

Legend

Project Site Area

Regional Project Area

Contour (10 m Interval)

General Features

Highway

Railway

Elevations (m)

High : 327

Low : 228

N

E

S

W

1:100,000

NAD 1983 UTM Zone 14N

1

0.5

0

1

2

3

km

Basemap: Manitoba Land Initiative; Canvec; NRCan

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Vivian Sand Extraction Project

Topography

CanWhite Sands Corp.

AECOM

Figure: 4-2

4.1.3 Soils

The Steinbach Ecodistrict, within which the Project Site is located, consists of well to imperfectly drained Dark Gray and Black Chernozems that have developed atop thin, discontinuous glaciolacustrine veneers that overlay extremely calcareous, water-eroded glacial till (Smith et al. 1998). As a result of improved drainage capabilities within the lowland areas of this Ecodistrict, a significant percentage of soils are used for cultivation of agricultural crops such as wheat and other cereals, oil seeds, and hay crops (Smith et al. 1998).

Soils of the Project Site occur mostly within the Pelan Series of provincial soils, with a small area (approximately 7%) within the Marquette Series (Manitoba Agriculture, Food and Rural Initiatives, 2010). The Pelan Series consists of imperfectly drained Gleyed Dark Gray Chernozem soils developed on thin moderately to strongly calcareous, coarse textured deltaic or lacustrine deposits overlying stony, extremely calcareous glacial till. The surface texture ranges from loamy fine sand to fine sand. A thin stone lime or pebble layer may be present at the contact of the overlay and the extremely calcareous till. Permeability is moderate in the surface layers and moderately slow in the subsoil; this results in impeded internal drainage and temporary saturation conditions following snow melt or above normal precipitation. Precipitation runoff is slow. The Marquette Series consists of imperfectly drained Gleyed Rego Black soils developed on thin (< 1 m), fine textured, moderately to strongly calcareous lacustrine deposits overlying extremely calcareous, medium to moderately fine textured stony glacial till. They occupy the very gently sloping sites in the transition belt between the lacustrine and high lime glacial till soils. Runoff is moderately slow, and permeability is slow.

Additional information on the soil characteristics within the Project Site are provided in **Appendix D**.

4.1.4 Groundwater

Groundwater in the vicinity of the Project is typically sourced from one of two targeted aquifer zones, the Red River Carbonate Formation (limestone) or Winnipeg Sandstone Formation, with some wells in the overlying till. The main source of potable water within the RM of Springfield is groundwater from the Red River Carbonate aquifer which is known to be of variable quality (Friesen Drillers, 2019). It is also a significant source of ground water supply for municipal, industrial, rural residential and agricultural uses throughout a large portion of south-eastern and central Manitoba (Betcher, et al., 1995). A detailed description of the hydrogeology of the area is provided in **Appendix A**.

The Winnipeg Formation Sandstone underlies the Red River Carbonate (limestone) aquifer throughout the Project area. This aquifer is the target aquifer for Project operations. It is confined and hydraulically separated from the overlying carbonate rocks of the Red River Formation by the Winnipeg Shale that overlies the Winnipeg Sandstone aquifer (Ferguson and Grasby, 2007).

Both aquifers are recharged in the Sandilands area to the east of the RM of Springfield with groundwater flow from east to west. The Sandilands area is a major sand and gravel moraine series that lies directly on the bedrock sub crop of both Paleozoic sequences (Friesen Drillers, 2019). Recharge occurs from snow melt and rainfall in the Sandilands area, and is supplemented by distributed recharge across the region.

Discharge from both aquifers occurs in the form of residential, agricultural and industrial use and natural discharge to surface water features. Natural discharge from the Red River Carbonate aquifer is primarily to the Red River, the Winnipeg Floodway and other streams and creeks. Discharge from the Winnipeg Sandstone aquifer is likely by slow seepage near or beneath Lake Winnipeg (Ferguson and Grasby, 2007).

A description of the regional aquifers and groundwater wells that are known to occur within the Local Project Area and surrounding region are provided in **Appendix A**.

4.2 Atmospheric Environment

4.2.1 Air Quality

The closest regional influences of air quality are associated with adjacent agriculture and open-pit aggregate/quarry operations, and vehicle traffic on PR 302 and RM of Springfield gravel roads both within and adjacent to the Project Site. Air quality may also be influenced at the Project Site by traffic Provincial Trunk Highway (PTH) 15 (1.7 km north of the Project Site), the CN rail line 1.3 km north of the Project Site and Greater Winnipeg Water District (GWWD) rail line running diagonally through the regional area (**Figure 1-1**).

4.2.2 Noise and Vibration

The above-described influences on regional air quality (**Section 4.2.1**), would also contribute to noise levels at the Project Site. Based on the planned equipment use and activities, the Project is not expected to be a source of significant vibration considering there are many water wells that have been drilled throughout the Regional Project Area (**Appendix A**) and there are no available records of public complaints regarding vibrations from previous well drilling activities. Therefore, vibrations are not considered further in this report. Noise has limited distance influence depending on the nature of the noise source (e.g., size, weight and type of machinery) and landscape features surrounding the sources of noise that may act to attenuate noise (e.g. tree cover; Yip et al. 2017; Albert 2004; and surrounding geology, e.g. Kumar et al. 2016).

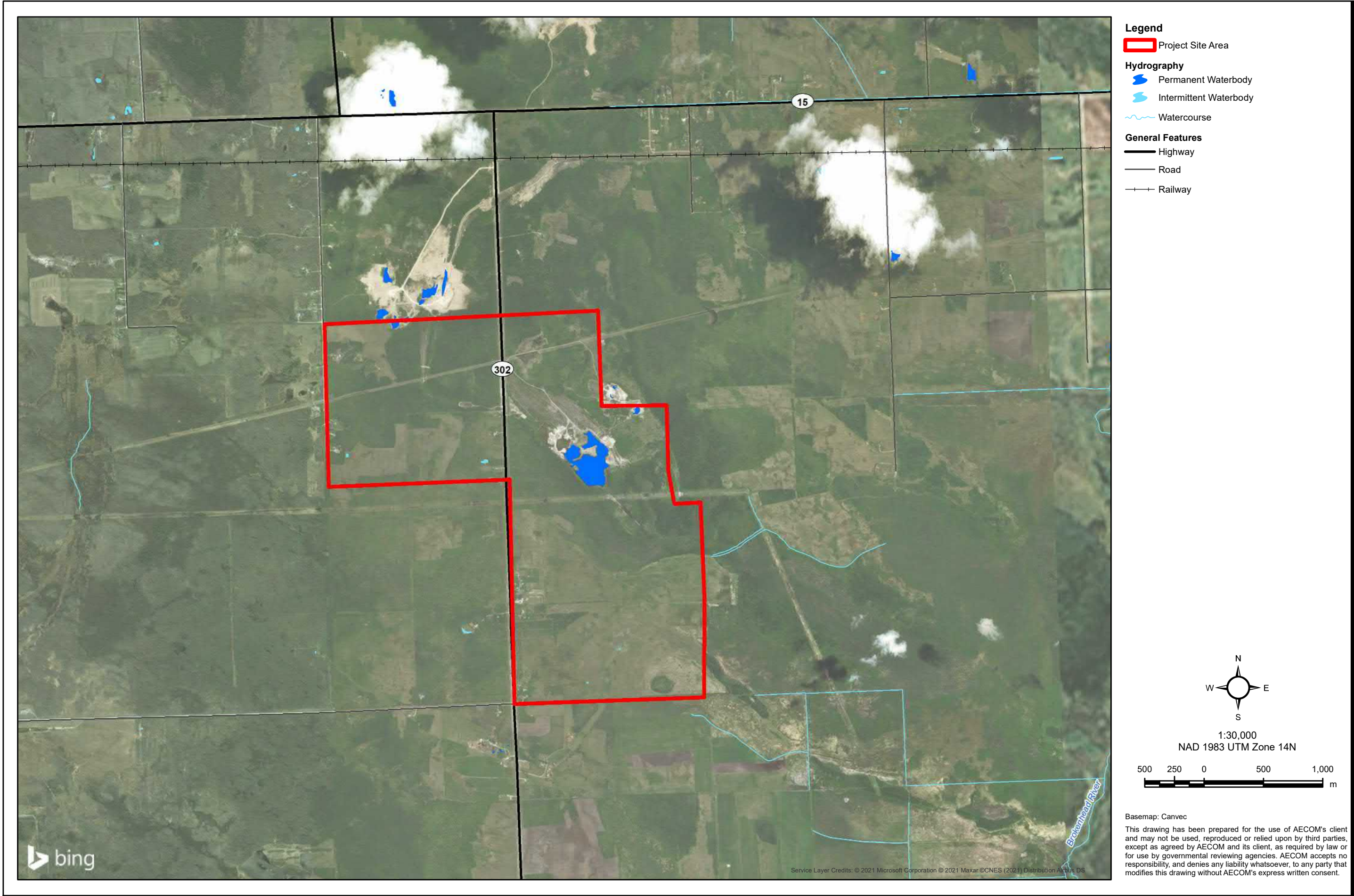
Existing noise at the Project Site is currently primarily influenced by the same human-generated that influence air quality as described above in **Section 4.2.1** (e.g. existing aggregate quarries; PR 302; PTH 15; CN and GWWD rail lines) and by natural sounds such as ambient weather (e.g. wind).

4.3 Aquatic Environment

4.3.1 Surface Water and Drainage

There are no natural lakes, rivers or streams within the Project Site. A 9.3 ha permanent pond, and two other ponds less than 1 ha in size each, that are associated with previous quarry operations occur in the Project Site (**Figure 4-3**).

The on-line Atlas of Canada Toporama mapping tool (Natural Resources Canada, n.d.) indicates surface water drainage at the Project Site occurs primarily within ditches and low drainage areas. Drainage in the eastern portion of the Project Site is generally northeast, eventually draining outside the Project Site into the Brokenhead River which flows north for approximately 65 km until connecting to Lake Winnipeg. Surface drainage in the western and southern portions of the Project Site generally flows northwest through ditches and low drainage areas to Cooks Creek, or to Edie Creek which connects with Cooks Creek. Cooks Creek then flows northeast for approximately 42 km to connect with the Red River near Selkirk, Manitoba.



4.3.2 Fish and Fish Habitat

Waterbodies that occur within the Project Site are described in **Section 4.3.1** and consist of isolated small ponds associated with previous quarry operations which have a low likelihood of providing suitable fish habitat.

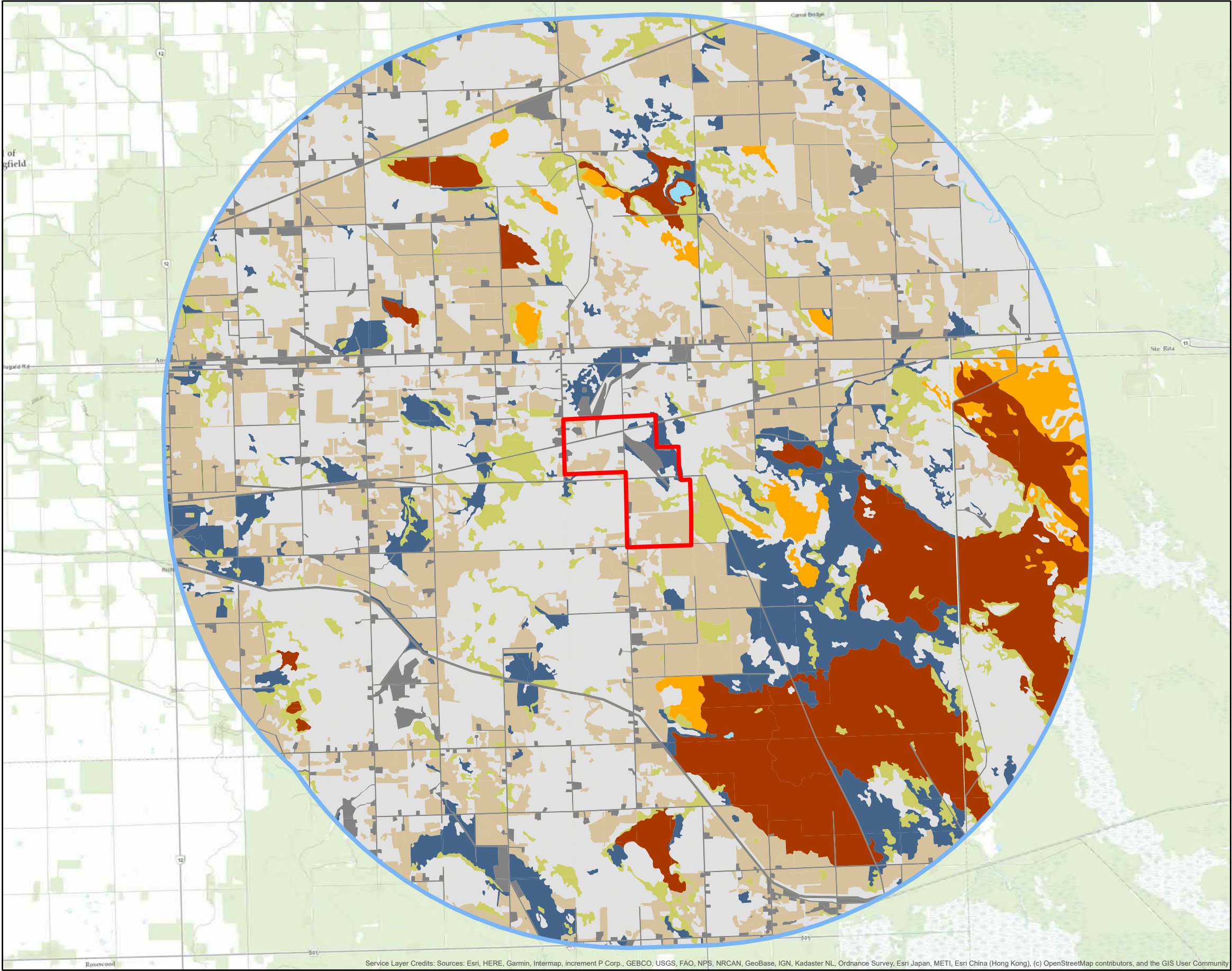
4.4 Terrestrial Environment

4.4.1 Vegetation

Information from the Manitoba Forest Resource Inventory, and on-site general reconnaissance in select locations within the Project Site area indicate that less than half (45%) of the Project Site is forested with agriculture fields being the next most common cover type (31%; **Table 4-1**).

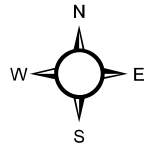
Forested areas within the Project Site are primarily hardwood species (at least 55%) consisting primarily of trembling aspen (*Populus tremuloides*), with occasional black spruce (*Picea mariana*) and tamarack (*Larix Laricina*) stands (**Table 4-2**). The forested areas in the Project Site are primarily young (54%) with approximately 19% of the forested area classified as mature (**Table 4-3**). Common understory shrub species include American hazel (*Corylus Americana*), red-osier dogwood (*Cornus sericea*), wild rose (*Rosa* spp.) and willow (*Salix* spp.). The naturally vegetated non-forested areas include meadows (8%) and wet willow and alder (*Alnus glutinosa*) dominated areas (2%; **Table 4-1**).

The areas and percentages of land cover types, dominant tree species and forest age classes within the Project Site as compared to the Regional Project Area are provided in **Table 4-1**, **Table 4-2** and **Table 4-3** and are illustrated in **Figure 4-4**, **Figure 4-5** and **Figure 4-6**.

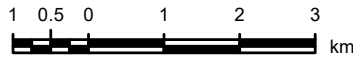


Legend

- Project Site Area
- Regional Project Area
- Cover Type**
- Treed Muskeg
- Willow / Alder
- Marsh - Muskeg
- Fields (Agriculture)
- Meadow
- Shelter Belts
- Developed
- Forested
- Water

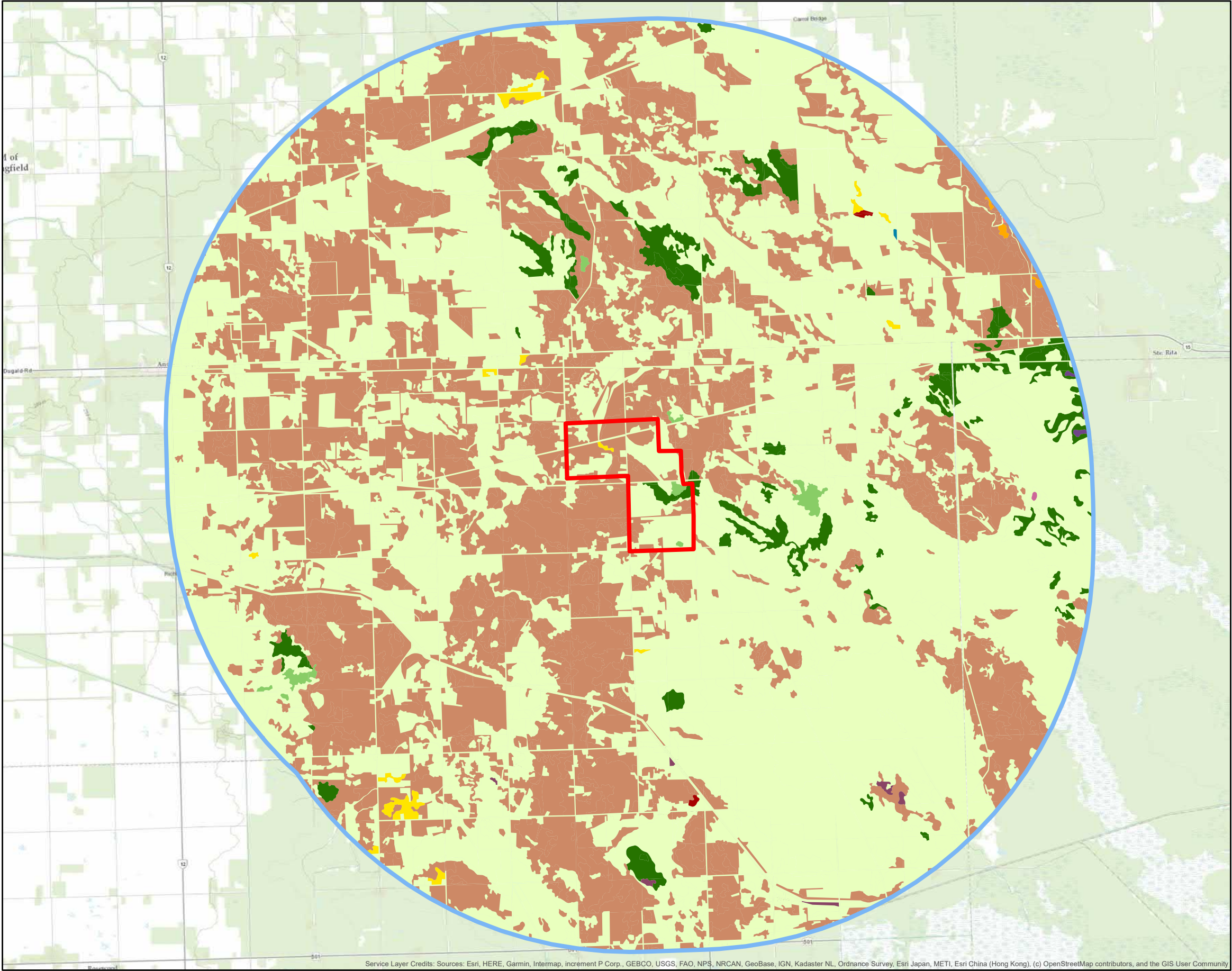


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NAD 1983 UTM Zone 14N



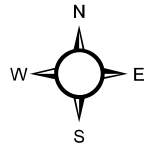
Basemap: Manitoba Land Initiative - Manitoba Forest Resource Inventory

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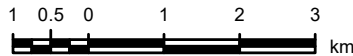


Legend

- Project Site Area
- Regional Project Area
- Dominant Tree Species**
- Hardwoods
- Jack Pine
- Tamarack Larch
- Trembling Aspen
- White Birch
- Black Spruce
- Oak
- Ash
- Balsam Fir
- Balsam Poplar
- Eastern Cedar
- Manitoba Maple



1:100,000
NAD 1983 UTM Zone 14N



Basemap: Manitoba Land Initiative - Manitoba Forest Resource Inventory

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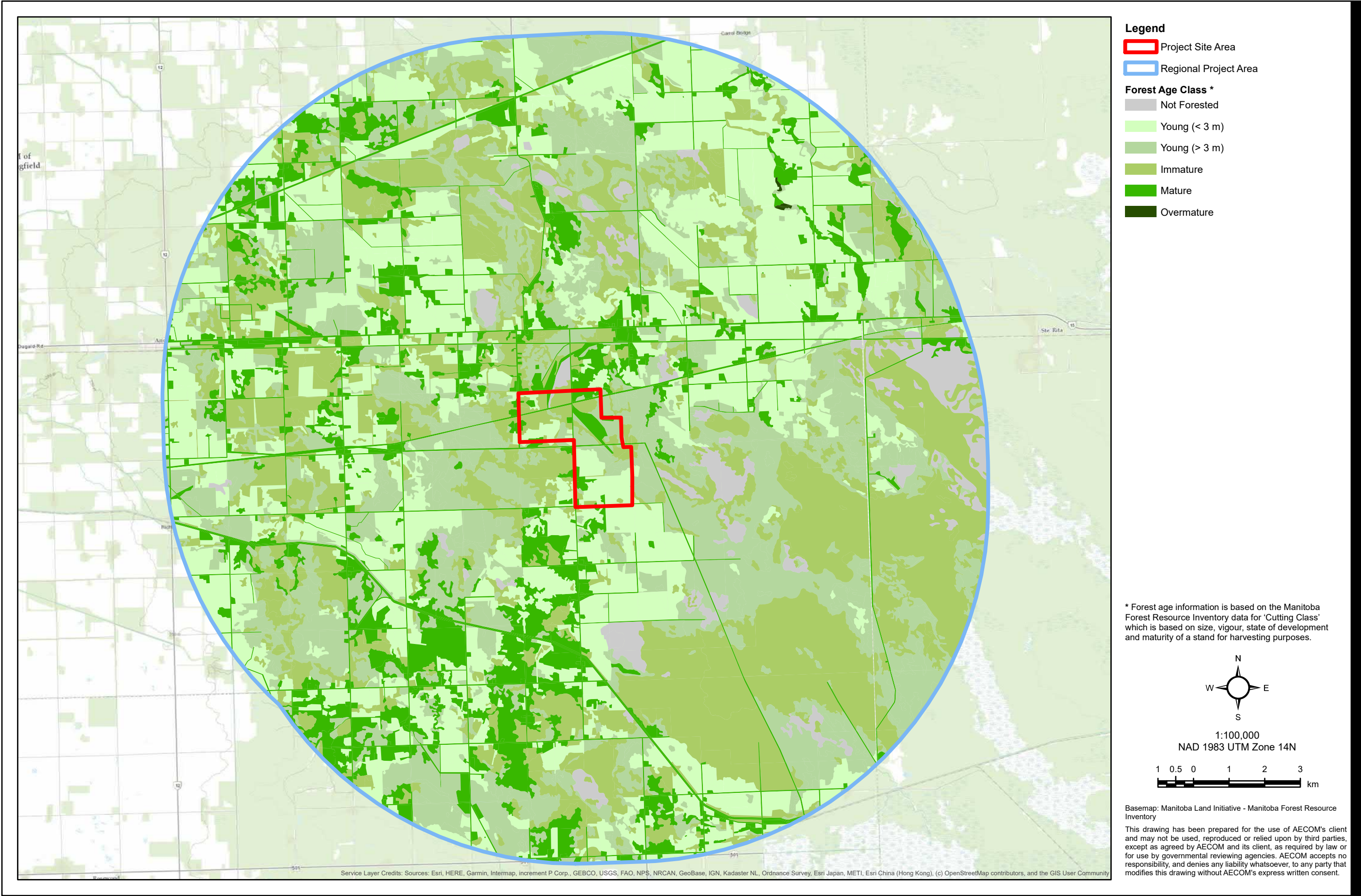


Table 4-1: Land Cover in the Project Site and Regional Project Area

Cover Type	Project Site (2021 to 2025)		Regional Project Area		24-year Life of Project Area*	
	Hectares (ha)	Percent (± 1%)	Hectares (ha)	Percent (± 1%)	Hectares (ha)	Percent (± 1%)
Developed	87	13	2,777	6	637	8
Fields (Agriculture)	204	31	11,426	26	2,016	24
Forested	289	45	17,246	40	4,561	55
Marsh - Muskeg	0	0	4,789	11	0	0
Meadow	53	8	3,382	8	510	6
Other (Gaps in Forest Inventory Mapping)	0	0	36	0	0	0
Shelter Belts	0	0	7	0	0	0
Treed Muskeg	0	0	914	2	0	0
Water	0	0	26	0	0	0
Willow / Alder	15	2	2,775	6	511	6

Project Site = 649 ha; Regional Project Area = 43,378 ha; 24-year Life of Project Area = 8,235 ha

*Refer to **Figure 1-1** for the 24-year Life of Project Area

Source: Manitoba Land Initiative (2017)

Table 4-2: Dominant Tree Species in the Project Site and Regional Project Area

Tree Species	Project Site (2021 to 2025)		Regional Project Area		24-year Life of Project Area*	
	Hectares (ha)	Percent (± 1%)	Hectares (ha)	Percent (± 1%)	Hectares (ha)	Percent (± 1%)
Ash	0	0	10	0	0	0
Balsam Fir	0	0	11	0	0	0
Balsam Poplar	0	0	25	0	1	0
Black Spruce	27	4	1096	3	29	0.4
Eastern Cedar	0	0	2	0	0	0
Hardwoods	360	55	26094	60	3,674	45
Jack Pine	0	0	14	0	0	0
Manitoba Maple	0	0	2	0	0	0
Oak	3	0	124	0.3	23	0.3
Other (Gaps in Forest Inventory Mapping)	0	0	36	0.1	0	0
Tamarack / Larch	11	2	89	0.2	16	0.2
Trembling Aspen	248	38	15871	37	4,491	55
White Spruce	0	0	2	0	0	0

Project Site = 649 ha; Regional Project Area = 43,378 ha; 24-year Life of Project Area = 8,235 ha

*Refer to **Figure 1-1** for the 24-year Life of Project Area

Source: Manitoba Land Initiative (2017)

Table 4-3: Forest Age Classes in the Project Site and Regional Project Area (may not need)

Forest Age Class**	Project Site (2021 to 2025)		Regional Project Area		24-year Life of Project Area*	
	Hectares (ha)	Percent ($\pm 1\%$)	Hectares (ha)	Percent ($\pm 1\%$)	Hectares (ha)	Percent ($\pm 1\%$)
Over-mature	0	0	9	0	0	0
Immature	173	27	11,671	27	1,507	18
Young (> 3 m)	141	22	11,423	26	2,367	29
Mature	123	19	6,403	15	1,965	24
Young (< 3 m)	208	32	12,505	29	2,368	29
Not Forested	3	0.5	1,329	3	28	0.3
Jack Pine	0	0	14	0	0	0

Project Site = 649 ha; Regional Project Area = 43,378 ha; 24-year Life of Project Area = 8,235 ha

*Refer to **Figure 1-1** for the 24-year Life of Project Area

Source: Manitoba Land Initiative (2017)

** Forest age information is based on the Manitoba Forest Resource Inventory data for 'Cutting Class' which is based on size, vigour, state of development and maturity of a stand for harvesting purposes.

4.4.2 Wildlife

Wildlife species expected to occur within the Project Site and throughout the Local and Regional Project Areas are those species that typically occur within the Steinbach Ecodistrict (Smith et al., 1998). Ungulate species include white-tailed deer and occasionally moose. A variety of furbearer species would occur within the landcover types within the Project Site with the most common likely being grey squirrel, red squirrel, smaller rodent species, snowshoe hare, red fox, coyote, American woodchuck and striped skunk. The occasional presence of black bears would also be expected.

According to the Manitoba Breeding Bird Atlas (2018), at least 60 bird species are likely to breed within the landcover types that occur within the Project Site, the majority of which are migratory birds protected under the federal *Migratory Birds Convention Act, 1994*.

Amphibian surveys were conducted within the Regional Project Area during May 14 to 18, 2018. Boreal Chorus Frogs were consistently heard in marshes with open water centres and extensive emergent plant growth along the margins. This type of wetland does not occur within the Project Site. The Project Site has some very limited areas of dense willow and alder wet meadows. Few frogs were heard calling in this type of wetland during the May 2018 surveys in the Regional Project Area. Other common amphibians expected to occur within the Project Site where suitable habitat occurs include wood frog, Northern leopard frog, spring peeper, Canadian toad and American toad. The red-sided garter snake is the reptile species most likely to occur in the Project Site (iNaturalist, n.d.).

4.4.3 Species of Conservation Concern

Manitoba Conservation Data Centre has compiled a list of Species of Conservation Concern for plant and animal species that are "rare, disjunct, or at risk throughout their range or in Manitoba and in need of further research" (Manitoba Conservation Data Centre, 2017). A full list of Species of Conservation Concern for the Interlake Plain Ecoregion, within which the Project Site is located, is included in **Appendix E**.

Plant 'Species at Risk'⁵ that may occur within which the Project Site include those listed in **Table 4-4**.

Table 4-4: Plant Species at Risk in the Interlake Plain Ecoregion that may occur in the Project Site

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
Rough Agalinis	<i>Agalinis aspera</i>	Endangered	Endangered	<p>Low</p> <ul style="list-style-type: none"> - Within Manitoba, this species occurs mainly in moist, sparsely vegetated areas with calcareous soils^a. - A limited amount of habitat occurs at the Project Site. - This species is known to occur only in small populations in Manitoba south of Brandon, in the southern Interlake, and south of Birds Hill Provincial Park^a. - As of 2012, only 15 extant known populations occur in Manitoba, the closest of which being a population south of Birds Hill Provincial Park, approximately 40 km north-west of the Project Site^a.
Gattinger's Agalinis	<i>Agalinis gattingeri</i>	Endangered	Endangered	<p>Very Low to Negligible</p> <ul style="list-style-type: none"> - Within Manitoba, this species occurs mainly in moist, sparsely vegetated prairie areas with calcareous soils, and can also occur along the upper banks of roadside ditches^b. - Existing prairie habitat is uncommon in the Project Site; a limited amount of habitat occurs at the Project Site^b. - Within Manitoba, there are only 5 extant populations; total abundance estimate is greater than 500 individuals^b. - Known locations for this species occurs in the southern portion of the Interlake Region, over 100 km north-west of the Project Site^b; however, may occur elsewhere in suitable locations not yet surveyed. - Can occur in association with Rough Agalinis^b
Western Silvery Aster	<i>Aster sericeus</i>	Threatened	Threatened	<p>Low - Moderate</p> <ul style="list-style-type: none"> - Western silvery aster occurs in dry open environments such as prairies and

⁵ 'Species at Risk' are defined for the purpose of this report as those species listed in [The Endangered Species and Ecosystems Act](#) of Manitoba (MBESEA) and/or those listed as 'Endangered' or 'Threatened' in Schedule 1 of the federal [Species at Risk Act](#) (SARA).

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
				<p>fields, as well as openings in oak and trembling aspen woodlands.</p> <ul style="list-style-type: none"> - This species grows in coarse calcareous, gravelly and sandy soil. They are generally found in undisturbed sites but can be found along roadside ditches and gravel pits^c. - In Manitoba, this species occurs in patchy populations ranging from north-east of Winnipeg south to the US border^c. - 20 extant populations occur in Manitoba, with the closest population occurring near the Town of Beausejour, approximately 20 km north of the Project Site. Other populations exist in the Birds Hill gravel esker complex, south of Birds Hill Provincial Park.

^aEnvironment Canada 2015

^bEnvironment and Climate Change Canada (ECCC) 2019a

^c ECCC 2017

Wildlife Species at Risk that may occur in the area of the Interlake Plain Ecoregion within which the Project site occurs include those listed in **Table 4-5**.

Table 4-5: Wildlife Species at Risk in the Interlake Plain Ecoregion

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
Little Brown Bat/Myotis and Northern Long-eared Bat/Myotis	<i>Myotis lucifugus</i> and <i>Myotis septentrionalis</i>	Endangered	Endangered	<p>Moderate (maternity roosting) to High (foraging)</p> <ul style="list-style-type: none"> - Summer maternity colonies are established in buildings or cavities of large diameter trees^a. The Project Site has approximately 19% mature tree forest cover that may contain some trees of suitable diameter for potential maternity cavity roost sites. - Foraging occurs over water, along waterways, forest edges, and forest gaps, in areas where insects are present^a. - Both species of bats require limestone/karst caves as winter hibernacula. There are non known hibernacula in the Project Site. - The probability of hibernacula occurring in the Project Site is unlikely a

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
				there are no recorded limestone/karst caves found the Project Region ^b .
Common Nighthawk	<i>Chordeiles minor</i>	Threatened	Threatened	<p>Low</p> <ul style="list-style-type: none"> - Very little potentially suitable nesting habitat occurs at the Project Site for this ground-nesting species, i.e., cleared areas, burned areas, rocky outcrops; and peat bogs^c for foraging - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 10%
Eastern Whip-poor-will	<i>Caprimulgus vociferus</i>	Threatened	Threatened	<p>Low to Moderate</p> <ul style="list-style-type: none"> - A limited amount of potentially suitable habitat occurs at the Project Site for this ground-nesting species, i.e., semi-open forests or patchy forests with clearings such as forests that are regenerating following major disturbances^d - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 10% to 20%
Barn Swallow	<i>Hirundo rustica</i>	Not Listed	Threatened	<p>Moderate to High</p> <ul style="list-style-type: none"> - This species builds a mud cup nest which adheres to vertical surfaces under overhangs^e - No natural nesting habitat (e.g. cliff overhang) in the Project Site. However, man-made structures such as buildings that are preferred nesting habitat occur within the Project Site. Buildings or structures with nesting Barn Swallows will not be removed within the Project footprint area
Bank Swallow	<i>Riparia</i>	Not Listed	Threatened	<p>Unlikely</p> <ul style="list-style-type: none"> - No steep riparian bank habitat occurs in the Project Site area that would be suitable nesting habitat for this species which burrows into banks for nesting^f
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	Threatened	Threatened	<p>Low to Moderate</p> <ul style="list-style-type: none"> - A limited amount of potentially suitable habitat occurs at the Project Site for this species, i.e., mature forest where canopy gaps create a patchy shrub

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
				layer that is comparable to the understorey of early successional sites, or the shrubby edge of wetlands ^g - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 10% to 20%
Canada Warbler	<i>Cardellina canadensis</i>	Endangered	Threatened	Low - This species uses a wide range of forest types (deciduous, coniferous, and mixed) with well developed shrub and forest floor, as well as in post disturbance and old-growth riparian shrub forests ^h . - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 0% to 10% and is more likely found further east of the Regional Project Area
Olive-sided Flycatcher	<i>Contopus virens</i>	Threatened	Threatened	Low - This species occurs primarily in coniferous or mixed forest with tall trees and tall snags for perching along open areas such as burns, wet areas such as bogs, and post-clearcut forest harvesting areas ⁱ . There is little potentially suitable nesting habitat within the Project Site for this species. - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 10%.
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Threatened	Threatened	Low to Moderate - This species occurs in a variety of habitat, including grasslands, forest edges, orchards, pastures, riparian forests, roadsides, and vegetated urban areas. In Manitoba, this species is strongly associated with trembling aspen forest with snags or trees with dead limbs in grazed cattle lots ^j . - Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the

Common Name	Scientific Name	MBESEA Status	SARA Status	Probability of Occurrence within the Project Site
				Breeding Birds of Manitoba to be approximately 20% to 40%
Short-eared Owl	<i>Asio flammeus</i>	Threatened	Special Concern	<p>Low</p> <p>- This species nests on the ground in larger open grassland areas including marsh/bog and fen habitat and rarely in agriculture fields^k, therefore optimal nesting habitat does not occur in the Project Site but this species may forage in the Project Site.</p> <p>- Probability of observation of this species in the Regional Project Area has been determined by the Atlas of the Breeding Birds of Manitoba to be approximately 20%</p>
Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>	Not Listed	Endangered	<p>Low</p> <p>- This species inhabits areas where sandy or friable soils surround fishless, semi-permanent to permanent water bodies. All known occurrences in Manitoba are from six locations in the Steinbach Ecodistrict within which the Project is located, but approximately 50 km or more south of the Project Site^l.</p>

^a COSEWIC 2013a^e COSEWIC 2011ⁱ Environment Canada 2016^b Bilecki 2003^f COSEWIC 2013b^j ECCC 2019b^c COSEWIC 2018a^g ECCC 2016a^k COSEWIC 2008^d Environment and Climate Change Canada (ECCC) 2018^h ECCC 2016b^l COSEWIC 2013c

4.4.4 Parks and Protected Areas

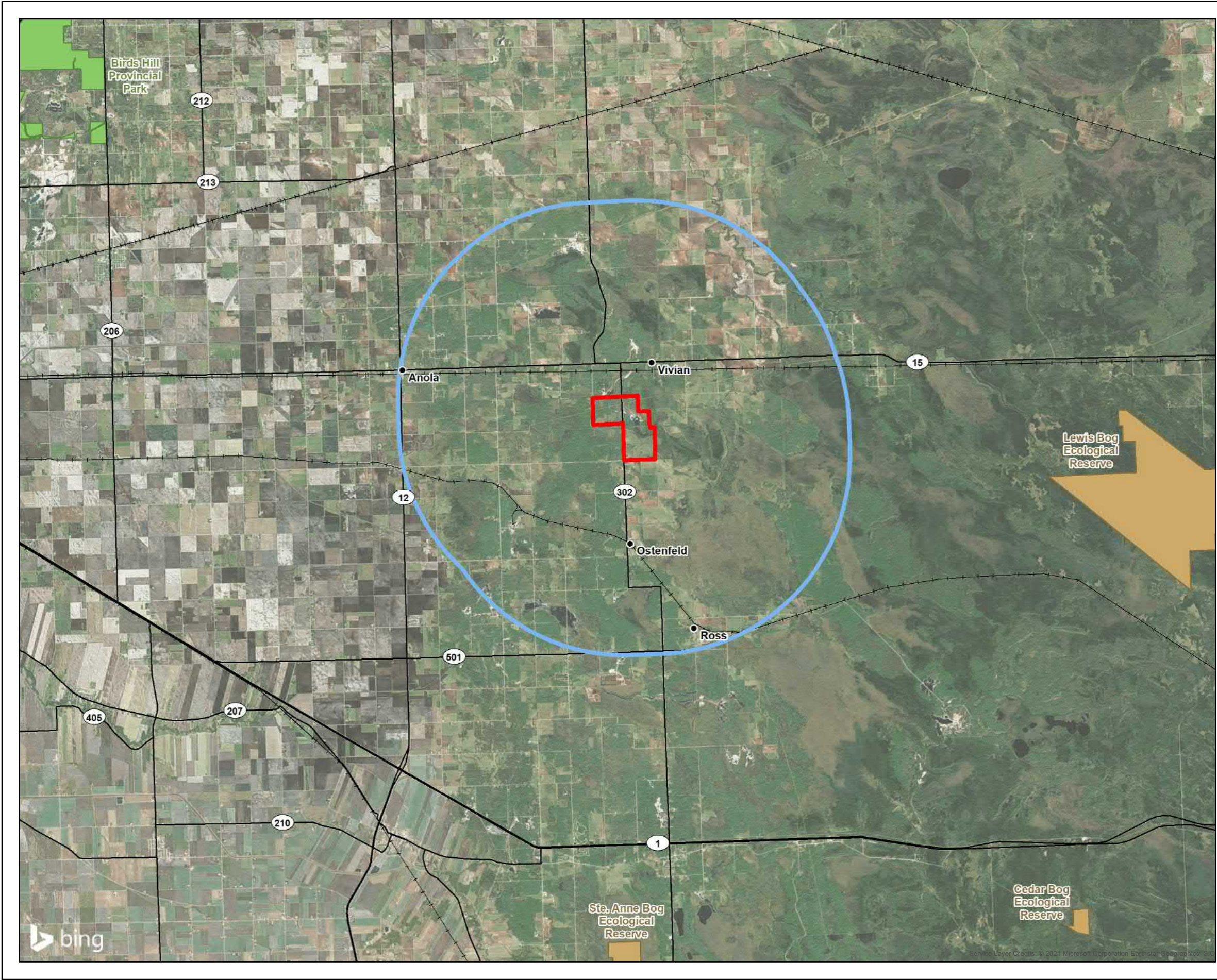
The nearest designated park to the Project Site is Birds Hill Provincial Park located approximately 30 km to the northwest of the Project Site (**Figure 4-7**). The park provides year-round recreational activities such as hiking, cycling, skiing, horseback riding along a network of established trails (Manitoba Conservation and Climate, n.d.).

The following are the closest ecological reserves to the Project Site (distance in parentheses);

- Lewis Bog Ecological Reserve (20 km east)
- Ste. Anne Bog Ecological Reserve (25 km south)
- Brokenhead River Ecological Reserve (35 km north)
- Cedar Bog Ecological Reserve (32 km southeast)

The closest Wildlife Management Areas (WMA) to the Project Site are the Mars Hill WMA located approximately 37 km north, and the Whitemouth Bog WMA located approximately 39 km northeast of the Project Site. Mars Hill WMA protects important wintering habitat for deer, moose and black bear, and is well-known as a top birding site in Manitoba (Manitoba Conservation and Climate, 2020). The Whitemouth Bog WMA was established in 2007 around the Whitemouth Bog Ecological Reserve to protect a calcareous

fen which is a rare wetland type. The Whitemouth Bog WMA is a peatland dominated by black spruce and tamarack with a wide variety of wetland vegetation including several species of conservation concern (Manitoba Conservation and Climate, 2020).



Legend

Project Site Area

Regional Project Area

Parks and Protected Areas

Ecological Reserve

Provincial Park

General Features

Highway

Railway

1:200,000
NAD 1983 UTM Zone 14N

Basemap: Manitoba Land Initiative

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4.5 Indigenous Peoples

The Project Site is located within Treaty No. 1 area (Indigenous and Northern Affairs Canada, 2017). There are no First Nation reserve lands within the Local or Regional Project Area. The closest First Nation reserve lands to the Project Site is the Brokenhead Ojibway Nation's Na-Sha-Ke-Penais Indian Reserve (3 ha) surrounded by East St. Paul and located approximately 38 km northwest of the Project Site.

The Regional Project Area is within an area recognized by the Manitoba Metis Federation as an area for Metis Natural Resource Harvesting (The Metis Economic Development Organization, 2018) which corresponds with the Manitoba Conservation and Climate Game Hunting Areas (GHAs) numbers 34A, 35 and 35A within which the Project Site is located (Manitoba Sustainable Development 2019).

The Project Site is comprised of private land covered under private surface rights and/or land used for municipal and public purposes and is currently designated as 'Aggregate', 'Agriculture Preserve Area' and 'Mixed Rural and Agriculture Area' in the RM of Springfield Development Plan (**Section 4.6.4**). Therefore, use of the Project Site for the exercise of Indigenous or Treaty rights would be restricted or limited.

4.6 Socioeconomic Environment

The proposed Project Site is located within the RM of Springfield. Considering the close proximity of Winnipeg (26 km west) and other surrounding rural municipalities in addition to the RM of Springfield, there are expected to be sufficient worker skills, trades and services available to support Project construction and operation within a reasonable commuting distance.

The demographic profile, labour force and employment related statistics for the surrounding rural municipalities and the City of Winnipeg are described below in **Sections 4.6.1** and **4.6.2** to demonstrate the workforce potential availability within reasonable commute time from the proposed Project Site. Therefore, the Regional Study Area represents the population regions that would be a potential source of employees, trades and services located within a reasonable commute time from the proposed Project.

4.6.1 Demographic Profile

The statistical data presented in this section reflects the most recent Statistics Canada information available and does not reflect changes to the current labour force that have resulted due to the coronavirus (COVID-19) pandemic. **Table 4-6** shows the Regional Project Area is increasing in population, with a range in population increase from 0.6% in the RM of Whitemouth, to 12.5% in the RM of Taché.

Table 4-6: Population of Regional Project Area Communities

Regional Project Area - Populations								Province
Population	RM of Springfield	RM of Taché	RM of Reynolds	RM of Broken-head	RM of White-mouth	RM of Lac du Bonnet	City of Winnipeg	Manitoba
2016 Census	15,342	11,568	1,338	5,122	1,557	3,121	705,244	1,278,365
2011 Census	14,069	10,284	1,285	4,635	1,548	2,930	663,617	1,208,268
Population Change (+%)	9.0	12.5	4.1	10.5	0.6	6.5	6.3	5.8

Source: Statistics Canada 2017

Table 4-7 provides the population of the regional communities by age groups. The Regional Project Area has a higher average age (41.3 years) and median age (43.7 years) in comparison to the Province (39.2 years and 38.3 years respectively).

Table 4-7: Distribution of Regional Project Area Communities by Age Groups

Regional Project Area – Population Percentages								Province
Population – Age (years)	RM of Springfield	RM of Taché	RM of Reynolds	RM of Broken-head	RM of White-mouth	RM of Lac du Bonnet	City of Winnipeg	Manitoba
0 – 14	18.9	25.1	15.3	19.0	16.1	9.3	16.8	19.1
15 – 64	67.3	66.6	65.7	67.3	63.7	64.3	67.5	65.4
64 and over	13.9	8.3	19.0	13.5	20.3	26.2	15.6	15.6
85 and over	0.9	0.4	1.1	0.9	2.9	1.3	2.4	2.3
Average age of population	39.9	34.4	43.1	39.6	43.8	48.6	39.9	39.2
Median age of population	42.1	34.8	47.1	41.0	47.6	54.2	38.8	38.3

Source: Statistics Canada 2017

4.6.2 Labour Force and Employment

The statistical data presented in this section reflect the most recent Statistics Canada information available and does not reflect changes to the current labour force that have resulted due to the coronavirus (COVID-19). **Table 4-8** presents the 2016 education levels for the Regional Project Area and the Province of Manitoba. The region had a higher percentage of the population that had not completed high school, and also had a higher percentage of the population that had completed an apprenticeship, trades, or completed a college or non-university certificate of diploma in comparison to the Province.

Table 4-8: Education Attainment of Regional Project Area Communities

Regional Project Area - Populations								Province
Education (aged 25 – 64)	RM of Springfield	RM of Taché	RM of Reynolds	RM of Broken-head	RM of White-mouth	RM of Lac du Bonnet	City of Winnipeg	Manitoba
Total population aged 25-64	8,400	6,070	710	2,855	745	1,445	378,780	654,670
Certificate, diploma or degree (%)	9	15	28	16	39	16	10	14
Secondary (high) school diploma or equivalency (%)	29	30	26	31	21	30	27	28
Apprenticeship or Trades certificate, diploma or degree (%)	13	13	12	16	12	14	7	8
College or non-university certificate or diploma (%)	24	25	25	23	20	26	21	21
University certificate or diploma below bachelor level (%)	4	3	1	3	2	6	3	3
University certificate, diploma or degree at bachelor level or above (%)	21	14	8	11	7	9	33	25

Source: Statistics Canada 2017

The statistical data presented in this section reflects the most recent Statistics Canada information available and does not reflect changes to the current labour force that have resulted due to the coronavirus (COVID-

19). **Table 4-9** presents labour force indicators including the total population aged 15 years and over, population in the labour force and participation, employment and unemployment rates for the Regional Project Area and the Province of Manitoba. The 2016 participation and employment rates in the Regional Project Area were higher on average in comparison to the Province, while the unemployment rates were lower, except for the RM of Reynolds which has an unemployment rate of 9.2%.

Table 4-9: Labour Force Indicators of Regional Project Area Communities

Regional Project Area - Populations							Province	
Labour Force	RM of Springfield	RM of Taché	RM of Reynolds	RM of Broken-head	RM of White-mouth	RM of Lac du Bonnet	City of Winnipeg	Manitoba
Total Population aged 15 and over	12,215	8,650	1,105	4,090	1,205	2,460	571,580	1,001,305
In the Labour Force	8,600	6,375	705	2,985	800	1,400	383,300	662,155
Participation Rate (%)	70.4	73.7	63.8	73.0	66.4	56.9	67.1	66.1
Employment Rate (%)	67.3	70.7	57.9	69.2	65.1	53.3	62.7	61.7
Unemployment Rate (%)	4.5	4.2	9.2	5.4	1.9	6.4	6.5	6.7

Source: Statistics Canada 2017

4.6.3 Infrastructure and Services

4.6.3.1 Transportation

Road

The Project Site can be accessed from the PTH 15 near Vivian by turning south on PR 302 or turning south on Queens Valley municipal road 42E from PTH 15 (**Figure 1-2**). The proposed Project design includes the construction of temporary access trails to extraction sites (**Section 2.4**).

Air

There are no airports/aerodromes in the Regional Project Area. The closest aerodrome is the Beausejour/AV-Ranch Airpark located 20 km north-northwest of the Project Site and 4 km southwest of the town of Beausejour. The largest regional airport is the Winnipeg James Armstrong Richardson International Airport located in Winnipeg MB, approximately 50 km west of the Project Site.

Rail

An existing CN railway line located 1.3 km north of the Project Site which will accommodate transportation of the sand product by rail to out of province markets from the proposed sand Processing Facility near Vivian which is currently under regulatory review for approval (**Figure 1-2**).

4.6.3.2 Emergency Services

Fire

The closest fire halls to the Project Site servicing the RM of Springfield include the following (RM of Springfield, 2020; driving distance and direction from the Project Site in parentheses):

- Anola Fire Station #2 (12 km west)
- Oakbank Fire Station #1 (34 km northwest)
- Springfield Industrial Area Fire Station #3 (40 km west)

Medical Services, Ambulance and Hospital

Medical Responder Programs are run out of each of the above-described fire halls to support medical emergencies in the RM of Springfield. Each station has two to three personnel who respond directly to the incident in private vehicles and are equipped with medical bags, automated external defibrillators (AEDs) and communication equipment (RM of Springfield, 2020).

Ambulance services are available through calling 911. The nearest hospitals to the Project Site include the Beausejour Hospital located 24 km north and the Ste. Anne Hospital located 38 km south. The nearest full-care 24-hour hospital is the St. Boniface Hospital in Winnipeg located 49 km west of the Project Site.

Police

Police services in the vicinity of the Project Site include the Springfield Police Service at 686 Main Street in Oakbank and RCMP services at 625 Balsam Crescent in Oakbank, both of which are located approximately 34 km northwest of the Project Site (RM of Springfield, 2020).

4.6.3.3 Community Services

Communications

The nearest cellular service tower is located adjacent to the town of Anola approximately 14 km west of the Project Site. Available cellular service providers include Bell MTS, Telus and Rogers.

Electricity

Manitoba Hydro provides electric power to industries and residents in the Regional Project Area (Manitoba Hydro, n.d.).

Water and Wastewater

The RM of Springfield provides potable water services sourced from municipal groundwater wells to a total population of approximately 1,300 within the communities of Anola, Oakbank and Dugald which are the closest communities to the Project Site supplied with municipal water services (Manitoba Sustainable Development, n.d.; RM of Springfield, 2019). The majority of the Regional Project Area is individually serviced by private groundwater wells. The locations of groundwater wells in the vicinity of the Project Site are provided in the Hydrogeological Assessment Report provided in **Appendix A**.

The nearest wastewater treatment facility to the Project Site is the RM of Springfield wastewater treatment lagoon system located in NE 11-11-5 EPM. (Manitoba Conservation, 2010).

Solid and Hazardous Waste Disposal

The RM of Springfield contracts BFI Canada to manage its waste and recycling programs at the local transfer stations (RM of Springfield, 2020).

The nearest waste transfer stations to the Project Site are the Oakwood Transfer Station located 11 km north of the Project Site and the Hillside Transfer Station located 40 km northwest of the Project Site. The

nearest landfill is the Brady Road Resource Management Facility in Winnipeg located 63 km southwest from the Project Site.

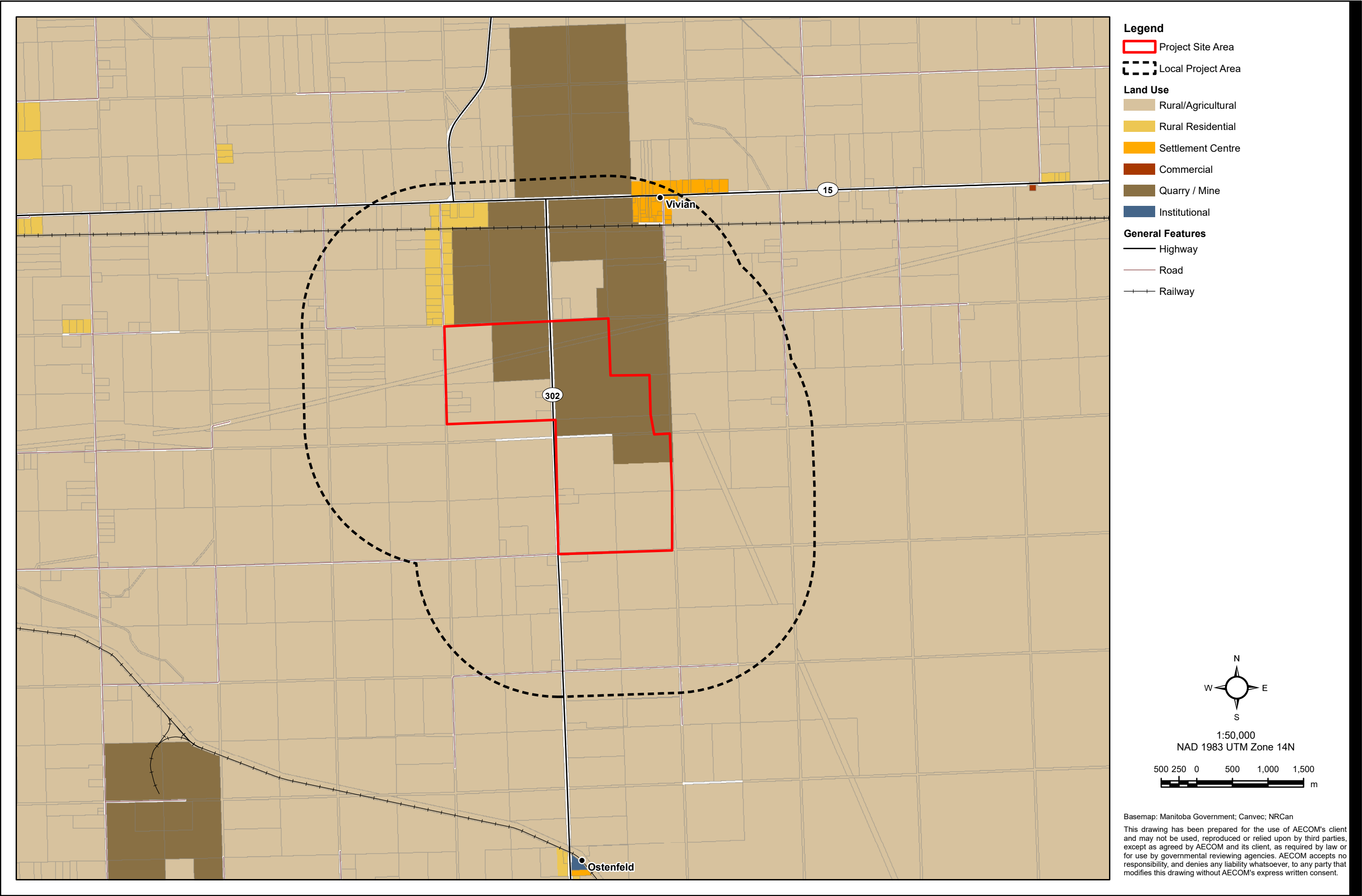
The nearest commercial hazardous waste facility, which also accepts household hazardous waste (e.g., oils and other petroleum products), is the Miller Environmental facility located at 1451 Saskatchewan Ave. in northwestern Winnipeg approximately 57 km west of the Project Site.

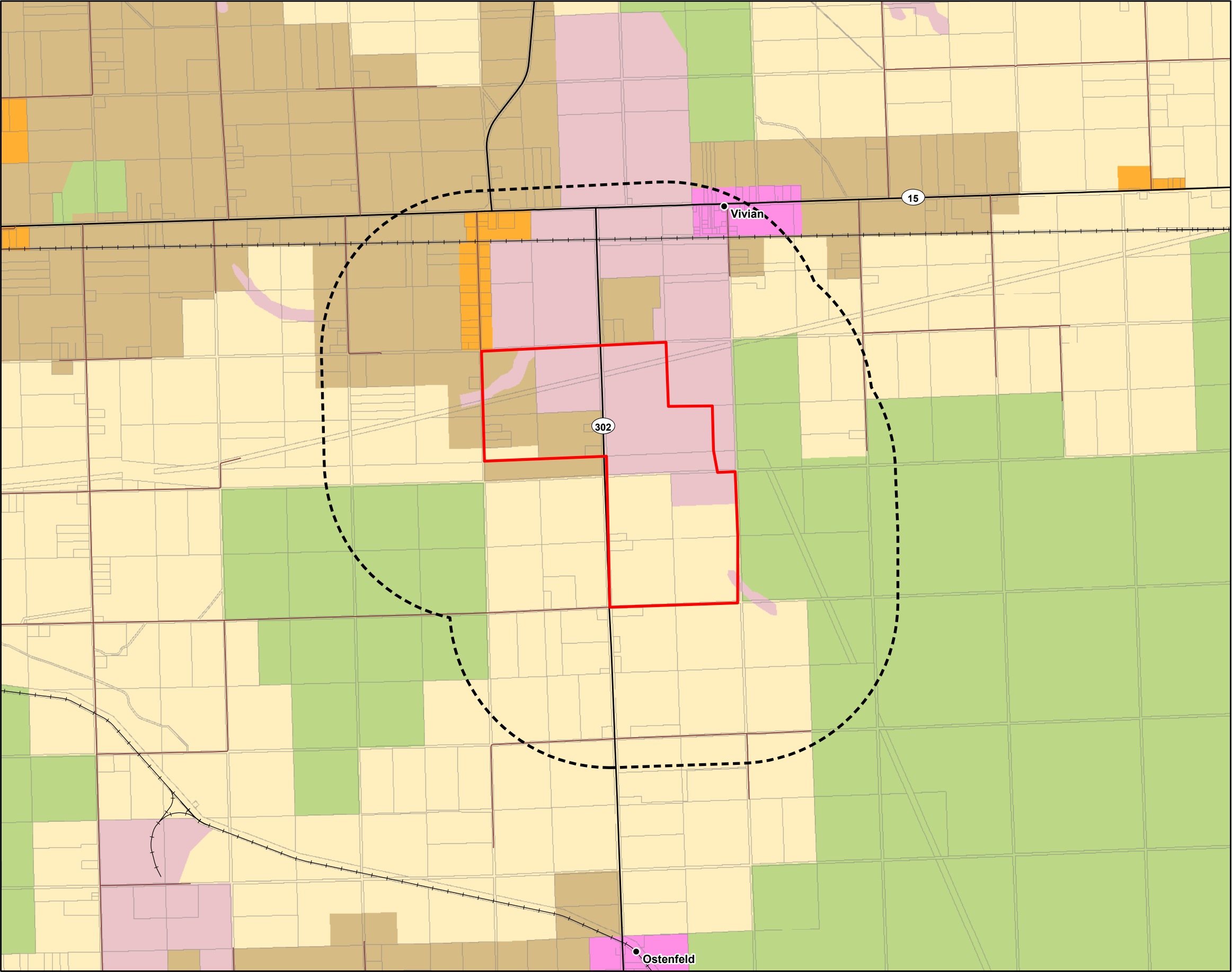
4.6.4 Land and Resource Use

Information from the Manitoba Lands Initiative geodatabase indicates that land use within the Project Site is designated as either rural/agricultural use or quarry / mine use (**Figure 4-8**).

The RM of Springfield Development Plan (RM of Springfield, 2018) has designated most of the Project Site as 'Aggregate' (45%) with other designated land uses including 'Agriculture Preserve Area' (37%) and 'Mixed Rural and Agriculture Area' (18%) (**Figure 4-9**).

As indicated in **Section 4.4.1**, approximately 31% of the Project Site has been developed for agriculture purposes. An additional 13% of the Project Site includes other types of land development such as quarry pits, residential lots, transmission line corridor and municipal and provincial roads.





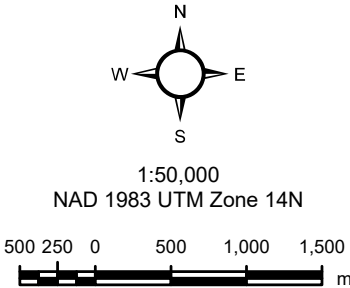
Legend

- Project Site Area
- Local Project Area
- * Development Plan Designations**
 - Agricultural Preserve Area
 - Mixed Rural and Agricultural Area
 - Aggregate
 - General Development
 - Rural Residential
 - Natural Resource Area

General Features

- Highway
- Road
- Railway
- Assessment Parcel

* Development Plan References:
- RM of Springfield. 2018. Rural Municipality of Springfield Development Plan. May 17, 2018



Basemap: Manitoba Government; Canvec; NRCan
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4.6.5 Heritage Resources

A screening request to Manitoba Historic Resources Branch was submitted on March 2, 2021 for the extraction years one to four within the proposed Project Site to determine if there are any potential heritage resources that may be affected by the proposed development and if a Heritage Resources Impact Assessment (HRIA) is required. Historic Resources Branch responded on March 11, 2021 that the Project Site had some areas of potential heritage resources sensitivity and that a HRIA was required to assess those 'areas of concern' for the presence of heritage resources (**Appendix F**).

On May 7 and 8, 2021, a qualified archaeologist conducted an HRIA of the Project Site in accordance with Historic Resources Branch requirements and under Heritage Permit A11-21. No archaeological artifacts or features were identified during the HRIA. The HRIA report, which also provides a historical overview of the general Project area is provided in **Appendix G**. The on-site archaeological investigation found the Project Site to have substantial previous disturbances and concluded that there were no heritage concerns regarding development of the Project at the Project Site (**Appendix G**).

CanWhite will submit additional screening requests to Historic Resources Branch for each of the subsequent four-year extraction block areas during the 24-year life of the Project and will have a qualified archaeologist conduct a HRIA, if required, prior to initiating Project construction activities.

5. Public and Indigenous Engagement

CanWhite has had, and will continue to have, discussions with residents, businesses, local stakeholders, all levels of government and local Indigenous communities in the area.

Public and regulatory feedback received during the Engagement Program and Environment Act Proposal review period for the Vivian Sand Facility Project Environment Act Licence application process included comments and questions related to the Vivian Sand Extraction Project, which is the subject of this report. Many of the comments and questions were regarding the potential for the Project to adversely affect local groundwater wells and the regional aquifers. During the review period for the Vivian Sand Facility Environment Act Proposal, hydrogeological studies were being planned and were conducted to assess potential effects of the Project on local groundwater wells and the regional aquifer, and to determine the mitigation measures and monitoring required to avoid adverse effects. An independent peer-reviewed extensive hydrogeological impact assessment study report was recently completed and is provided in **Appendix A** with peer-review comments and responses regarding the report provided in **Appendix B**. The hydrogeological impact assessment study report provides the outstanding information required to address comments and questions from the public and regulators regarding the potential effects of the Project on local groundwater wells and the regional aquifers which are summarized in **Section 6.2.3**.

The opportunity for public review of the proposed Project, including the hydrogeological impact assessment study report, will occur during the public review period for this Environment Act Proposal, during which time CanWhite will hold a public meeting to provide Project information and respond to public comments and questions on the proposed Project.

6. Environmental Assessment and Mitigation Measures

This section identifies the potential Project effects on the biophysical and socioeconomic environmental components, describes mitigation measures included in the design of the Project to avoid or minimize potential Project effects and determines the residual adverse impacts remaining after the application of mitigation measures.

The scope of this environmental assessment regarding spatial and temporal boundaries and the environmental components to be assessed has been described in **Section 3**.

6.1 Effects Assessment Methods

Table 6-1 identifies the biophysical and socioeconomic components that may be potentially affected by the Project due to the potential for interactions with the Project activities and components. Potential interactions were identified based on:

- Professional judgement;
- An understanding of Project components, construction methods, operation processes and the assumption that standard environmentally responsible construction techniques and operating procedures will be applied during Project construction, operation and decommissioning/closure.

Table 6-1: Environmental Component Potential Interactions with the Project

ACTIVITY	BIOPHYSICAL COMPONENTS										SOCIO-ECONOMIC COMPONENTS				
	Physical			Atmospheric		Terrestrial			Aquatic		Land and Resource Use	Human Health	Indigenous and Treaty Rights**	Heritage Resources	Aesthetics
	Geology/ Topography	Soil	Groundwater	Air Quality (dust, noise)	Climate / Greenhouse Gases	Vegetation	Wildlife	Species of Conservation Concern	Surface Water Quality	Fish and Fish Habitat*					
CONSTRUCTION															
Mobilizing construction equipment, materials and crew to and from Project Site		X		X	X	X	X	X	X		X	X		X	X
Vegetation clearing, grubbing and leveling as needed, for well clusters, temporary access trails and slurry line / water return line trails	X	X		X	X	X	X	X	X		X	X		X	X
Stockpiling cleared woody debris/organics/soil	X	X		X	X	X	X	X	X		X	X		X	X
Disposing of large woody debris (trees)		X		X	X	X	X	X			X	X		X	X
Drilling extraction wells	X	X	X	X	X	X	X	X	X		X	X		X	X
Establishment/laydown of slurry and return water line and associated pumping stations		X		X	X	X	X	X	X		X	X		X	X
Disposing and recycling of miscellaneous construction wastes (e.g. lubricant containers; parts packaging)		X		X	X		X	X				X			X
OPERATION and MAINTENANCE															
Mobilizing drill rigs and crew to and from Project site		X		X	X		X	X				X			X
Operation of air compressors, pumping stations and other equipment.	X	X	X	X	X		X	X			X	X			X
Disposing and recycling of miscellaneous operation and maintenance wastes(e.g. lubricant containers; parts packaging)		X		X	X		X	X				X			X
DECOMISSIONING/CLOSURE															
Mobilizing decommissioning/closure equipment, materials and crew to and from Project site		X		X	X		X	X				X			X
Dismantling slurry lines, water return lines and associated pumping stations		X		X	X		X	X				X			X
Progressive annual closure of extraction wells (well sealing)	X	X	X	X	X		X	X				X			X
Spreading organics/soil and revegetating previously disturbed areas	X	X		X	X	X	X	X				X			X
Disposing and recycling of miscellaneous construction wastes (e.g. lubricant containers; parts packaging)		X		X	X		X	X				X			X

* There is a low probability of fish habitat existing within the waterbodies (i.e. quarry ponds) occurring within the Project Site. Project activities will avoid waterbodies and will apply appropriate erosion and sedimentation mitigation practices. Therefore, Project related activities are not anticipated to interact with surface waterbodies.

** Project activities are not anticipated to adversely impact Indigenous and Treaty Rights (**Section 6.6.5**).

The framework for determining environmental impacts of the Project on environmental components includes the following:

- Determine potential adverse effects of the Project on environmental components;
- Apply mitigation measures to avoid or minimize potential adverse effects;
- Determine the residual environmental impacts, which are those adverse environmental effects that remain after the application of mitigation measures; and
- Evaluate the residual environmental impacts based on defined effects evaluation criteria.

The criteria used to evaluate residual environmental impacts are defined in **Table 6-2**, noting that the defined criteria is used as a general guide and may be modified to more appropriately evaluate impacts to specific environmental components.

Table 6-2: Environmental Effects Assessment Criteria

CRITERIA TERM	DEFINITION			
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the construction, operation and decommissioning/closure of the Project. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as less than (<) 1%, 1% to 10%, or greater than (>) 10% of the population or resource base. Where the magnitude of an effect was determined as virtually immeasurable or represented a potential change that was within the natural variation of population or resource levels, the effect was considered Negligible. An exception to this is regarding human health effects where, for example adverse health issues due to the Project and affecting 1% of the population would still be considered major			
	Negligible (immeasurable)	Minor (<1%)	Moderate (1 to 10%)	Major (>10%)
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, adverse or neutral effect			
	Positive	Adverse	Neutral	
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short term (<1 year), Moderate term (1 to 10 years) and long term (>10 years)			
	Short term (<1 year)	Moderate (1 to 10 years)	Long term (>10 years)	
Frequency:	Refers to the number of times an activity occurs over the Project phase and is identified as once, rare, intermittent or continuous			
	Once	Rare	Intermittent	Continuous
Scope of Effect:	Refers to the spatial area potentially affected by the effect and categorized as Project Site, Local Project Area or Regional Project Area as defined in Section 3.2 . Where possible, quantitative estimates of the resource affected are provided			
	Project Site	Local Project Area	Regional Project Area	
Reversibility:	Refers to if an adverse effect is likely to be reversed after completion of the activity or Project decommissioning/closure			
	Reversible		Irreversible	

The significance of residual environmental impacts is commented on where applicable regulatory criteria exist such as a regulatory threshold (e.g. air quality guidelines are exceeded due to Project activities). In the absence of such regulatory thresholds, an overall characterization of the impact is provided, taking into consideration the assessment criteria as described above in **Table 6-2**.

Environmental effects that may be caused due to accidents and malfunctions are discussed separately in **Section 6.9**.

6.2 Physical Environment

6.2.1 Geology/Topography

Magnitude of Effect: Minor (Topography and Geology)

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Project Site

Reversibility: Reversible (Topography); Irreversible (Geology)

The geology and topography of the Project Site will be affected by Project activities including:

- Clearing and levelling as needed at the sand extraction well locations;
- Clearing for temporary laydown areas in well cluster areas;
- Development of temporary access trails for drilling equipment access and temporary trails for slurry line and return water line and associated pumping stations; and
- Drilling of sand extraction wells.

Extraction of the silica sand resource will result in a permanent change to the underground geology in the form of horizontal arrays of rooms and pillars in the sandstone geological layer (between 52 m to 76 m), in the Winnipeg Formation aquifer within the Project Site.

Results of a geotechnical assessment based on preliminary exploratory drilling associated with this Project from 2017 to 2021 indicated that the overlying carbonate (limestone) geological layer needs to be at least 15 m thick to minimize the possibility of surface subsidence during sand extraction activities (Stantec, 2019; 2020; 2021). Additionally, the preliminary analysis indicated that:

- The diameter of extraction voids (areas where sand is extracted at each drill hole site) should not extend beyond 60 m in any circumstance, and should be reduced to 50 m as the overlying limestone layer thins to 15 m.
- The distance from the edge of one extraction void to the edge of the next extraction void should not be less than 60 m in direction.

Based on these cone diameters and distances between sand extraction centres, each extraction void would contain approximately 25,000 tonnes of sand resource, and a total estimated sand recovery of 1.06% targeted over the 24 year life of the Project compared to the total volume of sand identified as a resource in the Winnipeg Sandstone Formation (Stantec, 2020; 2021).

The following measures will be implemented to avoid or minimize Project adverse effects on geology and topography, including potential for underground and surface subsidence due to the sand and groundwater extraction activities:

- Where applicable, existing roads and trails and other previously disturbed areas will be utilized to minimize disturbance to the natural topography.
- The locations of annual extraction wells will be determined in consideration of the results of preliminary geotechnical modeling used to predict thresholds of extraction amounts to mitigate adverse effects related to the potential for underground and surface subsidence (Stantec, 2021).
- Additional testing will be conducted to further assess and confirm the limestone and overburden thickness and structure as the Project progresses geographically.
- Progressive annual decommissioning of extraction wells will be done using a concrete cap, bentonite and permeable backfill in accordance with applicable guidance documents such as 'Constructing and Sealing Wells in Manitoba' (Province of Manitoba, 2018).
- Levelling and grading will occur during progressive annual decommissioning of extraction wells to return the landscape to elevations typical to the surrounding area.

While measurable disturbances will be imposed on natural geologic and topographic features, disturbances will be limited to the Project Site. With the application of the above described mitigation measures, impacts on topography have been assessed as being minor because disturbed land will be leveled, graded and progressively rehabilitated. Impacts to geology are assessed as being minor due to the abundance of remaining silica sand resource with approximately 1.06% removed throughout the 24-year life of the project in the target regional aquifer geological layer within the Project Site. The extracted silica sand will not be replaced; therefore, impacts to the geology will be irreversible/permanent.

6.2.2 Soils

Magnitude of Effect: Minor

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Project Site

Reversibility: Reversible

Construction / operation activities including clearing, levelling, and construction of temporary access trails, well clusters and slurry line and water return line routes, and the progressive annual decommissioning of extraction wells and disturbed areas have the potential to cause soil erosion. Soil erosion can potentially increase during high wind and precipitation events, which are expected to be most frequent during the extraction activities when soils are exposed and not frozen/snow covered (i.e. April through November). Soil erosion may affect other environmental components, such as air quality (e.g. dust from soil disturbance), water quality and vegetation.

To mitigate the effects of soil erosion, the following measures will be incorporated:

- An Erosion and Sediment Control Plan will be implemented for all phases of the Project.
- During the progressive annual decommissioning activities, after Project components have been removed, the landscape will be leveled and graded, and disturbed areas will be revegetated as quickly as feasible to stabilize the soil and minimize soil erosion.

With the application of the above mitigation measures, the potential for soil erosion and associated adverse impacts to the surrounding environment are anticipated to be minor and restricted to the Project Site.

6.2.3 Groundwater

Magnitude of Effect: Minor

Direction of Effect: Adverse (quantity); Positive to Adverse (quality)

Duration of Effect: Long term

Frequency: Intermittent (i.e. seasonal)

Scope of Effect: Project Region

Reversibility: Reversible (aquifer will recharge over time)

The potential risks to groundwater are assessed to be minor, seasonal in duration and reversible. Water levels in the Winnipeg Sandstone and Red River Carbonate aquifers are expected to recover 80% in first two days with remaining 20% recovering over a period of 20 to 80 days following the end of extraction activities in the fall of each year.

As indicated in **Section 2.2.1**, the slurry loop system for transporting sand to the facility is designed to not require any additional water which allows for the majority of the water that comes from the extraction well to be returned to the aquifer within a short period of time. Therefore, very little extraction of groundwater from the aquifer is required.

A comprehensive hydrogeological and geochemical assessment was undertaken involving field investigation, data analysis, numerical groundwater modelling and geochemical modelling, with the results described in an extensive, peer-reviewed hydrogeology and geochemistry assessment report (**Appendix A**). Overall, drawdown effects associated with sand extraction were simulated to be localized, with limited to no effects beyond 1,500 m (4,921 ft) from the active extraction wells when the majority of groundwater is reinjected. During a pumping test, little to no decline (0.02 m to 0.77 m) in water levels was observed in the existing domestic wells near the Project site in the Winnipeg Sandstone or Red River Carbonate aquifers and no negative impacts were reported by well owners. Water levels in the observation well network declined by up to 8.5 m (Winnipeg Sandstone) and 1.5 m (Red River Carbonate) at a distance of 89.3 m from the pumping well. Drawdown effects are largely restricted to the Project Site boundary, but minor effects are anticipated to extend beyond it during and immediately following operation of extraction wells close to the boundary.

A draft version of the hydrogeology and geochemistry assessment report (final version in **Appendix A**) underwent peer review by two separate hydrogeologists with extensive knowledge of the subject matter and the regional aquifer. The peer review comments and responses to those comments are provided in **Appendix B**. The hydrogeology and geochemistry assessment report was finalized (**Appendix A**) in consideration of peer review input and additional information was incorporated to improve the assessment. The following two expert hydrologists conducted a peer review (**Appendix B**) of the draft version of the hydrogeology and geochemistry report:

Jeff Bell, B.Sc. (G.E.), P.Eng. Hydrogeological Engineer, Friesen Drillers Ltd.

Jeff Bell is president of the Manitoba Water Well Association and is the head hydrogeological engineer for Friesen Drillers Ltd., a company that specializes in water well drilling and is based in Steinbach, Manitoba. He has over 20 years' experience in groundwater development and hydrogeological studies. He has extensive experience in the design and supervision of water wells using a direct rotary, air, and reverse rotary drilling equipment and has designed numerous large capacity municipal, industrial and domestic water supply wells using innovative methods and techniques. He also has extensive experience in well rehabilitation and development techniques.

Mr. Bell has undertaken numerous large-scale municipal and industrial groundwater supply projects and resource evaluations. He has completed large scale numerical groundwater models for projects including the Red River Floodway and the City of Winnipeg Sandilands water supply project. He has also undertaken

regional groundwater mapping investigations, geochemical studies, and environmental hydrogeology studies. Mr. Bell has also undertaken several major environmental studies relating to possible groundwater supply impacts from municipal and industrial groundwater developments. Most recently, Mr. Bell was a lead hydrogeological engineer for the hydrogeological investigation of a proposed new municipal groundwater supply for the communities of Oakbank and Dugald in the R.M. of Springfield (Friesen Drillers, 2019).

Dr. Grant Ferguson, B.Sc., Ph.D., P.Geo., Eng.L. University of Saskatchewan, Professor Civil, Geological and Environmental

Grant Ferguson holds a B.Sc. in Honours Geology from the University of Waterloo and a PhD in Civil Engineering from the University of Manitoba. He is a Centennial Enhancement Chair and Professor in the Department of Civil, Environmental and Geological Engineering and School of Environment and Sustainability at the University of Saskatchewan and an Adjunct Professor in the Department of Hydrology and Atmospheric Sciences at the University of Arizona.

His research focuses on hydrogeology and hydrogeochemistry of regional groundwaters systems and the interplay between energy and water resources. He was the 2019 recipient of the Global Institute for Water Security's Research Excellence Award. Dr. Ferguson served as president of the International Association of Hydrogeologists – Canadian National Chapter (IAH CNC) from 2009 to 2015 and was one of the founders of the IAH's Early Career Hydrogeologists Network

Based on a comprehensive geochemical assessment that included geochemical modelling, the overall quality of groundwater within the maximum footprint of the Project will be largely preserved. The activities associated with Project operations and post-closure phases of the Project were determined to have a temporary and minor impact on groundwater quality. For some constituents, the impact was simulated to be positive due to reduction of concentrations of iron and manganese when oxygen (air) is introduced into the aquifer or is allowed to mix with water containing lower concentrations of those elements.

The following measures are expected to mitigate groundwater withdrawal effects and potential for groundwater contamination:

- Process water will be recycled in a loop system for reuse, which reduces the quantity of water required from groundwater;
- When each well is drilled, casing will be installed and grouted in place to isolate the Red River Carbonate and Winnipeg Sandstone aquifers from one another and thereby prevent vertical mixing of waters;
- Extraction wells will be progressively (sequentially) established and sealed (decommissioned) during the ongoing sand and groundwater extraction activities in accordance with applicable guidance documents such as 'Constructing and Sealing Wells in Manitoba' (Province of Manitoba, 2018) and Environment Act Licence requirements;
- Geochemical modelling (**Appendix A**) has indicated that reinjection of groundwater (which will be UV-treated) back to the sandstone aquifer will not adversely affect groundwater quality in either the Winnipeg Sandstone or Red River Carbonate aquifers. A Waste Characterization and Management Plan, Water Management Plan, Groundwater Monitoring and Impact Mitigation Plan and Progressive Well Abandonment Plan (**Section 8**) will be developed and implemented to protect groundwater quality and guide responses to any potential impacts to groundwater quantity and quality. Measures will be developed to avoid and/or mitigate any well interference issues as required by *The Water Rights Act* of Manitoba.

With the application of the above mitigation measures and utilization of groundwater at sustainable rates as determined by ongoing hydrogeological testing and monitoring, impacts to groundwater are anticipated to be minor, seasonal in duration and reversible. Considering there will not be a continuous and unsustainable drawdown on the regional groundwater aquifer for Project processes and that the majority of the water that comes from the extraction well will be returned to the aquifer within a short period of time, effects on groundwater quantity in the regional aquifer can be managed by adhering to a Water Management Plan and by implementing a Groundwater Monitoring and Impact Mitigation Plan. The aquifer will also continue to be recharged through natural groundwater recharge processes (i.e. rain and snow melt) and lateral groundwater flow. Effects on groundwater quality will be minor and, in some cases, positive. Risks to groundwater quality will be mitigated through application of a Waste Characterization and Management Plan, Progressive Well Abandonment Plan and a Groundwater Monitoring and Impact Mitigation Plan.

6.3 Atmospheric Environment

6.3.1 Air Quality

Magnitude of Effect: Minor to Negligible

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Project Regional Area

Reversibility: Reversible

Project activities are expected to affect air quality due to dust generated by movement of drilling rigs and other mobile equipment, and due to exhaust emissions including nitrogen dioxide (NO₂), carbon monoxide (CO) and sulfur dioxide (SO₂). The exhaust emissions and dust generated from mobile equipment can have adverse effects on human health, wildlife and vegetation.

The number of vehicles and equipment used for Project activities listed in **Section 2.8** would not all be operating simultaneously. Therefore, adverse effects on air quality beyond Manitoba's air quality guidelines at nearest residences⁶ from vehicles and mobile equipment use are not anticipated.

As indicated in **Section 1.1**, at no time will dry silica sand be left exposed at the Project Site. Sand will be wet and will either be contained within the extraction well lines or the slurry lines, or material that is too large ('overs'), such as concretions (calcified sand), will be stored in appropriate containment prior to removal from site or use in well sealing activities. Therefore, the risk of silica sand dust dispersal is eliminated.

Measures that will be applied to minimize potential Project effects to air quality include the following:

- Idling of motorized equipment will be minimized to the extent feasible;
- Water will be applied on gravel roads to control dust, as required; and
- Equipment and vehicles will be properly maintained.

With the application of the above measures, impacts on air quality are expected minor to negligible, and sufficiently mitigated.

⁶ Nearest residence is approximal 133 m west of proposed well cluster areas.

Impact assessment information for greenhouse gas (GHG) emissions is provided in **Section 6.3.2**.

6.3.2 Climate/Greenhouse Gases

Magnitude of Effect: Negligible

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Beyond the Project Regional Area

Reversibility: Irreversible

To estimate the annual emissions of greenhouse gases (GHG), emissions of carbon dioxide (CO₂), methane (CH₄) and Nitrous Oxide (N₂O) were estimated from onsite activities associated with the Project operation. Estimated GHG emissions associated with Project equipment are summarized in **Table 6-3**.

Table 6-3: Greenhouse Gas Annual Emissions (CO₂e)

Emission Sources	Total Utilization (hours/year)	CO ₂ e GHG Emission (kg CO ₂ e/year)
DIRECT EMISSIONS		
EXTRACTION		
10 x Extraction Rigs @ 200,000 each - Off-Road	60,000	2,445,719
Compressor trailer for extraction / OFD1550 Tier 4 Final Oil Free Rotary Screw Air Compressor	12,000	934,060
Excavator per pad	6,000	318,505
Light Plant x 8	24,000	385,998
Flat Deck Truck (2015 F650 XLT Super Duty w/ 17' bed)	6,000	303,487
Zoom Boom / Manitou MT 5519 Telescopic Handler	6,000	239,291
DRILLING		
TH60 for drilling Earth Drilling	6,000	489,898
DR24 for Drilling Earth Drilling	6,000	491,784
2022 Ford F750 Water Truck Heavy Duty	6,000	212,886
Grouting System	700	11,295
SEALING		
DR24 for Abandonment	3,000	250,513
Picker Truck On-Road	1,000	72,915
SUPPORT		
Welding Truck F350 Light Duty	750	46,332
Mechanical Service Truck F350 Light Duty	750	46,332
SLURRY HANDLING		
CAT C18 Diesel Generator Set	6,000	394,712
HDPE Tube Welding Machine	1,000	68,475
Vac Truck	1,000	72,777
INDIRECT EMISSIONS		
POWER CONSUMPTION		
Pump Station	8,784	12,432
Total (kg CO₂e/year)		6,797,411

The following measures to minimize the production of GHG emissions will be applied:

- Emissions will be minimized by regularly maintaining equipment and vehicles and minimizing idling of vehicles
- Vehicles and equipment will meet required emission standards.

Overall, the Project is estimated to generate 0.006797411 tonnes (Mt) of CO₂e annually with the application of the above mitigation measures, which is 0.0296% of the reported Manitoba emissions in 2019 which were 23 Mt CO₂e (ECCC, 2021), about 0.000931% of the reported 730 Mt CO₂e from Canada in 2019 (ECCC, 2021). Therefore, the impact of the Project on Greenhouse Gas contributions to the atmosphere is assessed as negligible.

6.3.3 Noise

Magnitude of Effect: Minor to Moderate

Direction of Effect: Adverse

Duration of Effect: Short-term

Frequency: Intermittent

Scope of Effect: Variable due to changing annual locations of Project activities within the Project Site

Reversibility: Reversible

Noise generated by Project activities (e.g. extraction well drilling; operation of vehicles and machinery such as pumping stations) has the potential to adversely affect wildlife (**Section 6.5.2**) and could result in nuisance noise to people living within the Local Project Area. Project components expected to generate noise that may contribute to noise levels at the nearest points of reception (e.g. nearest residence, i.e. 133 m from a well cluster area) are listed in **Section 2.8**. Example noise sources associated with Project activities include mobilization of extraction well drilling equipment, drilling of wells and operation of pump stations.

The following measures will be implemented to reduce noise generated from Project activities:

- Vegetation clearing will be minimized to the extent feasible.
- Project activities will setback a minimum of 100 m from nearest residences.
- Mobile equipment and vehicles will be kept well maintained and will be fitted with mufflers, and other noise mitigation equipment as required.
- Unnecessary idling and revving of engines will be avoided.
- Additional noise mitigation measures will be applied (e.g. portable noise barriers) as required.

In consideration of the above measures to minimize noise levels due to Project activities, it is anticipated that potential noise levels at the nearest residences will be adequately attenuated. Noise disturbances to wildlife are expected to be moderate in the vicinity of Project activities but are not expected to measurably affect wildlife populations within the Interlake Plain Ecoregion within which the Project is located.

6.4 Aquatic Environment

6.4.1 Surface Water

Magnitude of Effect: Negligible

Direction of Effect: Adverse

Duration of Effect: Short term

Frequency: Intermediate

Scope of Effect: Local Project Area

Reversibility: Reversible

Project operations do not involve the use of, or discharge of, any surface water of any kind. Residual effects from temporary extraction-related activities including clearing, levelling, compacting, and establishment of well clusters, extraction wells, temporary access trails and slurry and water return line trails has the potential to increase surface water runoff within the Project Site and Local Project Area and potentially affect surface water quality and quantity. Removal of existing vegetation can potentially pose a risk to surface water quality as more sediment will be exposed to surface water drainage, potentially resulting in sediment laden runoff water. However, considering the Project Site does not have natural waterbodies potentially affected by vegetation removal, adverse effects to surface water from vegetation removal are not anticipated.

Due to the absence of natural waterbodies such as wetlands in the Project Site and immediately adjacent Local Project Area that may be potentially affected due to a temporary drawdown effect⁷ from sand extraction activities, Project operations are not expected to affect surface water quantity.

The following mitigation measures will be implemented to avoid or minimize potential effects on surface water quality:

- Drainage ditching will be constructed along Project access trails and at disturbed areas, as required, to assist in directing runoff flow from rain and snow and maintaining natural drainage pathways through low areas.
- As per **Section 2.3.1**, portable toilets will be located at active well cluster sites which will be regularly pumped out by a licensed local contractor for proper disposal as a means to prevent potential contamination of local waterbodies with potentially harmful substances.
- As per **Section 6.2.2**, an Erosion and Sediment Control Plan will be implemented for all phases of the Project.

With the application of the above described mitigation measures, the impacts on surface water are assessed as negligible.

6.4.2 Fish and Fish Habitat

Project related impacts on fish and fish habitats are not anticipated due to the lack of potential fish habitat within the Project Site (**Section 4.3.2**), no expected impacts on surface water quantity (**Section 6.4.1**) and application of an Erosion and Sediment Control Plan as indicated in **Section 6.2.2**.

6.5 Terrestrial Environment

6.5.1 Vegetation

Magnitude of Effect: Minor (Project Site) to Negligible (Local Project Area)

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Project Site (vegetation clearing) to Local Project Area (dust deposition)

Reversibility: Reversible

⁷ Drawdown effect is the lowering of the water table related to the zone of influence that groundwater extraction activities would have in the vicinity of extraction sites (refer to **Appendix A** for a description of the predicted drawdown effect distance for Project operations).

The total amount of naturally vegetated area requiring clearing for annual Project operations will vary considering the variable amounts of natural vegetation present within each annual block of Project development lands within the Project Site (which consists of 31% agriculture lands and 13% 'developed land'; **Section 4.4.1**). There will be no permanent components associated with the extraction Project. Therefore, progressive annual rehabilitation/revegetation of Project activity sites will minimize the long-term effects on vegetation within the Project Site. Direct impacts on vegetation through annual clearing activities will be restricted to the Project Site in consideration of setback distances as described in **Section 1.4**.

The footprint area of each well cluster will be minor (i.e. 0.20 ha to 0.28 ha), with only seven well clusters active any one time and other well clusters being progressively rehabilitated and revegetated. The pathway required to accommodate the parallel slurry and water return line will be very narrow (2 m wide), with temporary access trails limited to approximately four m in width and up to approximately eight m in width at turning points to accommodate required drill rig turning areas. Routing of these lines and the temporary access trails will be located within previously disturbed/cleared areas to the extent feasible. Therefore, these annual pathway routes will not represent a substantial annual footprint area where natural vegetation will need to be cleared. The number and locations of pumping stations required along the slurry line routes will also vary annually with increasing distance from the Processing Facility. The footprint area of the pumping stations will also be minor; approximately 63 m² each.

Project activities and temporary components will be located on previously disturbed land to the extent feasible within a Project Site that consists of approximately 56% natural vegetation cover. Therefore, the amount of naturally vegetated area requiring clearing each year is expected to be minor.

The types of naturally vegetated land cover that will be cleared (i.e., forest, meadow and willow/alder) are common within the Regional Project Area (**Section 4.4.1**).

Considering progressive closure, rehabilitation and revegetation of extraction activity areas will be done each year, it is expected that most natural vegetation will be very well established after approximately four years, with reestablishment of trees and shrubs expecting to be evident within five to 10 years following closure.

The following mitigation measures will be implemented to avoid or minimize potential effects of clearing on vegetation:

- Areas to be cleared of vegetation will be minimized to the extent feasible and will be clearly marked to avoid clearing more than required.
- Usable trees/wood will be cut and stacked at the Project Site for local use as firewood for no longer than one year or disposed of in accordance with applicable regulations.
- Disturbed areas will be allowed to revegetate naturally and will be augmented using an approved native seed mixture and native plantings if required.
- A Revegetation Monitoring Program (**Section 8.7**) will be implemented annually after the first year of Project operations to determine the success of the revegetation program and determine if follow-up reseeding or replanting is required. The monitoring program will include monitoring during the growing season until the seedlings appear to be established.
- Mitigation measures to control dust (**Section 6.3.1**) will be applied.

Clearing impacts on vegetation are limited to the Project Site and are assessed as minor due to:

- The limited amount of clearing required for annual Project operations; and
- The progressive annual site reclamation and revegetation procedures that will occur to return the landscape to pre-construction conditions to the extent feasible.

Vegetation within the Project Site and Local Project Area can also be harmed due to dust deposition on the surface of plants, which may prevent adequate photosynthesis and other life functions of vegetation (Farmer, 1993). Dust will be generated during Project activities as follows:

- Due to vegetation clearing and ground levelling activities, as needed;
- During use of existing gravel roads and temporary access trails which will contribute to dust emissions, to mobilize employees and equipment to the Project Site; and
- During the progressive annual closure/reclamation activities, dust deposition will be generated from cleanup and removal of Project components.

Effects of dust deposition are assessed to be minor due to the application of the mitigation measures listed in the air quality **Section 6.3.1** to control dust.

With the application of the above mitigation measures, overall Project impacts to vegetation are assessed as minor within the Project Site and negligible within the Local Project Area.

6.5.2 Wildlife

Magnitude of Effect: Negligible

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Regional Project Area

Reversibility: Reversible

Project activities that disrupt the natural environment (e.g. vegetation clearing, noise) are the primary contributors to potential effects on wildlife. Wildlife management focuses on regional wildlife populations because wildlife populations (e.g. deer) are typically not measurably affected if only an individual or small number of individuals are affected within a relatively small spatial area (e.g. the home range of a deer). Therefore, the spatial scope of the assessment of the Project impacts on wildlife has been conducted in consideration of the Regional Project Area. The availability of nearby alternative habitat for wildlife is also taken into consideration when assessing the potential effects of a development on wildlife.

The limited average annual amount of natural vegetation clearing within the Project Site that is required for Project activities (**Section 6.5.1**) is unlikely to substantially affect wildlife populations within the Regional Project Area because:

- The Project Site currently provides sub-optimal wildlife habitat (generally) due to existing disturbances and resulting fragmented habitat from existing development (e.g. agriculture fields; existing roads; quarries; residential lots; **Section 4.6.4**);
- The types of landcover used by wildlife that will be cleared during Project activities are common in the Regional Project Area (**Section 4.4.1**);
- The amount of naturally vegetated area that will need to be cleared for the Project during each year of operation is minor considering approximately 44% of the Project site is previously disturbed landcover due to human development such as agriculture, roads and aggregate quarries.

Noise generated during Project activities is expected to influence wildlife behaviour (e.g. area avoidance) to varying degrees within the Project Site and Local Project Area depending on the type of wildlife (U.S. National Parks Service, 2018). Noise generated within the Project Site is not expected to be of a magnitude that would substantially affect wildlife populations within the Regional Project Area because:

- Project-generated noise is not expected to be substantial beyond the Project Site and adjacent Local Project Area (**Section 6.3.3**); and
- Wildlife species present in the vicinity of the Project are anticipated to be accustomed (habituated) to some level of noise (U.S. National Parks Service, 2018) due to the presence of existing developments (e.g. agriculture activities, residential areas, roads and aggregate quarries).

Additional potential effects of the Project on wildlife include the following:

- Light pollution emanating from the well cluster/work areas within the Project Site can also disturb wildlife and alter natural wildlife behaviour for wildlife that may be present within the zone of influence of site lighting (e.g. Dominoni, 2017).
- The minor increase in vehicle traffic in the Regional Project Area as a result of Project activities (**Section 6.7**) is anticipated to result in a minor increase the risk of vehicle collisions with wildlife.

The following measures will be applied to minimize potential adverse effects to wildlife resulting from Project activities:

- Areas to be cleared of vegetation will be minimized to the extent feasible and will be clearly marked to avoid clearing more than required.
- Vegetation clearing will take place outside of the spring and summer months to the maximum extent feasible to avoid disturbance to breeding birds and other spring breeding wildlife species.
- Vegetation clearing will not take place during the breeding bird season for this [‘Zone B4’](#) area (April 14 – August 24; Government of Canada, 2018).
- Areas disturbed during annual Project activities will be allowed to revegetate naturally after each Project operation year and will be augmented using an approved native seed mixture and native plantings if required.
- Noise mitigation as proposed in **Section 6.3.3** will be applied.
- Measures to control dust generation will be applied as described in **Section 6.3.1**.
- Fully shielded directional lighting fixtures will be used to focus light specifically to work areas to minimize the dispersal of light to the surrounding Project Site.
- Workers using the temporary access trails to access the Project Site (e.g. well cluster sites) will be required to limit vehicle speed to a maximum of 30 km/hr.
- Employees and contractors will be required not to feed or harass wildlife.

With the application of the above mitigation measures, Project impacts to the Regional Project Area wildlife populations are assessed as negligible. The Project is also not anticipated to have a measurable effect on wildlife populations within the Interlake Plain Ecoregion.

6.5.3 Species of Conservation Concern

Magnitude of Effect: Minor to Negligible

Direction of Effect: Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Regional Project Area

Reversibility: Reversible

Species of conservation concern that potentially occur in the Regional Project Area (**Section 4.4.3**; **Appendix E**) are not expected to experience a substantial decrease in regional populations as a result of Project activities due to:

- The limited amount of cleared vegetation/habitat that will be required for the Project (**Section 6.5.1**);
- Prevalence of similar cover types within the Regional Project Area, and the application of measures indicated in **Sections 6.5.1** and **6.5.2** to mitigate adverse effects of the Project on vegetation and wildlife in general.

Therefore, the Project impacts to regional populations of species of conservation concerns are assessed as minor to negligible, depending on the species of conservation concern and their habitat preferences.

6.6 Socioeconomic Environment

6.6.1 Labour Force and Employment

Magnitude of Effect: Minor

Direction of Effect: Positive

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Regional Project Area

Reversibility: Reversible

According to the labour force and education/training statistics provided in **Section 4.6.2**, there will be potentially employable people in the Local and Regional Project Areas having the skills, training and experience required for Project employment positions. There may also be other supply and services contracts associated with the operation of the Project that will provide additional long-term economic opportunities.

As indicated in **Section 2.5**, approximately 35 to 45 people will be employed for Project activities such as annual site clearing, extraction well drilling, extraction activities and relocation and assembly of temporary Project components. The need for local suppliers and other business to support Project activities is likely to provide an additional 100 to 120 indirect employment opportunities. Employment opportunities associated with the Project will be advertised as needed within the Regional Project Area and will be a positive, long-term and continuous benefit for the Regional Project Area.

6.6.2 Infrastructure and Services

6.6.2.1 Emergency Services

Magnitude of Effect: Minor

Direction of Effect: Neutral/Adverse

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Regional Project Area

Reversibility: Reversible

Emergency services (i.e., fire, policing and ambulance) in the Regional Project Area have the potential to be utilized more often potentially resulting in limitations to the current availability and response times for these regional services. To mitigate potential adverse effects of the Project on Regional Project Area emergency services, CanWhite will incorporate the following measures:

- An Emergency Response Plan will be available on-site during all Project phases that will clearly outline appropriate emergency response protocols.
- CanWhite will notify the RM of Springfield emergency services when annual Project activities will begin.
- Measures to avoid accidents and malfunctions as described in **Section 6.9** will be applied.

With the application of the above measures, the Project impacts on regional emergency services are anticipated to be minor.

6.6.2.2 Community Services

Magnitude of Effect: Minor (benefit)

Direction of Effect: Neutral to Positive

Duration of Effect: Long term

Frequency: Intermittent

Scope of Effect: Local and Regional Project Area

Reversibility: Reversible

Although Project activities (well drilling) will occur year-round, there will be no permanent structures associated with Project activities. Therefore, the need for community services will be limited, but may include sourcing of some supplies and services locally where available such as machine maintenance services; fuel, oil and grease supply; small tools and equipment supply; garbage removal; health and safety supplies as well as drilling materials such as cement. CanWhite may initiate agreements for local / regional community services that would be beneficial for both the RM of Springfield and the Project.

Solid waste generated at the temporary annual work areas will be transported by a licensed local contractor to be disposed at a local licenced landfill to an amount that would be sustainable for the local landfill. Otherwise, solid waste will be transported 63 km to the Brady Road Landfill managed by the City of Winnipeg.

Benefits to the Local and Regional Project Area from the opportunities for local business to supply required goods and services are anticipated to result in an overall minor positive impact to community services.

6.6.3 Land and Resource Use

Magnitude of Effect: Minor

Direction of Effect: Adverse

Duration of Effect: Short term

Frequency: Intermittent

Scope of Effect: Project Site

Reversibility: Reversible

Project activities will occur on CanWhite mining claims sequentially from 2021 to 2025 which will result in temporary use of a very limited portion of the Project Site land each year of the Project. Land use for Project activities will occur in accordance with municipal and provincial approvals and legislative requirements.

Use of the land for other purposes will not be available in the locations of annual Project activities. However, due to the progressive annual reclamation of extraction sites and other Project-related disturbed areas, parcels of land used for Project activities during any given year of Project operation will be available for other uses the following year or once the activities are complete. Sand Extraction activities occur over

weeks in one area rather than months, with individual wells over days. Therefore, the Project is anticipated to result in an overall minor temporary adverse impact to land use within the Project Site.

6.6.4 Human Health

Magnitude of Effect: Negligible

Direction of Effect: Adverse

Duration of Effect: Long Term

Frequency: Intermittent

Scope of Effect: Local and Regional Project Areas

Reversibility: Reversible

Project activities have the potential to adversely affect human health through:

- Increased traffic due to employees and contractors accessing the Project Site;
 - Emissions from vehicles affecting air quality; and
 - Higher potential for traffic accidents;
- Dust and noise generated by Project activities.

Mitigation measures that will avoid or minimize potential adverse effects on human health are the following:

- Measures to avoid or minimize adverse effects on air quality (**Section 6.3.1**) and effects on climate (**Section 6.3.2**) will be applied.
- Measures to control noise will be applied (**Section 6.3.3**).
- All CanWhite employees will abide by the standards, procedures and training required under *The Workplace Safety and Health Act* as well as CanWhite's internal Health and Safety Program and Emergency Response Plan.
- Employee Orientation and Safety training will be mandated for all new hires in addition to required yearly safety reviews for existing staff.
- Applicable personal protective equipment (PPE) will be provided to employees. Where required, visitor orientation and PPE will be provided when visitors enter employee only areas.

Through the implementation of the measures referenced above, impacts to human health are assessed as negligible.

6.6.5 Indigenous and Treaty Rights

The Project is not expected to adversely impact the exercise of Indigenous or Treaty rights because:

- The Project Site consists of private land covered under private surface rights that do not have public access unless by permission;
- No fish or fish habitat will be affected by the Project (**Section 6.4.2**);
- The residual environmental impact of the Project on vegetation beyond the Project Site is assessed to be negligible (**Section 6.5.1**); and
- The residual environmental impact of the Project on regional wildlife populations is assessed to be negligible (**Section 6.5.2**).

6.6.6 Heritage Resources

Magnitude of Effect: Minor

Direction of Effect: Adverse

Duration of Effect: Long Term

Frequency: Intermittent

Scope of Effect: Project Site

Reversibility: Irreversible

Activities related to Project construction and operations that disturb the land may have the potential to disturb or destroy heritage resources (e.g. unknown archaeological sites). Project activities that disturb the land include clearing for temporary access trails, clearing and leveling (as required) to prepare the well pad sites for establishment of extraction wells and drilling of extraction wells.

As indicated in **Section 4.6.5**, the results of an on-site archaeological investigation found the Project Site to have substantial previous disturbances and concluded that there were no heritage concerns regarding development of the Project at the Project Site (**Appendix G**).

If heritage resources are discovered within the Project Site, work will be stopped, Historic Resources Branch will be advised, and the discovered historic resources will be recorded by an archaeologist and adequately protected as required. The heritage resources protection practices outlined in the Heritage Resources Protection Plan for the Facility Project will also be used for this Project (AECOM 2020).

With the application of the above described mitigation measure and given the opinion of a qualified archaeologist indicating no heritage concerns regarding development of the Project at the Project Site, the impacts on heritage resources are assessed as minor.

6.7 Traffic

Magnitude of Effect: Minor

Direction of Effect: Adverse

Duration of Effect: Long Term

Frequency: Intermittent

Scope of Effect: Regional Project Area

Reversibility: Reversible

The increase in Regional Project Area traffic will be not substantial for the following reasons:

- The sand will be transported to the sand Processing Facility by slurry line rather than by haul truck which will limit traffic associated with the Project staff and contractors during the Project construction and operation.
- Project staff will be limited to approximately 35 to 45 personnel during the construction and operation phases of the Project (**Section 2.5**) with staff arrivals and departures being staggered daily to accommodate the 24 hours, seven days/week (24/7) operation schedule. Additional minor traffic will be related to weekly supply/parts deliveries and contractors for services such as waste disposal.
- To access the different well cluster locations which will vary within and between Project operation years (from April through November each year of the Project), traffic will travel within the Project Site along the PR 302 (Ostenfield Road) for up to 5 km or along municipal road 42E (Queens Valley Road) for up to 1.8 km, south from PTH 15.
- The distance and frequency that traffic will travel on local roads will be variable depending on the locations of the well cluster sites within and between Project operation years.

Therefore, the overall annual increased use of regional roads will be minor.

6.8 Aesthetics

Magnitude of Effect: Minor

Direction of Effect: Adverse

Duration of Effect: Long Term

Frequency: Continuous

Scope of Effect: Project Site

Reversibility: Reversible

The impact of the Project on the aesthetics of the Local Project Area is anticipated to be minor for the following reasons:

- Land disturbances and Project components will be temporary within a very limited area in the Project Site during each year of operation;
- Most of the Project Site will remain undisturbed, and vegetation clearing to accommodate the Project footprint will be minimized to the extent feasible (refer to mitigation described in **Section 6.5.1** 'Vegetation').
- Most of the land that will be used for the footprint of Project operations is previously disturbed (e.g. agriculture; gravel quarry).
- Annual well cluster sites and wells will be progressively closed / sealed each year, and disturbed areas will be rehabilitated throughout each year of Project operation.
- Setback distances where no activity will occur (e.g. from residences) will be maintained as described in **Section 1.4**.

6.9 Accidents and Malfunctions

To minimize the probability of accidents and malfunctions, the proposed Project activities will be conducted in accordance with applicable regulatory requirements. The following sections provide additional details on precautionary measures that will be implemented by CanWhite to further minimize the potential for accidents and malfunctions to occur.

6.9.1 Worker Health and Safety

Worker protection in Manitoba is regulated through standards, procedures and training under the *Workplace Safety and Health Regulation, M.R. 219/2015*. Safety equipment and personal protective equipment will be supplied to employees. Employees and contractors will be subject to site specific environmental health and safety orientation for all phases of the Project.

6.9.2 Spills and Leaks

Environmental effects may occur due to fuel and chemical spills from diesel fuel, lubricants, oils and hydraulic fluids. An accidental release of hazardous materials and/or equipment fluids could occur from improper storage and handling procedures. An accidental release of slurry or return water may also occur if a break or crack occurs in the slurry and/or water return line. Accidental releases, depending on the type and quantity of substances released, have the potential to affect air, surface water, groundwater and soils, with consequential effects on vegetation, aquatic resources and possibly human health and safety.

The following standard procedures will be implemented to prevent spills from occurring during Project activities:

- Diesel tanks used on-site will be self-contained aboveground storage tank(s);
- When servicing requires drainage or pumping of lubricating oils or other fuels from equipment, a groundsheet of suitable material and size and drip tray where applicable will be spread on the ground to catch all fluid in the event of a leak or spill. An adequate supply of suitable absorbent material and any other supplies and equipment necessary to immediately clean up spills will also be available;
- Storage and disposal of liquid wastes and filters from equipment maintenance, and residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with existing regulations;
- Waste oils, fuels, and other hazardous wastes will be handled in a safe manner. Staff will be required to transport, store and handle all such substances as recommended by the suppliers and/or manufacturers and in compliance with applicable federal, provincial and municipal regulations. Manitoba Conservation and Climate will be notified immediately if a reportable spill occurs;
- Fuels, oils or other hazardous materials will be stored in designated areas;
- Storage sites will be inspected regularly for compliance;
- Personnel on-site will be trained in how to deal with spills, including knowledge of how to properly deploy site spill kit materials which will be available on-site;
- Spill kits will be stationed and readily available for easy access;
- Service and repairs of equipment will be performed at the Processing Facility whenever possible, and all service and repairs will be done by trained personnel;
- Vehicles and Equipment will have pre-shift inspections and walk arounds to check for fluid leaks, primarily from the fuel system and/or hydraulics. Any detected leak will result in the unit being pulled from service until repaired. All service and repairs will be logged and tracked in the units operating and maintenance logs. A manufacturer defined maintenance and preventative care will be practiced by CanWhite and its employees;
- Slurry and water return line will be inspected on a daily basis, and after extreme weather events, to check for leaks and/or breaks in the line. If leaks or breaks in the line are detected, appropriate spill containment and clean-up measures will be applied as soon as feasible and the line will be repaired or replaced; and
- Fuel and chemical handlers will be trained and qualified, and appropriate emergency response measures will be in place and readily available.

Taking into account application of the above mitigation measures as necessary, and assuming the implementation of safe work practices, the risk of spills and leaks is considered to be appropriately mitigated.

6.9.3 Fires and Explosions

The presence of mechanical equipment, fuels and other hazardous materials creates a potential for fires and explosions. Such incidents can harm on-site personnel, cause equipment damage and lead to a release of contaminants, resulting in consequent effects to other environmental components (air, surface water, groundwater, plants, wildlife, aquatic resources and aesthetics).

Necessary precautions will be taken to prevent fire hazards at the Project Site; including but not limited to:

- Removal of flammable waste on a regular basis and disposal at a licenced disposal facility;
- Workers will be provided with appropriate fire prevention training;

- Appropriate fire extinguishers will be available on the Project Site. Such equipment will comply with and be maintained to the manufacturers' standards and employees will be appropriately trained in their use;
- Storage, transportation and use of hazardous materials, including flammable waste, will comply with regulatory requirements;
- On-site fire prevention/response equipment will be checked on a routine basis and in accordance with local fire safety regulations to maintain proper working order;
- Greasy or oily rags or materials subject to spontaneous combustion will be deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and be disposed of at licenced waste disposal facility;
- Emergency communication devices will be available and easily accessible to personnel to communicate and emergency as not all sites will have cellular signal; and
- Smoking will be restricted to designated areas.

With the measures outlined above, and assuming implementation of safe work practices, the risk of fires and explosions is assessed to be appropriately mitigated.

6.9.4 Transportation Accidents

An increase in traffic due to employee and contractor traffic to and from the Project Site has the potential to increase the likelihood for transportation accidents. Transportation accidents can consequently result in the release of pollutants to the environment such as fuel and oils, or materials that the vehicles colliding are transporting (e.g. construction wastes). Such accidental releases to the environment could potentially result in secondary effects on other environmental components (e.g., groundwater contamination through seepage, decline in surface water quality through runoff) or tertiary effects on vegetation (e.g., decline of growth potential due to soil contamination), wildlife, aquatic resources and human health.

The following measures will be employed to reduce the risk of transportation accidents:

- The sand will be transported from the extraction wells to the sand Processing Facility directly by slurry line rather than using transport trucks.
- Personnel retained to drive and operate vehicles and equipment such as drill rigs will have a valid appropriate-Class Manitoba Driver's License with a copy provided to CanWhite.
- Speed limits on municipal road and provincial roads/highways will continue to be implemented. Signage and speed limits on the PR 302 and PTH 15 are regulated by the Province of Manitoba.

The above noted measures are assessed to appropriately mitigate the potential risk of transportation accidents during all phases of the Project.

6.10 Summary of Environmental Effects and Mitigation Measures

Table 6-4 summarizes potential environmental effects of the proposed Project and the design features, standard operating procedures and other mitigation measures that will be implemented.

Table 6-5 summarizes potential accidents and malfunctions and measures to reduce the risk of such occurrences.

With the application of proposed mitigation measures, adverse environmental impacts of the Project are expected to be sufficiently mitigated.

Table 6-4: Summary of Environmental Assessment and Mitigation Measures

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
PHYSICAL ENVIRONMENT				
Geology / Topography	Construction/Operation	Clearing, levelling (as needed), and construction of temporary components including access trails, well clusters, extraction well drilling, slurry and return water line/routing trails and associated pumping stations.	Where applicable, existing roads and trails and other previously disturbed areas will be utilized to minimize disturbance to the natural topography. The locations of annual extraction wells will be determined in consideration of the results of preliminary geotechnical modeling used to predict thresholds of extraction amounts to mitigate adverse effects related to the potential for underground and surface subsidence (Stantec, 2021). Additional testing will be conducted to further assess and confirm the limestone and overburden thickness and structure as the Project progresses geographically.	Minor (Topography and Geology)
	Decommissioning	Progressive annual removal of Project components; progressive annual closure of extraction wells and rehabilitation of disturbed areas.	Progressive annual decommissioning of extraction wells will be done using a concrete cap, bentonite and permeable backfill in accordance with applicable guidance documents such as 'Constructing and Sealing Wells in Manitoba' (Province of Manitoba, 2018). Levelling and grading will occur during progressive annual decommissioning of extraction wells to return the landscape to elevations typical to the surrounding area.	
Soil Erosion	Construction	Clearing, levelling (as needed), and construction of temporary components including access trails, well clusters, extraction well drilling, slurry and return water line/routing trails and associated pumping stations.	An Erosion and Sediment Control Plan will be implemented for all phases of the Project.	Minor
	Decommissioning	Progressive annual removal of Project components; progressive	During the progressive annual decommissioning activities, after Project components have been removed, the landscape will be	

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
		annual closure of extraction wells and rehabilitation of disturbed areas.	leveled and graded, and disturbed areas will be revegetated as quickly as feasible to stabilize the soil and minimize soil erosion.	
Groundwater	Construction/Operation and Decommissioning	Withdrawing quantities of groundwater water that exceed capacity of the source aquifer may potentially affect the regional groundwater aquifer and potentially affect regional aquifer quantity and quality.	Process water will be recycled in a loop system for reuse, which reduces the quantity of water required from groundwater.	Minor
			When each well is drilled, casing will be installed and grouted in place to isolate between the various formation layers to prevent vertical mixing of the different aquifers present.	
			The water contained within the extraction lines will be returned between the grouted in place casing that goes to the sandstone and the production piping so that it does not contact the shale layers between aquifers and has no other place to go except the sandstone aquifer.	
			Extraction wells will be progressively (sequentially) established and sealed (decommissioned) during the ongoing sand and groundwater extraction activities in accordance with applicable guidance documents such as 'Constructing and Sealing Wells in Manitoba' (Province of Manitoba, 2018) and Environment Act Licence requirements.	
			A Waste Characterization and Management Plan, Groundwater Monitoring and Impact Mitigation Plan, Progressive Well Abandonment Plan, and Water Management Plan will be developed and implemented to protect groundwater quality and guide responses to any potential impacts. Measures will be developed to avoid and/or mitigate any well interference issues as required by <i>The Water Rights Act</i> of Manitoba.	
ATMOSPHERIC ENVIRONMENT				
Air Quality	Construction/Operation and Decommissioning	Generation of greenhouse gases from Project equipment. Dust generation from construction traffic along the main roads and temporary trails, and	Idling of motorized equipment will be minimized to the extent feasible.	Minor to Negligible
			Water will be applied on gravel roads to control dust, as required.	
			Equipment and vehicles will be properly maintained.	

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
		during other Project activities.		
Climate / Greenhouse Gases	Construction/Operation, and Decommissioning	Generation of greenhouse gases from Project equipment.	Emissions will be minimized by regularly maintaining equipment and vehicles and minimizing idling of vehicles.	Negligible
			Vehicles and equipment will meet required emission standards.	
Noise	Construction/Operation and Decommissioning	Noise from Project construction/operations activities such as extraction well drilling; operation of vehicles and machinery such as pumping stations and noise from decommissioning activities.	Vegetation clearing will be minimized to the extent feasible.	Minor to Moderate
			Project activities will setback a minimum of 100 m from nearest residences.	
			Mobile equipment and vehicles will be kept well maintained and will be fitted with mufflers, and other noise mitigation equipment as required.	
			Unnecessary idling and revving of engines will be avoided.	
			Additional noise mitigation measures will be applied (e.g. portable noise barriers) as required.	
AQUATIC ENVIRONMENT				
Surface Water	Construction/ Operation, and Decommissioning	Clearing, leveling (as needed), compacting; ditching for water drainage as required; stockpiling overs; progressive annual closure of extraction wells and rehabilitation of disturbed areas.	Drainage ditching will be constructed along Project access trails and at disturbed areas, as required, to assist in directing runoff flow from rain and snow and maintaining natural drainage pathways through low areas.	Negligible
			Portable toilets will be located at active well cluster sites which will be regularly pumped out by a licensed local contractor for proper disposal as a means to prevent potential contamination of local waterbodies with potentially harmful substances.	
			An Erosion and Sediment Control Plan will be implemented for all phases of the Project.	
Fish and Fish Habitat	Construction/Operation and Decommissioning	Not applicable.	Project related impacts on fish and fish habitats are not anticipated due to the lack of potential fish habitat within the Project Site, no expected impacts on surface water quantity and application of an Erosion and Sediment Control Plan.	None
TERRESTRIAL ENVIRONMENT				
Vegetation	Construction/Operation and Decommissioning	Clearing, leveling, compacting, ditching for water drainage as	Areas to be cleared of vegetation will be minimized to the extent feasible and will be clearly marked to avoid clearing more than required.	Minor (Project Site) to

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
		required; operation of machinery and activities that produce dust; progressive annual closure of extraction wells and rehabilitation of disturbed areas.	<p>Usable trees/wood will be cut and stacked at the Project Site for local use as firewood for no longer than one year or disposed of in accordance with applicable regulations.</p> <p>Disturbed areas will be allowed to revegetate naturally and will be augmented using an approved native seed mixture and native plantings if required.</p> <p>A Revegetation Monitoring Program will be implemented annually after the first year of Project operations to determine the success of the revegetation program and determine if follow-up reseeding or replanting is required. The monitoring program will include monitoring during the growing season until the seedlings appear to be established.</p> <p>Mitigation measures to control dust (see Air Quality component in this table) will be applied.</p>	Negligible (Local Project Area)
Wildlife	Construction/ Operation, and Decommissioning	Vegetation clearing; human presence and noise related to Project construction/operation and decommissioning activities such as operation of machinery and well drilling; increased human presence at the Project Site and increased traffic at the Project Site and adjacent Local Project Area.	<p>Areas to be cleared of vegetation will be minimized to the extent feasible and will be clearly marked to avoid clearing more than required.</p> <p>Vegetation clearing will take place outside of the spring and summer months to the maximum extent feasible to avoid disturbance to breeding birds and other spring breeding wildlife species.</p> <p>Vegetation clearing will not take place during the breeding bird season for this 'Zone B4' area: April 14 – August 24 (Government of Canada, 2018).</p> <p>Areas disturbed during annual Project activities will be allowed to revegetate naturally after each Project operation year and will be augmented using an approved native seed mixture and native plantings if required.</p> <p>Mitigation measures to control noise (see Noise component in this table) and dust (see Air Quality component in this table) will be applied.</p> <p>Fully shielded directional lighting fixtures will be used to focus light specifically to work areas to minimize the dispersal of light to the surrounding Project Site.</p>	Negligible

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
			Workers using the temporary access trails to access the Project Site (e.g. well cluster sites) will be required to limit vehicle speed to a maximum of 30 km/hr.	
			Employees and contractors will be required not to feed or harass wildlife.	
Species of Conservation Concern	Construction/Operation, and Decommissioning	As above for the Vegetation and Wildlife components.	Mitigation measures as listed for the Vegetation and Wildlife components above will be applied.	Minor to Negligible
SOCIOECONOMIC ENVIRONMENT				
Labour Force and Employment	Construction/Operation and Decommissioning	Employment and contract services required for Project construction/ operation and decommissioning phases.	Employment opportunities associated with the Project will be advertised as needed within the Regional Project Area.	None (adverse) to Minor (benefit)
Emergency Services	Construction/ Operation, and Decommissioning	Accidents, malfunctions and extreme natural events such as storms.	An Emergency Response Plan will be available on-site during Project construction and operation that will clearly outline appropriate emergency response protocol. CanWhite will notify the RM of Springfield emergency services when Project construction/operation will begin. Measures to avoid accidents and malfunctions as described in Table 6-5 will be applied.	Minor
Community Services	Construction/ Operation, and Decommissioning	Requirement for use of Local and Regional Project Area supplies and services (e.g. contractor services; waste removal)	Solid waste will be transported by a licensed local contractor to be disposed at a local licenced landfill to an amount that would be sustainable for the local landfill. Otherwise, solid waste will be transported 63 km to the Brady Road Landfill managed by the City of Winnipeg. CanWhite may initiate agreements for local / regional community services that would be beneficial for both the RM of Springfield and the Project.	None (adverse) to Minor (benefit)
Land and Resource Use	Construction/ Operation, and Decommissioning	Use of the Project Site for Project activities which will result in temporary use of a very limited portion land each	Land use for Project activities will occur in accordance with municipal and provincial approvals and legislative requirements. Due to the progressive annual reclamation of extraction sites and other Project-related disturbed areas, parcels of land used for Project activities during any given year of Project operation	Minor

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
		year of Project operations.	will be available for other uses the following year or once the activities are complete.	
Human Health	Construction/Operation, and Decommissioning	Increased traffic due to employees and contractors accessing the Project Site; dust and noise generated by Project activities.	Mitigation measures that will avoid or minimize potential adverse effects on human health are those that will be implemented to control noise (See Noise component in this table), avoid or minimize effects on air quality (see Air Quality component in this table) and avoid or minimize effects on climate (see Climate/Greenhouse Gasses component in this table).	Negligible
			All CanWhite employees will abide by the standards, procedures and training required under <i>The Workplace Safety and Health Act</i> as well as CanWhite's internal Health and Safety Program and Emergency Response Plan.	
			Employee Orientation and Safety training will be mandated for all new hires in addition to required yearly safety reviews for existing staff.	
			Applicable personal protective equipment (PPE) will be provided to employees. Where required, visitor orientation and PPE will be provided when visitors enter employee only areas.	
Effects on Indigenous and Treaty Rights	Construction, Operation, and Decommissioning	Potential effects as above Land and Resource Use and Human Health components.	<p>The Project is not expected to adversely impact the exercise of Indigenous or Treaty rights because:</p> <ul style="list-style-type: none"> • The Project Site consists of private land covered under private surface rights that do not have public access unless by permission • No fish or fish habitat will be affected by the Project (See Fish and Fish Habitat section of this table); • The residual environmental impact of the Project on vegetation beyond the Project Site is assessed to be negligible (See Vegetation section of this table); and • The residual environmental impact of the Project on regional wildlife populations is assessed to be negligible (See Wildlife section of this table). 	None anticipated ⁸

⁸ Note: there are no First Nation reserve lands within the Local or Regional Project Area.

Environmental and Social Component	Project Phase	Sources of Potential Effects	Summary of Measures *	Residual Adverse Impact
Heritage Resources	Construction and Decommissioning	Clearing, leveling, compacting, ditching for water drainage as required; removal of Project infrastructure and rehabilitation of disturbed areas	If heritage resources are discovered within the Project Site, work will be stopped, HRB will be advised, and the discovered historic resources will be recorded by an archaeologist and adequately protected as required.	Minor
			The heritage resources protection practices outlined in the Heritage Resources Protection Plan for the Facility Project will also be used for this Project (AECOM 2020).	

*Additional mitigation measures are proposed in the Closure Plan (**Section 7**) and submitted to Manitoba Conservation and Climate as a requirement under the project licencing process. **Section 7** outlines detailed mitigation and monitoring requirements for reclamation of the Project Site.

Table 6-5: Summary of Potential Accidents and Malfunctions and Measures to Mitigate Risk of Occurrence

Risks Associated with Accidents and Malfunctions	Project Phase	Possible Consequences	Measures to Reduce Risk of Occurrence	Conclusion
Worker Health and Safety	Construction/ Operation and Decommissioning	Risk of workplace accidents affecting worker health.	Worker protection in Manitoba is regulated through standards, procedures, and training under the Workplace Safety and Health Regulation, M.R. 217/2006.	Risk is assessed to be appropriately mitigated
			Safety equipment and personal protective equipment will be supplied to employees.	
			Employees and contractors will be subject to site specific environmental health and safety orientation for all phases of the Project.	
Spills and Leaks	Construction/ Operation and Decommissioning	Spills and leaks from diesel fuel, lubricants, oils, hydraulic fluids, and other hazardous materials can have adverse effects to air quality, water quality, groundwater quality, wildlife, plants and human health and safety.	Diesel tanks used on-site will be self-contained aboveground storage tank(s).	Risk is assessed to be appropriately mitigated
			When servicing requires drainage or pumping of lubricating oils or other fuels from equipment, a groundsheet of suitable material and size will be spread on the ground to catch all fluid in the event of a leak or spill. An adequate supply of suitable absorbent material and any other supplies and equipment necessary to immediately clean up spills will also be available.	
			Storage and disposal of liquid wastes and filters from equipment maintenance, and residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with existing regulations.	
			Waste oils, fuels, and other hazardous wastes will be handled in a safe manner. Staff will be required to transport, store, and handle all such substances as recommended by the suppliers and/or manufacturers and in compliance with applicable federal, provincial, and municipal regulations. Manitoba Conservation and Climate will be notified immediately if a reportable spill occurs.	
			Fuels, oils, or other hazardous materials will be stored only in designated areas.	
			Storage sites will be inspected regularly for compliance.	
			Personnel on-site will be trained in how to deal with spills, including knowledge of how to properly deploy site spill kit materials which will be available on-site.	
			Spill kits will be stationed and readily available for easy access.	
			Service and repairs of equipment will only be performed by trained personnel.	

Risks Associated with Accidents and Malfunctions	Project Phase	Possible Consequences	Measures to Reduce Risk of Occurrence	Conclusion
			<p>Vehicles and Equipment will have pre shift inspections and walk arounds to ensure no fluid leaks, primarily from the fuel system and/or hydraulics. Any detected leak will result in the unit being pulled from service until repaired. All service and repairs will be logged and tracked in the units operating and maintenance logs. A manufacturer defined maintenance and preventative care will be practiced by CanWhite and its employees.</p> <p>Slurry and water return line will be inspected on a regular basis, and after extreme weather events, to check for leaks and/or breaks in the line. If leaks or breaks in the line are detected, appropriate spill containment and clean-up measures will be applied as soon as feasible and piping will be repaired or replaced.</p> <p>Fuel and chemical handlers will be trained and qualified, and appropriate emergency response measures will be in place and readily available.</p>	
Fires and Explosions	Construction/ Operation and Closure	Accidental fires and explosions from mechanical equipment, fuels, and other hazardous materials may result in loss of equipment and infrastructure, worker health and safety risk, and deterioration or loss of natural habitat.	<p>Removal of flammable waste on a regular basis and disposal at a licenced disposal facility.</p> <p>Workers will be provided with appropriate fire prevention training.</p> <p>Appropriate fire extinguishers will be available on the Project Site. Such equipment will comply with and be maintained to the manufacturers' standards, and employees will be appropriately trained in their use.</p> <p>Storage, transportation and use of hazardous materials, including flammable waste, will comply with regulatory requirements.</p> <p>On-site fire prevention/response equipment will be checked on a routine basis and in accordance with local fire safety regulations to maintain proper working order.</p> <p>Greasy or oily rags or materials subject to spontaneous combustion will be deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and be disposed of at licenced waste disposal facility.</p> <p>Emergency communication devices will be available and easily accessible to personnel to communicate and emergency as not all sites will have cellular signal.</p> <p>Smoking will be restricted to designated areas.</p>	Risk is assessed to be appropriately mitigated
Transportation Accidents		Vehicular collisions (human health and	The sand slurry will be transported from the extraction wells to the sand Processing Facility directly by slurry line rather than using transport trucks.	Risk is assessed to be

Risks Associated with Accidents and Malfunctions	Project Phase	Possible Consequences	Measures to Reduce Risk of Occurrence	Conclusion
	Construction/ Operation and Decommissioning	safety, traffic disruption, road closure, release of contaminants) and wildlife collisions (loss of wildlife, human health and safety, road closures).	<p>Personnel retained to drive and operate vehicles and construction equipment will have a valid appropriate-Class Manitoba Driver's License with a copy provided to CanWhite.</p> <p>Speed limits on access roads, local road and Provincial Highways will continue to be implemented. Signage and speed limits on the PR 302 and PTH 15 are regulated by the Province of Manitoba.</p>	appropriately mitigated

7. Closure Plan

At the request of Manitoba Conservation and Climate, a Closure Plan will be developed and submitted to Manitoba Conservation and Climate for this Project accordance with the Manitoba Mine Closure Regulation 67/99 General Closure Plan Guidelines, although this Project is proposed to be licenced under *The Environment Act*. For this reason, the cost estimate associated with a required Closure Plan under *The Mines and Minerals Act* has not been provided at this time but will be provided on request from the applicable regulatory agency.

7.1 Site Decommissioning

The decommissioning of the Project will be conducted in accordance with a Closure Plan and will generally include the following:

- Sealing and decommissioning of extraction wells and well cluster sites;
- Removal and disposal of miscellaneous infrastructure (e.g., slurry and water return lines; pumping stations; generators);
- Removal of sand overs/fines (some to be used in well decommissioning)
- Removal of surface and well drilling equipment;
- Removal of propane, fuel and oil tanks, as applicable;
- Testing and remediation of contaminated soils, as required;
- Re-grading and contouring of previously disturbed areas; and
- Revegetation of disturbed areas to restore the landscape to native conditions to the extent feasible.

As observed at previous mine closures in the region, the growth of grasses and forbs is expected within the first few years following closure. The establishment of shrubs and trees is expected to be evident within 5 to 10 years following closure.

7.2 End Use

At the Project end of life, the Project Site will be returned to a natural state to the extent possible, with no known plans for residential, commercial or industrial development on the site at this time.

8. Follow-up Plans

Follow-up programs verify the accuracy of the environmental assessment of a project and determine the effectiveness of measures taken to mitigate the potential adverse environmental effects of the project. **Sections 8.1 to 8.9** describe the follow-up plans and programs will be implemented during the construction, operation, and decommissioning phase of the Project. The follow-up plans and programs developed for this Project are intended to be 'living documents' that will be updated periodically, as needed, and will be available on-site as reference documents for Project staff and contractors.

8.1 Waste Characterization and Management Plan

This document will focus on expanding the dataset for geochemical interpretations and validating the conclusions of the geochemical assessment. It will be developed under the guidance of a geochemist with specialization in ML/ARD to guide future characterization, management and monitoring of geologic waste materials generated during Project operations. It will be consistent with industry guidance pertaining to the characterization and management of waste materials to prevent, manage and mitigate ML/ARD risks. It will likely rely on characterization of drill cuttings during operations and additional geochemical testing in the laboratory, or field testing to evaluate the geochemical behaviour of each rock type under field conditions.

The objectives of the Waste Characterization and Management Plan will be to:

- Describe Project activities, with a focus on site preparation, silica sand extraction and the resultant waste streams.
- Summarize characteristics of each type of waste material that will be extracted based on the Hydrogeology and Geochemical Assessment report (**Appendix A**), literature and laboratory testing.
- Describe protocols for identifying, sampling, characterizing and managing waste materials to minimize the risk of ML/ARD and incremental impacts to the environment by following protocols consistent with industry standards.
- Define appropriate end uses for each type of waste material based on the volume of waste material generated, degree of characterization, geochemical classification (e.g., Potentially Acid Generating [PAG], Uncertain, Non-PAG, Metal Leaching [ML]), understanding of its geochemical behaviour and the intended end use.
- Describe measures that can be implemented to mitigate ML/ARD and incremental impacts to the environment.
- Describe protocols for monitoring surface water and groundwater quality to assess field performance against the design goals and objectives of the management plan.

The Waste Characterization and Management Plan will include procedures for documenting and reporting information obtain through the various characterization and monitoring activities contained in the Plan. This will include reporting frequency, minimum information to be contained within reports (soil quality, surface and groundwater quality, geochemical testing data, volume of waste generated), and procedures for the review and modification of monitoring programs.

8.2 Water Management Plan

The Water Management Plan will establish policies, procedures and objectives for the management of water during operations and closure pertaining to management of surface water, groundwater, slurry and process water contained in the slurry lines. It will include separation of contact/non-contact water and management of sediment-laden water related to Project operations.

The objectives of the Plan will be to:

- Describe Project activities, with a focus on site preparation, silica sand extraction and the resultant flow of water, solids and/or slurry, the volume of storage vessels and the expected volume of groundwater returned to the aquifer. The volume of water required to commission the slurry system each year will be provided.
- Describe the operational management strategy for water and solids during operations and closure phases of the Project. Inputs to the water balance, storage volumes and outputs will be identified for Extraction Mobile Equipment.
- Establish a framework for monitoring of water, solids, and slurry flow during and following Project operations to assess field performance against the design goals and objectives of this Water Management Plan.
- Establish the parameters that will be monitored, the frequency of monitoring, monitoring locations (e.g. pumping rates, groundwater use, return rates).
- Identify best management practices for the management of water, solids, slurry and sediment during Project operations and closure to protect groundwater and surface water resources.

The Water Management Plan will present a refined water balance for the extraction and reinjection/treatment of groundwater following additional testing by CanWhite to refine the solid/liquid ratio and the volume of water required to commission and decommission the conveyance system each year. It will specify elements that require ongoing monitoring and confirmation (e.g. pumping rates, groundwater use, reinjection rates).

The water monitoring component of the Water Management Plan will rely on the following components:

- Establishment of a groundwater and surface water monitoring network consisting of flow meters, and water level monitoring devices to facilitate monitoring of water levels, pressures, stored quantity and flows during and after seasonal extraction operations.
- Assessment of groundwater return efficiency based on volume of sand extracted.
- Routine inspections of water management infrastructure including extraction facilities, mitigation measures, conveyance piping, storage volumes, and other water management related infrastructure.
- A rigorous water monitoring plan to confirm the findings of the Hydrogeology and Geochemistry Assessment (**Appendix A**) with respect to the effective pumping rate from each extraction well and the resultant zone of influence around Project operations to confirm the magnitude and extent of any impacts on groundwater quantity. Results will be evaluated by a qualified professional with experience in hydrogeology and geochemistry, with findings reported.
- Primary mitigation measures (Best Management Practices) that aim to avoid impacts and secondary mitigation measures that aim to sufficiently minimize any potential effects to reduce any impacts.

The Plan will also establish a framework for reporting. A procedure for documenting and addressing public concerns and complaints will be included in the Plan.

8.3 Progressive Well Abandonment Plan

The purpose of the Progressive Well Abandonment Plan (PWAP) is to provide an operational plan for progressive closure of each extraction well to ensure groundwater resource remains protected. The PWAP is developed in a manner that is consistent with industry standard practice and meets or exceeds the requirements of *The Groundwater and Water Well Act* and its supporting regulations, including the Groundwater and Water Well Regulation and the Well Standards Regulation. The PWAP will also meet borehole abandonment requirements of *The Mines and Minerals Act* and borehole licences issued under Part 3 of the Drilling Regulation.

Wells will be abandoned (also know as well sealing) in accordance with *The Groundwater and Water Well Act* and with guidance from the Construction and Sealing Wells in Manitoba – Information for Well Driller and Well Sealers document (Manitoba Government, 2018).

The following procedures will be used to abandon or seal Project wells:

1. A mechanical plug will be placed at the predetermined depth to isolate the movement of water within the already cemented casing between the sandstone and limestone aquifers. Then a bentonite plug will be placed prior to cementing to ensure the cement does not dilute or leak into the water prior to setting.
2. Above this plug, a several foot-thick cement plug will be placed and allowed to set. Cement will be pumped into place using a tremie grout system. The cement plug will be confirmed by manual contact prior to proceeding to the next step.
3. Once set, layers of bentonite and pea gravel will be used, or a benitoite grout to 5 feet (1.5 m) within surface.
4. Where pea gravel and bentonite are used, no more than 15 feet (4.6 m) of pea gravel will be used before another layer of bentonite. In addition, careful attention will be paid to the layering of bentonite across any interfaces between aquifers (e.g., the limestone to the till interface) to prevent vertical mixing of the aquifers.
5. A 5 feet (1.5 m) thick cement cap will be placed at the very top, allowed to set and then the topsoil/organics are replaced on top of the cement to allow for vegetation regrowth/remediation of the surface land to occur.
6. Detailed logs will be kept of the well abandonment and depths of each layer, in addition to the GPS coordinates of each well.

This procedure will be used in all extraction wells and wells that exceed 2 inches (5 cm) in diameter. Where a monitoring well exists, these are often nested 5-inch (12.7 cm) and 2-inch (5 cm) PVC (polyvinyl chloride) casing sizes. As per the above referenced guidelines (Manitoba Government, 2018), the 2-inch (5 cm) casing is grouted the entire length of the well as other sealing materials like bentonite chips can bridge off (expand and create a blockage) in the small diameter PVC casing.

8.4 Groundwater Monitoring and Impact Mitigation Plan

This document will establish a framework for survey of existing domestic wells in advance of operations, monitoring of groundwater quantity and quality during and following Project operations, and responding to well owner complaints. It will establish the parameters that will be monitored, the frequency of monitoring, monitoring locations and reporting requirements. Mitigation measures will be developed to avoid and/or mitigate any well interference issues as required by *The Water Rights Act*.

The Groundwater Monitoring and Impact Mitigation Plan will be designed to:

- Describe Project activities, with a focus on site preparation, silica sand extraction and the resultant waste streams.
- Summarize hydrogeological characteristics of each aquifer and aquitard, including an overview of groundwater flow based on the Hydrogeology and Geochemical Assessment report (**Appendix A**).
- Establish a framework for survey of existing water supply wells in advance of operations, monitoring of groundwater quantity and quality during and following Project operations, and responding to well owner complaints.
- Describe protocols for monitoring surface water and groundwater quality to assess field performance against the design goals and objectives of this Groundwater Monitoring and Impact Mitigation Plan, Waste Characterization and Management Plan and the Water Management Plan.
- Establish the parameters that will be monitored, the frequency of monitoring, monitoring locations and reporting requirements.
- Identify mitigation measures required to avoid and/or mitigate any well interference issues. Mitigations may include establishment of a set back distance between extraction activities and wells, modification of extraction operations to avoid impacts, lowering of pumps or provision of alternate water supply.
- Establish a framework for reporting findings.

The groundwater monitoring component of the Plan will address the following components:

- Establishment of a regional and local groundwater monitoring well network consisting of monitoring wells completed in the Glacial Sediments, Red River Carbonate and Winnipeg Sandstone to facilitate monitoring of groundwater levels (groundwater quantity), and groundwater quality before, during and after operations. Proposed Project activities will be evaluated in advance of each operational year to determine the zone of influence and water supply wells that may be impacted by Project operations. A local groundwater monitoring well network may be installed to supplement the regional network based on proximity to Project operations each year and access to existing water supply wells for monitoring.
- Conducting a water well survey within the zone of influence to determine the precise location of existing water supply wells, well construction, well condition, well performance history and water quality. Some of these wells may be utilized to expand upon the regional groundwater monitoring well network before, during and immediately following nearby Project operations.
- A rigorous monitoring plan to confirm the findings of the Hydrogeology and Geochemistry Assessment (**Appendix A**) with respect to the zone of influence around Project operations and any impacts on groundwater quantity and groundwater quality. Results will be evaluated by a qualified professional with experience in hydrogeology and geochemistry, with findings documented.
- Primary mitigation measures that aim to avoid impacts and secondary mitigation measures that aim to significantly reduce any impacts.

The Groundwater Monitoring and Impact Mitigation Plan will also contain provisions for the development of monitoring reports that interpret impacts from operations on water quantity and quality, and a procedure for documenting and addressing private well owner concerns and complaints will be prepared and implemented.

8.5 Erosion and Sediment Control Plan

Erosion and sediment control will be applied to all aspects of the Project as required including development and operation of extraction wells, placement of slurry pipe, and any access trail and ditch construction. The implementation of environmental best management practices (BMP) to limit sediment introduced to streams, ditches and low-lying wet areas will require sound judgment by the contractor based on dialogue

with CanWhite, AECOM, and regulators according to the natural conditions at each site. The general approach to the ESC Plan implementation will be to monitor construction activities, preserve the natural environment to the extent possible, minimize the extent of disturbance, implement the BMP measures to reduce the amount of erosion or sedimentation, and respond to concerns and additional measures required from a list of acceptable BMPs to prevent erosion or sedimentation.

The objective of the Erosion and Sediment Control (ESC) Plan is to prevent, minimize and/or control the potential for erosion and sediment accumulation that transpire on site as a result of natural environmental occurrences or human induced events. The water that enters or leaves the Project site is to be controlled so that deleterious materials do not leave the site and sediments are not transported elsewhere and potentially cause further environmental damage.

8.5.1 Application of Erosion and Sedimentation Control Best Management Practices (BMP)

The following list of BMPs are provided as a quick reference of measures to be implemented at all applicable sites regardless of proximity to watercourses, channel bed slope or soil type. These measures would be considered a first level of protection suitable in all locations and weather events.

- Adhere to the conditions of the Environment Act License and other applicable approvals.
- Modify work accordingly when seasonal and environmental influences increase the risk of wind and water erosion and sedimentation.
- Existing vegetation provides natural erosion and sedimentation control and these features should be maintained as much as possible. Make every reasonable effort to minimize disturbance by confining the work area to the predefined and staked area.
- Protect aquatic areas from sedimentation by installing and maintaining silt fences, energy dissipation and erosion control mats or other erosion control devices such as a straw blanket on disturbed slopes. Silt fences will need to be checked after rain events to ensure that they are still in place and functioning as intended.
- Replace topsoil and restore the area to the original condition (to the maximum extent possible) as soon as practical upon completion of construction using an appropriate seed mix or fast-growing cereal crops for late fall or spring germination.
- Maintain natural drainage patterns as much as possible and implement new drainage patterns as designed.
- Place excess material from the excavation in a location where it won't be a source of siltation to any wetland areas.
- Provide dust suppression as required.
- Construction should occur in stages to minimize dust erosion from exposed soils.

Ensure that employees are aware of this ESC Plan and that they are trained on how to prevent erosion and siltation from happening on the Project.

8.5.2 General Site Management

Erosion and sedimentation will be controlled, to the degree possible, by implementing the ESC Plan practices described in the BMPs above and by following the best site management practices below:

1. General ESC Plan practices are to be discussed with the Contractor at the start of construction and will be adhered to at all times.
2. Vegetation clearing will not be permitted from April 14 to August 24 inclusive to protect breeding migratory bird species.

3. The Contractor must ensure that employees are trained on the implementation, inspection, maintenance and repairs of ESC BMP outlined in the ESC Plan.
4. All manufactured erosion control devices will be installed and maintained in accordance with the manufacturer's recommendations.
5. Erosion and sediment control measures will be inspected at the frequency indicated below during construction and afterwards to ensure that they are functioning properly and are maintained and/or upgraded as required until vegetation has been re-established on the disturbed area.
 - Daily, informal checks during active construction and after storm events by the appointed on-site contractor personnel.
 - Weekly, formal inspections during active construction.
6. Phase construction to limit soil exposure to wind and water erosion. Stabilize exposed soils as soon as practical following construction and before commencing the next stage of construction by using protective barriers or plant materials.
7. Every reasonable effort must be made to minimize disturbance to wetlands and to retain as much of the existing plant cover as possible.
8. Maintenance of erosion control materials and structures is necessary and silt that accumulates in silt fences will be removed and disposed of in a location which is at least 100 m from any known water body, wetland or storm water drainage channel.
9. The installation of permeable sediment barriers or permanent erosion control measures, site clearing, and any earthworks such as ditch or embankment grading will occur before the removal of temporary measures.
10. All equipment on site will be maintained free of external grease, oil and mud. Measures must be taken to ensure that gasoline, diesel fuel, grease or other deleterious substances do not enter the water body or wetland. Fuel will be stored, and equipment shall be refueled and serviced, at least 100 m from any surface water. A fuel spill kit must be available for use on site in case of accidental fuel or oil spill.
11. On a daily basis the construction site must be cleared of scrap wood, excess concrete and other debris, and disturbed soils adequately protected with rip rap, vegetation or geo-fabric to prevent erosion from seasonal precipitation runoff.

The contractor(s) will be made aware of all concerns with regard to erosion and sedimentation and be given a copy of the ESC Plan. Judgment will be used to determine the most viable options for erosion prevention and sediment control considering factors such as site conditions, site access needs, and both seasonal and daily forecasted weather.

8.6 Environmental Emergency Response Plan

CanWhite is committed to protecting the community and the environment in the event that environmental emergency situations arise from the Project. The purpose of the Environmental Emergency Response Plan (EERP) is to identify and respond to potential environmental accidents and emergency situations, and to identify preventative and mitigative measures for any associated potential impacts.

The EERP will outline the general procedures to be followed for environmental emergency situations and incidents that could occur as a result of Project activities, equipment failure, human error, or natural causes. The EERP will identify roles and responsibilities, emergency contact numbers, equipment and resources, and training requirements. A copy of the will be maintained on-site during all phases of the Project.

An Environmental Manager (or designated person) will review and revise, as necessary, the EERP quarterly, and after the occurrence of any environmental accident or emergency situation, to ensure its relevance.

The EERP will contain detailed policies and standard operating procedures for the communication of environmental emergency situations to CanWhite employees, contractors, emergency responders, regulators and the general public. The EERP will include procedures for responding to emergencies and reporting and investigating environmental incidents. These procedures will address a variety of potential environmental emergency situations, including:

- Spills of potentially hazardous materials;
- Fire;
- Extreme weather, including hail, thunderstorms, lightning, and flooding;
- Erosion emergency; and
- Wildlife.

8.7 Revegetation Monitoring Program

As described in **Section 6.5.1**, vegetation in areas temporarily disturbed by construction activities is expected to naturally re-establish. A Revegetation Monitoring Program will be implemented to determine the success of the revegetation program and determine if follow-up reseeding or replanting is required using approved native seed mixture and native plantings. Where reseeding or replanting is required, CanWhite will communicate with regional MBCC staff to determine strategies for potentially enhancing revegetation of disturbed areas to benefit wildlife species such as the Golden-winged Warbler which is a Species at Risk that may occur in the Regional Project Area (**Section 4.4.3**).

The revegetation monitoring program will include monitoring during the growing season until the seedlings appear to be established.

8.8 Heritage Resources Protection Plan

As indicated in **Section 4.6.5**, the results of an on-site archaeological investigation found the Project Site to have substantial previous disturbances and concluded that there were no heritage concerns regarding development of the Project at the Project Site (**Appendix G**).

If heritage resources are discovered within the Project Site, work will be stopped, Historic Resources Branch will be advised, and the discovered historic resources will be recorded by an archaeologist and adequately protected as required. The heritage resources protection practices outlined in the Heritage Resource Protection Plan for the Facility Project will also be used for this Project (AECOM 2020).

8.9 Closure Plan

As described in **Section 7**, a proposed Closure Plan will be developed for review and approval by Manitoba Conservation and Climate, as requested, under the Project licensing process. The proposed Closure Plan will outline detailed mitigation and monitoring activities that will be implemented to rehabilitate the Project Site during the closure phase of the Project. Pending provincial review of a proposed Closure Plan, the Closure Plan may be revised to reflect changes or additional requirements that may be needed. As part of a Closure Plan submission, closure cost estimates and financial assurances are required and will be submitted by CanWhite to the province as part of the Project licensing process.

9. Conclusion

CanWhite is proposing to extract high purity silica sand from the Winnipeg Sandstone aquifer (approximately 61 m, or 200 ft below ground) within the Winnipeg Sandstone geological formation southwest of the hamlet of Vivian, Manitoba and approximately 26 km east of the City of Winnipeg from the border of the CanWhite mining claims. The proposed extraction of silica sand, i.e., the Vivian Sand Extraction Project (the 'Project'), is being developed for the purpose of supplying high purity silica sand for use in a variety of markets such as the renewable energy industry (e.g. solar panel production), metallurgical silicon (lithium ion batteries), telecommunications (e.g. fibre optics), smart glass, precipitated silica (e.g. tires, medical and dental), silica carbides (e.g. electronics, cellphones, computer chips) silicon enhanced alloys (e.g. aluminum components for aerospace and automobile), low iron glass (architectural envelopes) and ceramics.

The Project will not be using an open pit quarry method due to the depth of the target sand deposit. Instead, water well drilling rigs will be used to drill extraction wells and install casing to the target sand deposit. The extraction wells will be between 16 inches (40.6 cm) and 8 inches (20.3 cm) in diameter. Using compressed air, silica sand will be brought to the surface with groundwater from approximately 61 m (200 ft) below ground surface depending on the formation depth in the area. Extraction activities will occur April through November (and winter, weather dependant) each year of operation, while well drilling activities will occur year-round.

Key activities and components of the Project will include:

- Establishment of temporary access trails to annual sand extraction areas to accommodate water well drilling rigs.
- Extraction well drilling year-round.
- Sand extraction April to November (and winter, weather dependant) at an initial average of 56 well clusters of seven extraction wells per cluster, annually.
- Maximum of up to seven extraction wells operating simultaneously for 5 to 7 days each.
- Separation of water from sand at the extraction site where excess water is returned to the sandstone aquifer via the sand producing well after UV treatment, and sand enters the slurry transport loop.
- Pre-screening of sand and water slurry at the extraction site to remove material that is too large ('overs') such as concretions (calcified sand), with additional screening occurring at the proposed Processing Facility.
- Temporary contained storage at the well cluster of the overs material and well drill cuttings for disposal or for use in annual progressive closure and decommissioning (i.e. sealing) of extraction wells. Usage for well sealing activities will only be for approved cuttings and may include sandstone or carbonate (limestone).
- Construction of above-ground temporary slurry line (high density polyethylene tubing) and associated pumping stations, to transport the pre-screened sand directly to the Processing Facility and transport recycled water from the Processing Facility back to the extraction sites for re-use.
- Dismantling and relocating the above-ground slurry and water return lines and pumping stations, as needed, to the subsequent annual sand extraction area.
- Treatment of groundwater separated from the sand and water slurry at the extraction site using a UV system before returning excess groundwater to the aquifer via extraction wells.
- Progressive decommissioning (sealing) of annual extraction wells and well cluster areas.

- Progressive annual rehabilitation of temporary drill rig access trails, equipment laydown areas, slurry line trails and return water line trails.

At no time will dry silica sand be left exposed at the Project Site. Sand will be wet and will either be contained within the extraction well lines or the slurry line. Material that is too large ('overs'), such as concretions (calcified sand), will be stored in appropriate containment prior to removal from site or for use in well sealing activities. Therefore, the risk of silica sand dust dispersal is eliminated.

The sand Processing Facility and associated infrastructure, including the rail loop and interconnection with the existing Canadian National Railway, are being reviewed by Manitoba Conservation and Climate (MBCC) as a separate project requiring a separate Environment Act Licence to proceed. Therefore, the Processing Facility and associated infrastructure components are not assessed within this Environment Act Proposal.

Extraction activities will gradually progress further from the Processing Facility each year within blocks of land adjacent to previous year extraction activity land areas over the anticipated 24-year life of the Project. CanWhite is currently applying for an Environment Act Licence for extraction activities up to and including 2025 because advancements in extraction methods and operations are expected to increase efficiency and reduce overall footprint after 2025. This will be explained in subsequent Notices of Alteration for the future potential extraction years, with the information and review process for Notices of Alteration of an Environment Act Licence for the Project being as required under Section 14 of *The Environment Act*. Therefore, the scope of this Environment Act Proposal is limited to the proposed activities and Project spatial extent up to and including 2025.

Following provincial and municipal regulatory approval of the proposed Project, the initial year of extraction activities will begin Q3/Q4⁹ 2021, then April through November (and winter, weather dependant) for each extraction year thereafter. Activities will occur 24 hours per day, seven days/week (24/7) up to and including 2025. Extraction well drilling will occur year-round.

The results of the environmental and socioeconomic effects assessment are summarized as follows:

Geology/Topography

Impacts on topography and geology have been assessed as being minor.

While measurable disturbances will be imposed on topographic features during Project construction and operation, disturbances will be limited to the Project site. Effects on topography will be minimized by using existing roads, trails and other previously disturbed areas to the extent feasible to minimize disturbance to the natural topography. Levelling and grading will occur upon Project decommissioning to return the landscape to elevations typical to the surrounding area.

Impacts to geology are assessed as being minor due to the abundance of remaining silica sand resource with approximately 1.06% of sand removed through the 24 year life of the project, and approximately 0.18% up to and including 2025 in the target regional aquifer geological layer within the Project Site.

⁹ Note: QX = year quarter (e.g. Q1 = January through April timeframe)

Soils

The potential for soil erosion and associated adverse impacts to the surrounding environment are anticipated to be minor and restricted to the Project site.

The sequential extraction activity areas disturbed during Project operations will be revegetated as quickly as feasible to stabilize the soil and minimize soil erosion. An Erosion and Sediment Control Plan will be implemented for all phases of the Project. During the progressive annual decommissioning activities, after Project components have been removed, the landscape will be leveled and graded, and disturbed areas will be revegetated as quickly as feasible to stabilize the soil and minimize soil erosion.

Groundwater

The potential risks to groundwater are assessed to be minor, seasonal in duration and reversible. Water levels in local area domestic groundwater wells in the Winnipeg Sandstone and Red River Carbonate aquifers in the areas surrounding active sand extraction wells are expected to recover 80% in first two days with the remaining 20% recovering over a period of 20 to 80 days following the end of the extraction activities each year.

The slurry loop system for transporting sand to the facility is designed to not require any additional water which allows for the majority of the water that comes from the extraction well to be returned to the aquifer within a short period of time. Therefore, very little extraction of groundwater from the aquifer is required.

A comprehensive hydrogeological and geochemical assessment was undertaken involving field investigation, data analysis, numerical groundwater modelling and geochemical modelling, with the results described in an extensive, peer-reviewed hydrogeology and geochemistry assessment report. Overall, drawdown effects associated with sand extraction were simulated to be localized, with limited to no effects beyond 1,500 m (4921 ft) from the active extraction wells when the majority of the groundwater is reinjected. During a pumping test, little to no decline (0.02 m to 0.77 m) in water levels was observed in the existing domestic wells near the Project site in the Winnipeg Sandstone or Red River Carbonate aquifers and no negative impacts were reported by well owners. Water levels in the observation well network declined by up to 8.5 m (Winnipeg Sandstone) and 1.5 m (Red River Carbonate) at a distance of 89.3 m from the pumping well. Drawdown effects are largely restricted to the Project Site boundary, but minor effects are anticipated to extend beyond it during and immediately following operation of extraction wells close to the boundary.

Based on a comprehensive geochemical assessment that included geochemical modelling, the overall quality of groundwater within the maximum footprint of the Project will be largely preserved. The activities associated with Project operations and post-closure phases of the Project were determined to have a temporary and minor impact on groundwater quality. For some constituents, the impact was simulated to be positive due to reduction of concentrations of iron and manganese when oxygen (air) is introduced into the aquifer or is allowed to mix with water containing lower concentrations of those elements.

The following measures are expected to mitigate groundwater withdrawal effects and potential for groundwater contamination:

- Process water will be recycled in a loop system for reuse, which reduces the quantity of water required from groundwater;
- When each well is drilled, casing will be installed and grouted in place to isolate the Red River Carbonate and Winnipeg Sandstone aquifers from one another and thereby preventing vertical mixing of waters;

- Extraction wells will be progressively (sequentially) established and sealed (decommissioned) during the ongoing sand and groundwater extraction activities in accordance with applicable guidance documents such as 'Constructing and Sealing Wells in Manitoba' (Province of Manitoba, 2018) and Environment Act Licence requirements;
- Geochemical modelling has indicated that reinjection of groundwater (which will be UV-treated) back to the sandstone aquifer will not adversely affect groundwater quality in either the sandstone or carbonate aquifers;
- A Waste Characterization and Management Plan, Water Management Plan, Groundwater Monitoring and Impact Mitigation Plan and Progressive Well Abandonment Plan will be developed and implemented to protect groundwater quality and guide responses to any potential impacts to groundwater quantity and quality. Measures will be developed to avoid and/or mitigate any well interference issues as required by *The Water Rights Act* of Manitoba.

With the application of the above mitigation measures and utilization of groundwater at sustainable rates as determined by ongoing hydrogeological testing and monitoring, impacts to groundwater are anticipated to be minor, seasonal in duration and reversible. Considering there will not be a continuous and unsustainable drawdown on the regional groundwater aquifer for Project processes and that the majority of the water that comes from the extraction well will be returned to the aquifer within a short period of time, effects on groundwater quantity in the regional aquifer can be managed by adhering to a Water Management Plan and by implementing a Groundwater Monitoring and Impact Mitigation Plan. The aquifer will also continue to be recharged through natural groundwater recharge processes (i.e. rain and snow melt) and lateral groundwater flow. Effects on groundwater quality will be minor and, in some cases, positive. Risks to groundwater quality will be mitigated through application of a Waste Characterization and Management Plan, Progressive Well Abandonment Plan and a Groundwater Monitoring and Impact Mitigation Plan.

Air Quality

The impact of the Project on air quality is assessed as minor to negligible.

Project activities are expected to have a negligible effect on air quality due to dust generated by movement of drill rigs and other mobile equipment, and due to exhaust emissions including nitrogen dioxide (NO₂), carbon monoxide (CO) and sulfur dioxide (SO₂).

At no time will dry silica sand be left exposed at the Project Site. Sand will be wet and will either be contained within the extraction well lines or the slurry line, or material that is too large ('overs'), such as concretions (calcified sand), will be stored in appropriate containment prior to removal from site or use in well sealing activities. Therefore, the risk of silica sand dust dispersal is eliminated.

Measures that will be applied to minimize potential Project effects on air quality include the following:

- Minimizing idling of motorized equipment to the extent feasible;
- Applying water on gravel roads to control dust, as required; and
- Equipment and vehicles will be properly maintained.

With the application of the above measures, impacts on air quality are expected to be sufficiently mitigated

Climate/Greenhouse Gases (GHGs)

The impact of the Project on GHG contributions to the atmosphere is assessed as negligible.

Overall, the Project is estimated to generate 0.006797411 tonnes (Mt) of CO₂e annually with the application of the above mitigation measures, which is 0.0296% of the reported Manitoba emissions in 2019 which were 23 Mt CO₂e, about 0.000931% of the reported 730 Mt CO₂e from Canada in 2019.

Noise

The impact of the Project on noise levels at nearest points of reception (e.g. nearest residences) is assessed as minor to moderate with intermittent duration and short-term frequency.

Example noise sources associated with Project activities include mobilization of extraction well drilling equipment, drilling of wells and operation of pump stations.

The following measures will be implemented to reduce noise generated from Project activities:

- Vegetation clearing will be minimized to the extent feasible.
- Project activities will setback a minimum of 100 m from nearest residences.
- Mobile equipment and vehicles will be kept well maintained and will be fitted with mufflers, and other noise mitigation equipment as required.
- Unnecessary idling and revving of engines will be avoided.
- Additional noise mitigation measures will be applied (e.g. portable noise barriers) as required.

In consideration of the above measures to minimize noise levels due to Project activities, it is anticipated that noise levels will be adequately attenuated.

Surface Water

The impacts on surface water are assessed as negligible.

Due to the absence of natural waterbodies such as wetlands in the Project site and immediately adjacent local area that may be potentially affected due to a temporary drawdown effect from sand extraction activities, Project operations are not expected to affect surface water quantity.

Project operations do not involve the use of, or discharge of, any surface water of any kind. Drainage ditching will be constructed along Project access trails and at disturbed areas, as required, to assist in directing runoff flow from rain and snow and maintaining natural drainage pathways through low areas. Portable toilets will be located at active well cluster sites which will be regularly pumped out by a licensed local contractor for proper disposal to prevent potential contamination of local waterbodies with potentially harmful substances. An Erosion and Sediment Control Plan will be implemented for all phases of the Project. Therefore, Project activities are not expected to impact surface water quality.

Fish and Fish Habitat

Project related impacts on fish and fish habitat are not anticipated due to the lack of fish habitat within the Project Site, and application of an Erosion and Sediment Control Plan.

Vegetation

The overall Project impacts to vegetation are assessed as minor within the Project site and negligible within the local area.

The total amount of naturally vegetated area requiring clearing for annual Project operations will vary considering the variable amounts of natural vegetation present within each annual block of Project development lands within the Project Site (which consists of 31% agriculture lands and 13% 'developed'

land). No land cover considered rare for the regional area was observed in the Project site during terrestrial reconnaissance of the Project site. Vegetation species at risk are not expected to occur within the Project site.

The annual footprint area requiring clearing to accommodate other Project components will be minor and temporary, with disturbed areas allowed to revegetate naturally and will be augmented using an approved native seed mixture and native plantings if required. Considering progressive closure, rehabilitation and revegetation of extraction activity areas will be done each year, it is expected that most natural vegetation will be very well established after approximately four years, with reestablishment of trees and shrubs expecting to be evident within five to 10 years following closure.

A Revegetation Monitoring Program will be implemented to determine the success of the revegetation program and determine if follow-up reseeding or replanting is required.

Wildlife

Project impacts on the regional wildlife populations are assessed as negligible.

The types of naturally vegetated land cover (wildlife habitat) that will be cleared (i.e., forest, meadow and willow/alder) are common within the regional area. The amount of naturally vegetated area that will need to be cleared for the Project during each year of operation is minor considering approximately 44% of the Project site is previously disturbed landcover due to human development such as agriculture, roads and aggregate quarries. Project components will be located on previously disturbed land to the extent feasible.

Minimizing vegetation clearing to the extent feasible will limit adverse effects to wildlife habitat and will assist in mitigating noise from Project activities. Noise will also be minimized by the measures described above for the noise topic. Wildlife species present in the vicinity of the Project are anticipated to be accustomed (habituated) to some level of noise due to the presence of existing developments (e.g. agriculture activities, residential areas, roads and aggregate quarries).

Vegetation clearing will take place outside of the spring and summer months to the maximum extent feasible to avoid disturbance to breeding birds and other spring breeding wildlife species. Vegetation clearing will not take place during the breeding bird season (April 14 – August 24).

The minor increase in vehicle traffic in the regional area as a result of Project construction and operation activities is anticipated to result in a minor increase in the risk of vehicle collisions with wildlife given the relatively small spatial scale of the Project site and overall minor increase in regional area traffic.

In summary, the Project is not anticipated to have a measurable effect on wildlife populations, including Species at Risk, within the Interlake Plain Ecoregion.

Labour Force and Employment

Employment opportunities associated with the Project will be a positive, long-term and continuous benefit for the regional area within a reasonable commute time to the Project Site.

Approximately 35 to 45 people will be employed during Project operation activities such as annual site clearing, extraction well drilling, extraction activities and relocation and assembly of temporary Project components. The need for local suppliers and other business to support Project activities is likely to provide an additional 100 to 120 indirect employment opportunities.

Infrastructure and Services

The Project is expected to have minor impacts on regional emergency services because an Emergency Response Plan will be available on-site during Project operations that will clearly outline appropriate emergency response protocols. Standard mitigation measures to avoid accidents and malfunctions will also be applied.

Land and Resource Use

Project activities will occur on CanWhite mining claims sequentially from 2021 to 2025 which will result in temporary use of a very limited portion of the Project Site land each year of the Project. Land use for Project activities will occur in accordance with municipal and provincial approvals and legislative requirements.

Use of the land for other purposes will not be available in the locations of annual Project activities. However, due to the progressive annual reclamation of extraction sites and other Project-related disturbed areas, parcels of land used for Project activities during any given year of Project operation will be available for other uses the following year or once the activities are complete. Sand Extraction activities occur over weeks in one area rather than months, with individual wells over days. Therefore, the Project is anticipated to result in an overall minor temporary adverse impact to land use within the Project site.

Human Health

The measures that will be applied to minimize adverse effects on air quality and noise (as summarized above) are expected to adequately mitigate adverse effects on human health both on and off the Project site.

All CanWhite employees will abide by the standards, procedures and training required under *The Workplace Safety and Health Act* as well as with CanWhite's internal Health and Safety Program and Emergency Response Plan. Employee Orientation and Safety training will be mandated for all new hires in addition to required yearly safety reviews for existing staff. All required personal protective equipment (PPE) will be provided to employees. Where required, visitor orientation and PPE will be provided when visitors enter employee only areas. Therefore, the risk of adverse impacts on human health is determined to be negligible.

Indigenous and Treaty Rights

The Project is not expected to adversely impact the exercise of Indigenous or Treaty rights because:

- The Project Site consists of private land covered under private surface rights that do not have public access unless by permission;
- No fish or fish habitat will be affected by the Project;
- The residual environmental impact of the Project on vegetation beyond the Project site is assessed to be negligible; and
- The residual environmental impact of the Project on regional wildlife populations is assessed to be negligible.

Heritage Resources

Results of an on-site archaeological investigation found the Project Site to have substantial previous disturbances and concluded that there were no heritage concerns regarding development of the Project at the Project site. If heritage resources are discovered within the Project site, work will be stopped, Historic Resources Branch will be advised, and the discovered historic resources will be recorded by an archaeologist and adequately protected as required.

With the application of the above described mitigation measure and given the opinion of a qualified archaeologist indicating no heritage concerns regarding development of the Project at the Project site, the impacts on heritage resources are assessed as minor.

Traffic

The increase in regional area traffic will be not substantial because the sand will be transported to the sand Processing Facility by slurry line rather than by haul truck which will limit traffic associated with the Project staff and contractors during the Project construction and operation. Project staff will be limited to approximately 35 to 45 personnel during Project operations with staff arrivals and departures being staggered daily to accommodate the 24 hours, seven days/week (24/7) operation schedule. Traffic will travel within the Project Site along the PR 302 (Ostenfield Road) for up to 5 km or along municipal road 42E (Queens Valley Road) for up to 1.8 km, south from PTH 15. Therefore, the overall annual increased use of regional roads will be minor.

Aesthetics

The impact of the Project on the aesthetics of the Local Project Area is anticipated to be minor because land disturbances and Project components will be temporary within a very limited area in the Project site during each year of operation. Most of the Project site will remain in the current condition, and vegetation clearing to accommodate the Project footprint will be minimized to the extent feasible. Annual well cluster sites and wells will be progressively closed / sealed each year, and disturbed areas will be rehabilitated throughout each year of Project operation. Setback distances where no activity will occur (e.g. from residences) will be maintained.

Public and Indigenous Engagement

CanWhite has had, and will continue to have, discussions with residents, businesses, local stakeholders, all levels of government and local Indigenous communities in the area. The opportunity for public review of the proposed Project, including the hydrogeological impact assessment study report, will occur during the public review period for this Environment Act Proposal, during which time CanWhite will hold a public meeting to provide Project information and respond to public comments and questions on the proposed Project.

Follow-up Plans and Overall Assessment

The follow-up plans and monitoring programs that will be implemented include, but are not necessarily limited to, the following: Waste Characterization and Management Plan, Water Management Plan, Progressive Well Abandonment Plan, Groundwater Monitoring and Impact Mitigation Plan, Erosion and Sediment Control Plan, Emergency Response Plan, Revegetation Monitoring Program, Heritage Resources Protection Plan and Closure Plan.

It is recommended that mitigation measures, follow-up plans, and monitoring programs described in this report be implemented to avoid or minimize potential environmental effects and/or identify any unanticipated adverse effects early so that appropriate adaptive management action can be undertaken.

In summary, based on the proposed Project description and with the application of the proposed mitigation measures and follow-up plans outlined in this Environment Act Proposal, adverse residual environmental impacts resulting from the Project are expected to be sufficiently mitigated. The success of the Project is anticipated to be a substantial benefit to the local and regional area communities in terms of training, employment, and potential business opportunities related to the services that will be required for the Project and the tax revenue that will be realized with the proposed Project being located in the RM of Springfield.

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