of shrubs or trees that could provide cover for wildlife.

6.1.3 Barriers

Barriers to movement are not present within the Study Area; however, Township Road 393A and the CN railway line may present barriers to wildlife movement into and out of the Study Area.

6.2 ECOLOGICAL CONNECTIVITY

Ecological connectivity is illustrated on Figure 3 (Appendix A). Due to their close proximity and contiguous nature, high intra-connectivity exists between the following features: WL1-WL2, WL2-DR1, WL2-WL3, DR1-WL3, and WT1-WL2. None of the features within the Study Area received moderate or low intra-connectivity ratings. Inter-connectivity of natural features within and outside of the Study Area was rated as moderate.

6.2.1 Intra-Connectivity

WL1 and WL2 exhibit high inter-connectivity west of the Study Area, because these two features extend beyond the Study Area to the west. They may facilitate wildlife movement through numerous tree stands to a large wetland complex northwest of the Study Area (Appendix A, Figure 3).

6.2.2 Inter-Connectivity

WL1, WL2, WL3, and DR1 are ranked as having moderate inter-connectivity to natural features south of the Study Area. While these features are in close proximity to tree stands south of the Study Area, the presence of the CN railway line may create a barrier to wildlife movement. However, wildlife may cross the CN railway line and move through numerous tree stands south of the Study Area towards the Blindman River and eventually the Red Deer River. These rivers provide a regional movement corridor through the area.

Due to the presence of Township Road 393A, which may create a barrier to wildlife movement, WL3 is ranked as having moderate inter-connectivity to natural features north of the Study Area. However, as with WL1 and WL2, WL3 may also facilitate wildlife movement to the large wetland complex northwest of the Study Area via numerous tree stands between the Study Area and the wetland complex.

6.3 ECOLOGICAL VALUE RATING

The Study Area contained three features ranked as having high ecological value (i.e., WL1, WL2, and WL3), one feature with moderate ecological value (i.e., DR1), and three features with low ecological value (i.e., WT1, TP1, and TP2). Ecological value ratings are illustrated in Figure 4 (Appendix A).

6.3.1 High Ecological Value

WL1, WL2, and WL3 are ranked as having high ecological value. They are relatively large features that combine to create a large habitat patch that has a high and moderate degree of connectivity to natural features outside the Study Area. These features have a relatively high

native species richness and no weed species, no anthropogenic disturbances, and provide habitat for a wide range of wildlife species.

In addition, WL1, WL2, and WL3 may support populations of the Hobomok skipper, which is listed as a non-sensitive element occurrence in the ACIMS database search results (AEP 2015b). While the Hobomok skipper was not observed within the Study Area during the field assessment, WL2 in particular may provide suitable habitat for the Hobomok skipper due to the north aspect and presence of white spruce trees.

WL1, WL2, and WL3 may also support populations of purple martins, which may be found within 2 km of the Study Area (AEP 2016) and are listed provincially as Sensitive (Alberta Government 2016). While purple martins were not observed within the Study Area during the field assessment, standing dead wood in WL1, WL2, and WL3 and the residences in the surrounding areas may support populations of purple martins.

6.3.2 Moderate Ecological Value

DR1 is ranked as having moderate ecological value. It is part of the large habitat patch created by WL1, WL2, and WL3, and provides a connection between WL2 and WL3, but has a low native species richness, low ground cover, and evidence of historical disturbance.

6.3.3 Low Ecological Value

WT1 is ranked as having low ecological value. While it is directly adjacent to WL2 and provides a stepping stone from WL2 to the matrix of TP1, WT1 has low native species richness, is dominated by non-native species, and provides marginal habitat for wildlife. While WT1 is a water body, it does not provide the habitat requirements to support populations of sauger, longnose suckers, or great blue herons, all of which may be found within 2 km of the Study Area (AEP 2016).

TP1 and TP2 are also ranked as having low ecological value due to their low native species richness, lack of habitat for a wide range of wildlife species, high degree of historical anthropogenic disturbance, and presence of creeping thistle. Crowfoot violet, which is listed as a non-sensitive element occurrence in the results of the ACIMS database search (Section 4.2.1), is listed as May Be At Risk (Alberta Government 2016). This species is not expected to be found within TP1 or TP2 because these features do not provide the habitat requirements for the crowfoot violet.

7.0 CONSERVATION TOOLS

Conservation tools that may be used to retain all or portions of natural features within the Study Area include Environmental Reserve/Environmental Reserve Easement, Municipal Reserve, and Conservation Easement (Lacombe County 2015).

Based on the information obtained during the desktop review and field assessment and on the ecological integrity analysis, Woodlots WL1, WL2, and WL3 are suitable for conservation as Municipal Reserve. These features have relatively high native species richness, and a low level of anthropogenic disturbance. They also provide a linkage between natural features south of the Study Area (e.g., Blindman River and Red Deer River) to natural features north of the Study Area (e.g., large wetland complex), making them a component of a regional movement corridor for wildlife. In addition, they may support populations of Hobomok skippers and purple martins.

Disturbed/Regenerating Area DR1 is also suitable for conservation as Municipal Reserve if it is restored to maintain the connection between Woodlots WL2 and WL3 and to maintain the contiguity of the larger habitat patch. Restoration activities may include soil stabilization and revegetation.

Wetland WT1 and Tame Pastures TP1 and TP2, which had low native species richness, historical disturbance, and marginal habitat, were ranked as having low ecological value. These features do not provide enough ecological value to warrant conservation. In addition, because Wetland WT1 is ephemeral, incorporating this feature into the development plan from a drainage perspective presents challenges associated with matching pre-development drainage flows to WT1, which typically will only contain standing water following snow melt in the spring.

8.0 SUMMARY

Natural features observed within the Study Area consisted of three woodlots (WL1, WL2, and WL3), a disturbed/regenerating area (DR1), and one ephemeral wetland (WT1). The Study Area also consisted of two tame pastures (TP1 and TP2), which are anthropogenic features that create a matrix between these natural features. The disturbed/regenerating area, ephemeral wetland, and tame pastures all appear to have been impacted by anthropogenic disturbances; however, the woodlots appear to be in an undisturbed state. Intra-connectivity (i.e., within the Study Area) was high for all features, and inter-connectivity (i.e., outside the Study Area) was high or moderate. The woodlots were ranked as having high ecological value, the disturbed/regenerating area was ranked as having moderate ecological value, and the ephemeral wetland and tame pastures were ranked as having low ecological value. All or portions of the woodlots and the disturbed/regenerating area could be conserved as Municipal Reserve within the development. Due to their low ecological value ranking, the ephemeral wetland and tame pastures do not warrant conservation.

9.0 RECOMMENDATIONS

The following general recommendations have been made to mitigate potential effects to the Study Area as a result of development of Sandhill Estates:

- If natural features ranked as having high ecological value cannot be retained in their entirety, it is recommended to retain portions that maintain a wildlife movement corridor through the Study Area
- Post-development drainage flows to retained natural features should be maintained so as to provide approximately the same amount of moisture to the trees as they receive under pre-development conditions
- Prior to beginning development of the Study Area, the applicable regulatory authorities for the identified wetland should be contacted, and the appropriate level of documentation submitted for approval prior to any disturbance or removal of this feature.
  - It is likely that AEP will require not compensation for disturbance of Wetland WT1; however, an approval will be required prior to disturbance
- Any tree clearing activities within the breeding bird season will require a nest search survey to satisfy requirements under the *Wildlife Act* (R.S.A. 2000, c. W-10) and *Migratory Birds Convention Act* (S.C. 1994, c. 22)
- Trees along the perimeter of the retained portions of the woodlots should be protected by designating a root protection buffer. This buffer will protect the individual trees and their associated root zones from adjacent development
- Erosion and sediment control (ESC) measures to protect soil from water and wind erosion should be considered. An ESC plan should be developed with protection of the Blindman River in mind, given that development plans propose draining stormwater to this water body
- Vehicles or equipment should not be washed within 30 m of a water body
- Fuel and/or hazardous material storage should be greater than 100 m from a water body
- Vehicle and equipment refueling or other maintenance should not occur within 100 m of a water body
- Water from any dewatering activities should be discharged in a manner so that it will not directly enter drainage courses, water bodies, or wetlands
- Creeping thistle, which is a *noxious* weed species, should be controlled or removed, as required in the *Weed Control Act* (S.A. 2008, c. W-5.1) and associated regulations
- If herbicide application is chosen as a method of weed control, all herbicides should be applied by a "Certified Applicator" as defined by *Pesticide (Ministerial) Regulation* (A.R. 43/1997)

10.0 REFERENCES

Alberta Agriculture and Forestry. 2016. Alberta Soil Information Viewer. [Online]. Accessed July 2016. http://www4.agric.gov.ab.ca/agrasidviewer/.

Alberta Environment and Parks (AEP). 2015a. Alberta Wetland Identification and Delineation Directive. [Online]. Accessed July 2016. http://aep.alberta.ca/water/programs-and-services/wetlands/documents/WetlandIdentificationDelineation-Jun2015.pdf.

Alberta Environment and Parks (AEP). 2015b. Search ACIMS Data. [Online]. Accessed June 2016. Available: http://www.albertaparks.ca/acims-data.

Alberta Environment and Parks (AEP). 2016. Access FWMIS data. [Online]. Accessed June 2016. Available: http://esrd.alberta.ca/fish-wildlife/fwmis/access-fwmis-data.aspx.

Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System Guide. Water Policy Branch, Policy and Planning Division. Edmonton, Alberta.

Alberta Fishing Guide. 2016. Sauger in Alberta (Sander canadensis). [Online]. Accessed July 2016. http://www.albertafishingguide.com/fish/sauger.

Alberta Government. 2016. Element Occurrence Data. [Online]. Accessed July 2016. http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/download-data.aspx#trackedWatch.

Alberta Online Encyclopedia (AOE). No Date. Central Parkland Wildlife. [Online]. Accessed July 2016. http://www.abheritage.ca/abnature/parklands/centralwild.htm.

Banks, R.C., C. Cicero, J.L. Dunn, A.W. Kratter, R.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising, and D.F. Stoltz. 2006. Forty-Seventh Supplement to the American Ornithologists' Union Check-List of North American Birds. The Auk, 123(3): 926-936.

Bennett, A.F. 2003. Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation. IUCN Forest Conservation Programme, Conserving Forest Ecosystems Series No. 1. International Union for Conservation of Nature and Natural Resources. Cambridge, UK.

Butterflies and Moths of North America. No Date. Attributes of Poanes hobomok. [Online]. Accessed July 2016. http://www.butterfliesandmoths.org/species/Poanes-hobomok.

County of Lacombe No. 14. 1989. Burbank Area Local Plan. [Online]. Accessed July 2016. http://www.lacombecounty.com/index.php/plans-a-bylaws/other-plans/109-burbank-area-local-plan.

Environmental Protection and Enhancement Act. Revised Statutes of Alberta, 2000. Chapter E-12.

Fisheries Act. Revised Statutes of Canada, 1985. Chapter F-14.

Froelich, S. No Date. Versatile Violets. Nature North. [Online]. Accessed July 2016. http://www.naturenorth.com/spring/flora/violets/violets.html.

Government of Canada. 2009. Wildlife Species Search. [Online]. Accessed July 2016. http://www.cosewic.gc.ca/eng/sct1/index_e.cfm.

Government of Canada. 2016. Canadian Climate Normals 1981-2010 Station Data, Red Deer Alberta. [Online]. Accessed July 2016. http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=red+deer&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=2133&dispBack=0.

Government of Ontario. 2015. Sauger. [Online]. Accessed July 2016. https://www.ontario.ca/page/sauger.

Integrated Taxonomic Information System (ITIS). 2016. Integrated Taxonomic Information System. [Online]. Accessed March 2016. Available: www.itis.gov.

Lacombe County. 2015. Multi-Lot Development Proposals: Lacombe County's Guide to the Approval Process. Lacombe County, Alberta.

Migratory Birds Convention Act, 1994. Statutes of Canada, 1994. Chapter 22.

Migratory Birds Regulations. Consolidated Regulations of Canada. Chapter 1035.

Moss, E.H. and J.G. Packer. 1994. Flora of Alberta, a Manual of Flowering Plants, Conifers, Ferns and Fern Allies Found Growing Without Cultivation in the Province of Alberta, Canada. University of Toronto Press. Toronto, Ontario.

Municipal Government Act. Revised Statutes of Alberta, 2000. Chapter M-26.

Natural Regions Committee. 2006. Natural Regions and Subregions of Alberta. Pub. No. T/852. Compiled by D.J. Downing and W.W Pettapiece. Government of Alberta. Edmonton, Alberta.

Ontario Fish Species. No Date. Sauger. [Online]. Accessed July 2016. http://www.ontariofishspecies.com/sauger.html.

Palmer, W.C. 1965. Meteorological Drought. Research Paper No. 45. U.S. Weather Bureau. Washington D.C.

Parkland Geotechnical Consulting Ltd. (Parkland Geo). 2016. Geotechnical Investigation, Burbank Subdivision, Portion of SW 24-039-27 W4M. Lacombe County, AB. Prepared for 1842107 Alberta Ltd. Red Deer, Alberta.

Pesticide (Ministerial) Regulation. Alberta Regulation 43/1997.

Public Lands Act. Revised Statutes of Alberta, 2000. Chapter P-40.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Bulletin 184. Department of Fisheries and Oceans. Fisheries Research Board of Canada. Ottawa, Ontario.

Snyman, N. 2012. Progne subis, Purple Martin. [Online]. Accessed July 2016. http://animaldiversity.org/accounts/Progne_subis/.

Species at Risk Act. Statutes of Canada, 2002. Chapter 29.

Spencer Environmental Management Services Ltd. (Spencer). 2006. Edmonton State of Natural Areas Report. Prepared for the City of Edmonton. Edmonton, Alberta.

Stantec Consulting Ltd. (Stantec). 2016a. Sandhill Estates Outline Plan. Prepared for Lacombe County. Red Deer, Alberta.

Stantec Consulting Ltd. (Stantec). 2016b. Sandhill Estates Stormwater Management Report. Prepared for 1842107 Alberta Ltd. Red Deer, Alberta.

Stantec Consulting Ltd. (Stantec). 2016c. Burbank Subdivision Hydrogeologic Summary and Aquifer Potential Evaluation. Prepared for 1842107 Alberta Ltd. Red Deer, Alberta.

Tarof, S. 2013. Purple Martin (Progne subis). The Birds of North America Online. [Online]. Accessed July 2016. http://bna.birds.cornell.edu/bna/species/287/articles/introduction.

The Cornell Lab of Ornithology. 2015. Great Blue Heron. [Online]. Accessed July 2016. https://www.allaboutbirds.org/guide/Great_Blue_Heron/id.

University of Wisconsin Sea Grant Institute. 2013. Longnose Sucker. [Online]. Accessed July 2016. http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=84.

Vennesland, R.G. and R.W. Butler. 2011. Great Blue Heron (Ardea herodias). The Birds of North America Online. [Online]. Accessed July 2016. http://bna.birds.cornell.edu/bna/species/025/articles/introduction.

Water Act. Revised Statutes of Alberta, 2000. Chapter W-3.

Weed Control Act. Statutes of Alberta, 2008. Chapter W-5.1.

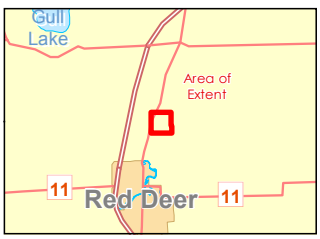
Weed Control Regulation. Alberta Regulation 19/2010.

Wheatley, M. and J. Bentz. 2002. A Preliminary Classification of Plant Communities in the Central Parkland Natural Sub-Region of Alberta. Prepared for: Resource Data Branch, Public Lands Division, Alberta Sustainable Resource Development. Edmonton, Alberta.

Wildlife Act. Revised Statutes of Alberta, 2000. Chapter W-10.

Wildlife Regulation. Alberta Regulation 143/1997.

APPENDIX A
FIGURES



Study Area

Quarter Section

0 150 300 metres

1:15,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

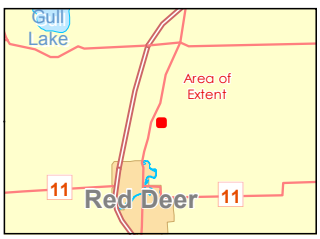
112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
1

Title
Site Location Plan

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community-2010



Study Area

Natural Features

- Ephemeral Wetland
- Aspen Woodland Alliance
- Disturbed/Regenerating
- White Spruce Woodland Alliance
- Tame Pasture

0 50 100 150 metres

1:4,000 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community-2010

Stantec

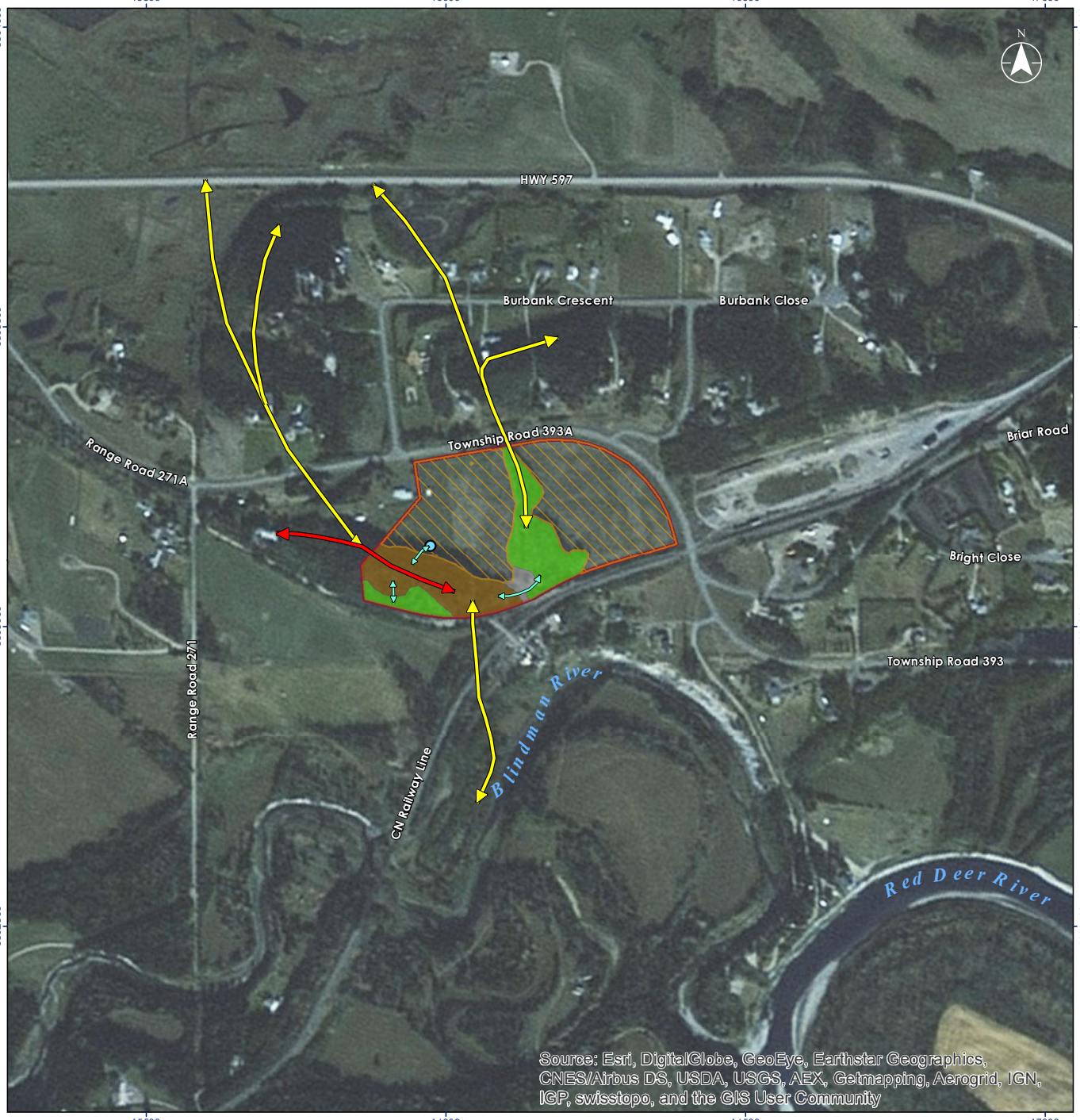
Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

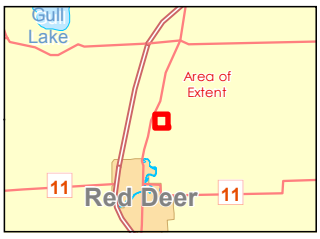
112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
2

Title
Natural Features





Study Area

Natural Features

- Ephemeral Wetland
- Aspen Woodland Alliance
- Disturbed/Regenerating
- White Spruce Woodland Alliance
- Tame Pasture

Inter-connectivity

- High
- Moderate

Intra-connectivity

- High

0 100 200 300 metres

1:10,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

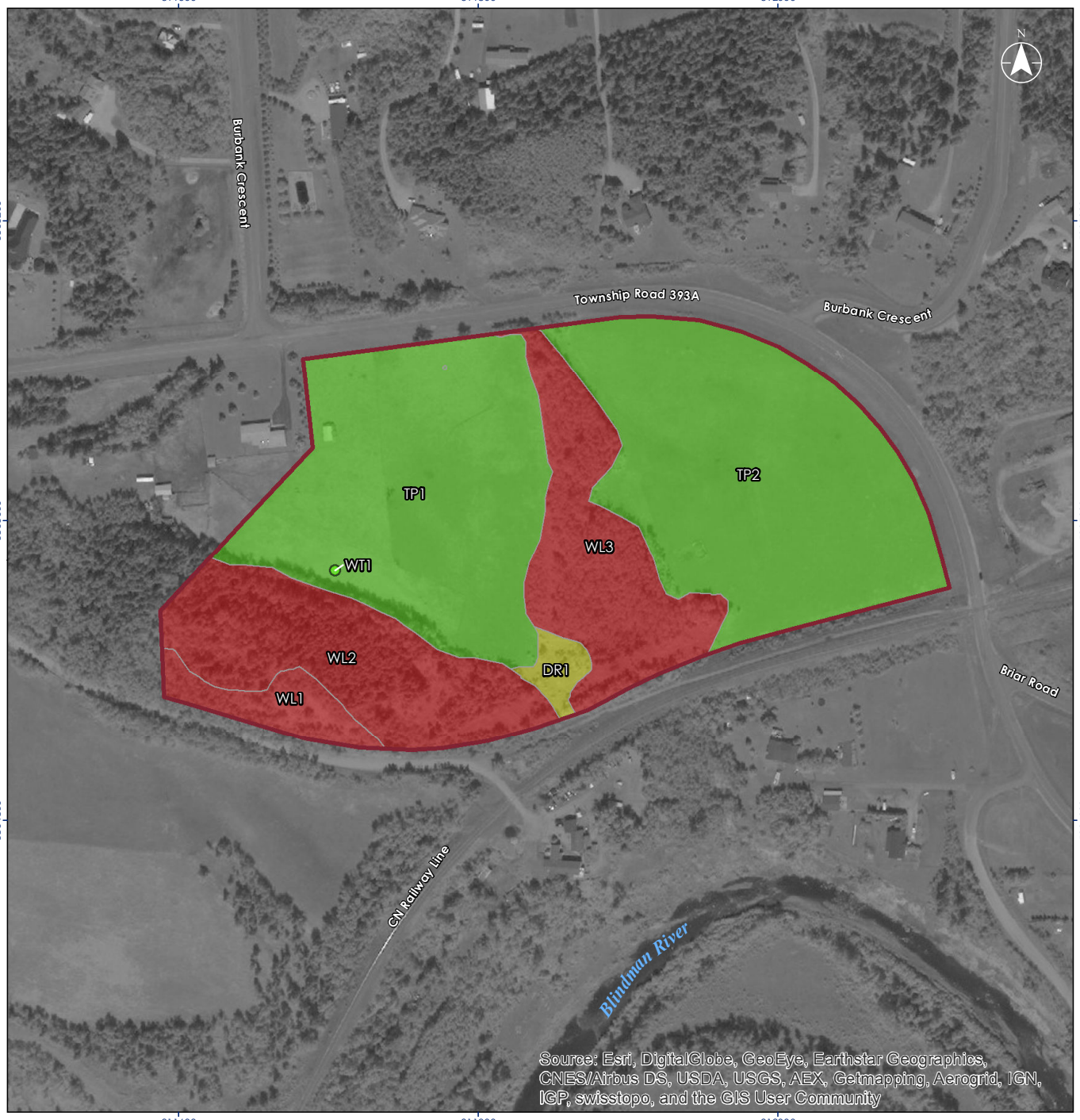
112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

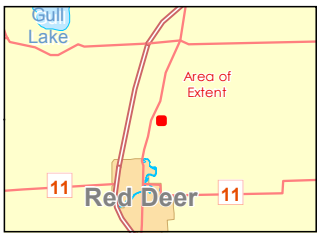
Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
3

Title
Connectivity

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community-2010





Study Area

Ecological Value

- High
- Moderate
- Low

0 50 100 150 metres

1:4,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

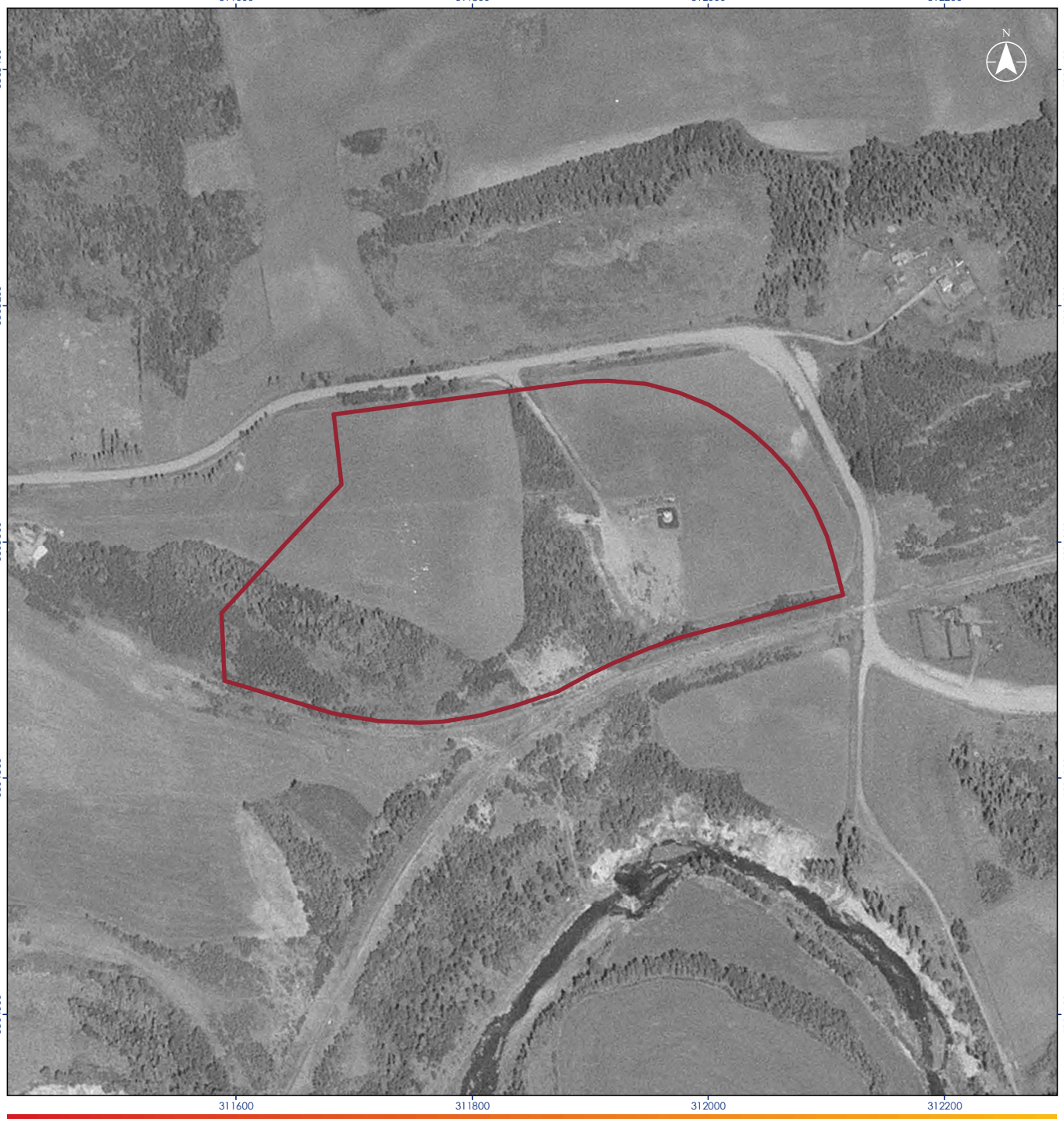
Figure No.
4

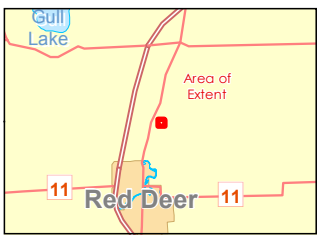
Title
Ecological Value

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community-2010

APPENDIX B
HISTORICAL AERIAL PHOTOGRAPHS

\\Cd1001-c200\workgroup\1102\active\112849578\gis\Figures\historical\subsite1962.mxd Revised: 2016-07-22 By: mkuhl





Study Area

0 50 100 150 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

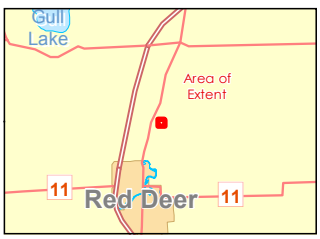
Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
1962

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS0824-094, 1962-06-30

\\Cd1001-c200\workgroup\1102\active\112849578\gis\Figures\historical\subsite1979.mxd Revised: 2016-07-22 By: mkuhl



Study Area

0 50 100 150 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

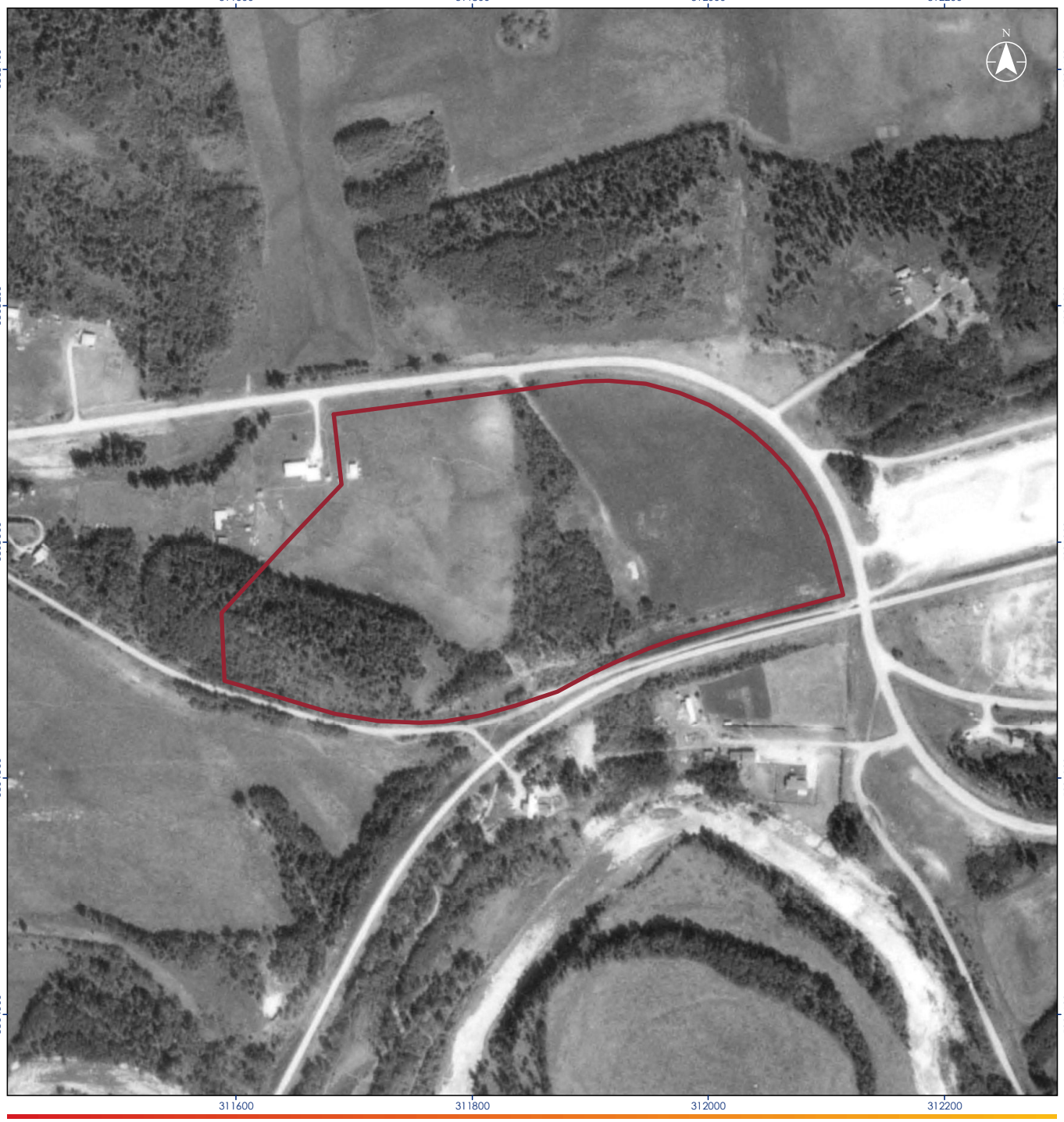
Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

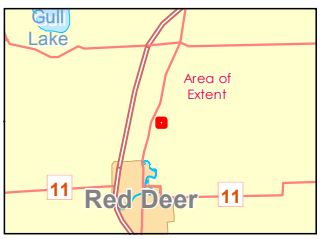
Figure No.
1979

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS2999-063, 1979-05-16

\\Cd1001-c200\workgroup\1102\active\112849578\gis\Figures\historical\subsite1983.mxd Revised: 2016-07-22 By: mkuhl





Study Area

0 50 100 150 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

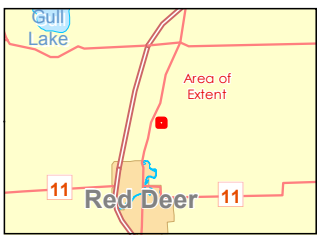
Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
1983

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS2737-193, 1983-07-18

\\Cd1001-c200\workgroup\1102\active\112849578\gis\Figures\historical\subsite1998.mxd Revised: 2016-07-22 By: mkuhl



Study Area

0 50 100 150 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

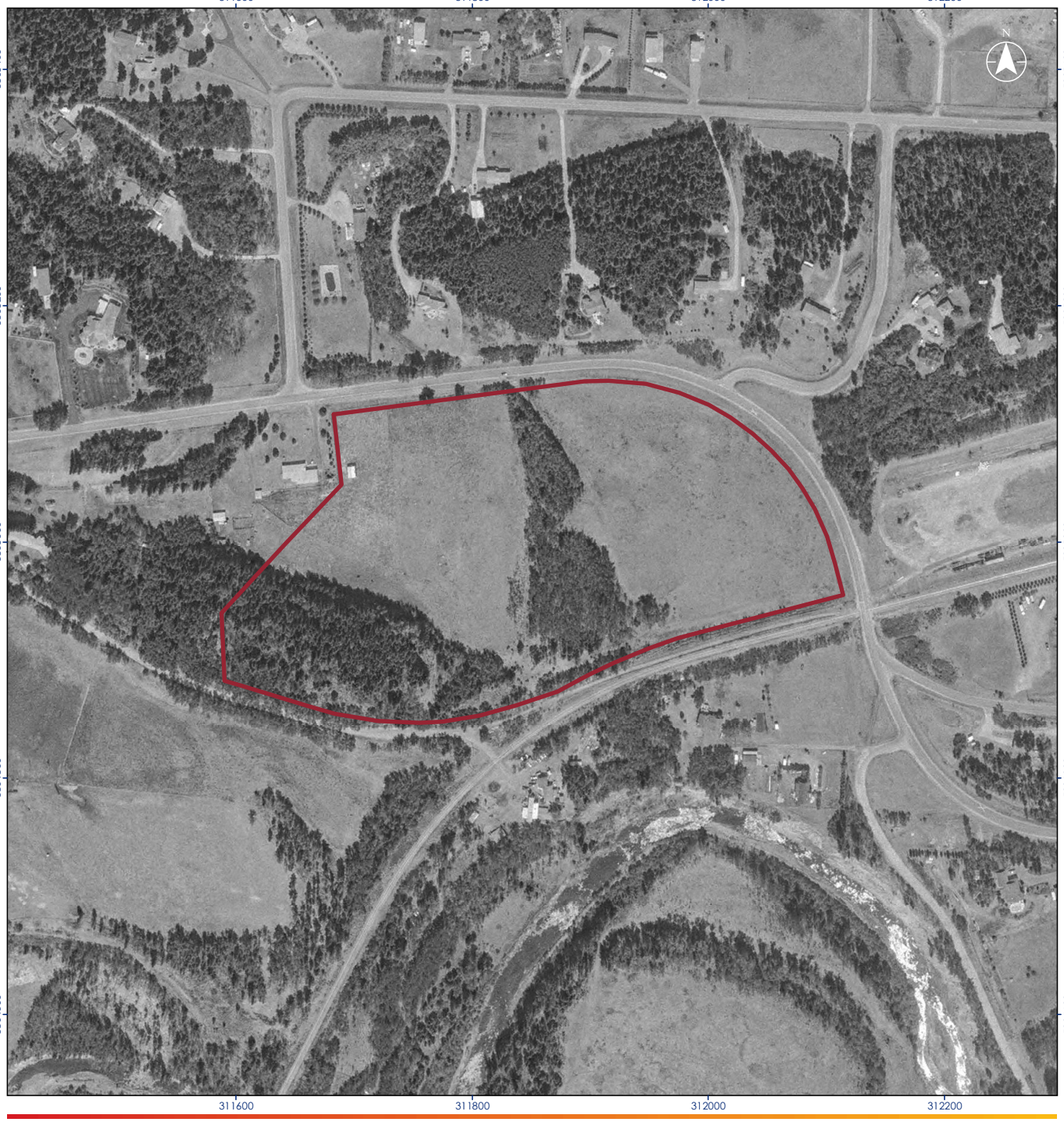
Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

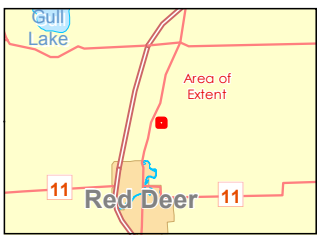
Figure No.
1998

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS4969-132, 1998-05-13

\\Cd1001-c200\workgroup\1102\active\112849578\gis\Figures\historical\subsite2003.mxd Revised: 2016-07-22 By: mkuhl





Study Area

0 50 100 150 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 24-039-27 W4M
Lacombe County, Alberta

112849578
Prepared by JC on 2016-03-31
Review by MK on 2016-07-18

Client/Project
1842107 Alberta Ltd.
Sandhill Estates Biophysical Assessment

Figure No.
2003

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS5469-100, 2003-06-09

APPENDIX C
DATABASE SEARCH RESULTS

Table of Results Print Preview

Date: 29/3/2016
Requestor: Consultant
Reason for Request: Environmental Assessment
SEC: 24 **TWP:** 039 **RGE:** 27 **MER:** 4

Non-sensitive EOs: 2 (*Data Updated:July 2015*)

M-RR-TTT-SS	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D
4-27-039-24	1856	IILEP73020	S2	Poanes hobomok	Hobomok Skipper	7-Jun-92
4-27-039-24	11234	PDVIO041J0	S3	Viola pedatifida	crowfoot violet	9-Jun-51

Next Steps: See FAQ

Sensitive EOs: 0 (*Data Updated:July 2015*)

M-RR-TTT	EO_ID	ECODE	S_RANK	SNAME	SCOMNAME	LAST_OBS_D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 0 (*Data Updated:May 2015*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN

No Protected Areas Found

Crown Reservations/Notations: 0 (*Data Updated:May 2015*)

M-RR-TTT-SS	NAME	TYPE

No Crown Reservations/Notations Found

Alberta Environment and Parks

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 29-Mar-2016 11:55

Species present within the current extent :

Fish Inventory

- BROWN TROUT
- BURBOT
- GOLDEYE
- LAKE CHUB
- LAKE WHITEFISH
- LONGNOSE SUCKER
- MOUNTAIN WHITEFISH
- NORTHERN PIKE
- SAUGER
- SHORTHEAD REDHORSE
- TROUT-PERCH
- WALLEYE
- WHITE SUCKER
- YELLOW PERCH

Wildlife Inventory

- GREAT BLUE HERON
- PURPLE MARTIN

Stocked Inventory

No Species Found in Search Extent

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Buffer Radius:
584019, 5800072	10-TM AEP Forest	SW 24 39 27 4	2 kilometers

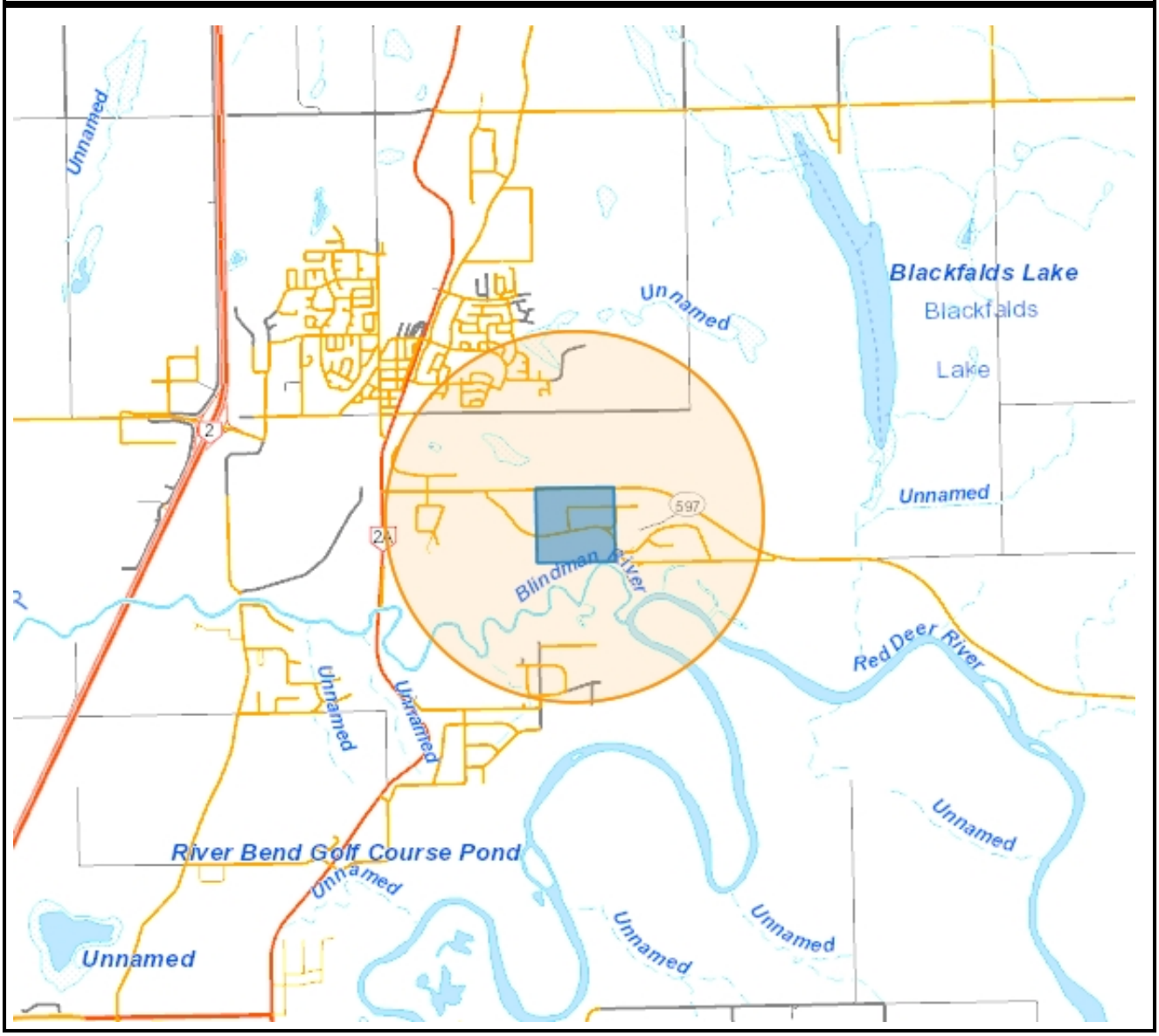
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

29-Mar-2016 11:55

Map Results



APPENDIX D
SITE PHOTOGRAPHS

Photo 1: Looking south at Woodlot WL1 (May 30, 2016)

Photo 2: Ground cover and litter in Woodlot WL1 (May 30, 2016)

Photo 3: Looking west at Woodlot WL2 (May 30, 2016)

Photo 4: Ground cover and litter in Woodlot WL2 (May 30, 2016)

Photo 5: Looking south at Woodlot WL3 (May 30, 2016)

Photo 6: Ground cover and litter in Woodlot WL3 (May 30, 2016)

Photo 7: Looking north across Tame Pasture TP2 (May 30, 2016)

Photo 8: Looking north in Disturbed/Regenerating Area DR1 (May 30, 2016)

Photo 9: Looking north at Wetland WT1 (May 30, 2016)