Bulk Agro Centre, Rural Municipality of Brokenhead, Manitoba

Environment Act Proposal Report

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Bulk Agro Centre, Rural Municipality of Brokenhead, Manitoba
Enviornment Act Proposal Report
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List of Acronyms and Abbreviations

AWSA	Agrichemical Warehousing Standards Association
BBA	Breeding Bird Atlas
bgl	below grade level
BSC	Bird Studies Canada
CN	Canadian National
CO	carbon monoxide
CO_2 eq	carbon dioxide equivalent
EAP	*Environment Act* Proposal
Ecodistrict	Gimli Ecodistrict
Ecoregion	Interlake Plain Ecoregion
Ecozone	Boreal Plains Ecozone
ERP	Emergency response plan
ESA	Environmental Site Assessment as it relates to a Phase I/II/III investigation
GHG	Greenhouse gas emission
HRIA	Heritage resources impact assessment
Km	Kilometer
kWh	Kilowatt-hour
LAA	Local assessment area
L/s	litres per second
m	Metre
MAL	maximum acceptable level
masl	Metres above sea level
MCDC	Manitoba Conservation Data Centre
MDL	maximum desirable level
MHA	Manitoba Herps Atlas
Mm	Millimetre
MTL	maximum tolerable level

MSD	Manitoba Sustainable Development
O_3	Ozone
$PM_{2.5}$	particulate matter 2.5
ppb	parts per billion
ppm	parts per million
PR	Provincial Road
PS	Project Site (i.e., Beausejour Consumer's Cooperative Ltd.'s proposed project site for an anticipated new bulk agro centre, near Beausejour, Manitoba)
PTH	Provincial Trunk Highway
RAA	Regional assessment area
RCMP	Royal Canadian Mounted Police
RM	Rural municipality
RTAC	Roads and Transportation Association of Canada
SARA	Species at Risk Act
US	United States of America
VC	Valued component
WDG	Waste disposal ground
WMA	Wildlife Management Area
Wood	Wood Environment & Infrastructure Solutions

Executive Summary

This *Environment Act* Proposal Report (EAP Report) summarizes the environmental assessment completed for Beausejour Consumers Co-operative Limited's (Beausejour Co-op) proposed construction and operation of a new Bulk Agro Centre (the Project Site) on land (roll number 181425, legal land location SE ¼ 12-13-7 EPM) in the Rural Municipality (RM) of Beausejour Manitoba. The Project Site. The Project Site was previously licenced under *Environment Act* licence #2852 (revoked)as a biodiesel fuels manufacturing plant.

As the proposed Bulk Agro Storage Centre will be a bulk materials retail facility, that may blend, handle, sort, store and transfer or sell fertilizer, it is considered a Class 1 Development per the *Classes of Development Regulation of the Environment Act, M.R 39/2016* (the Regulation) and requires an *Environment Act* licence for its construction and operation.

Existing Project Site Conditions

The Project Site was formerly licenced under *Environment Act* licence #2852, for a biodiesel manufacturing plant. The licence was originally issued in 2008 for a biodiesel manufacturing plant with a storage warehouse, chemical tank farm and distribution facilities. In 2015, Brokenhead Biodiesel Fuels applied for a Notice of Alteration (NoA) to change from a biodiesel manufacturing plant to an agricultural crop protection products warehouse. Given that the two operations were distinct development types under the Classes of Development Regulation, the NoA was denied by Manitoba Conservation and Climate and the licence for the Project Site was revoked.

The storage warehouse is the only infrastructure located on the Project Site from the previous development.

Proposed Bulk Agro Centre

Wood has prepared this EAP Report on behalf of Beausejour Co-op as supporting documentation for Beausejour Co-op's EAP for a new development that will be located in the RM of Brokenhead near PTH 44 and PTH 12, near the Town of Beausejour, in Manitoba. The proposed development will consist of the construction and operation of a bulk seed treating facility with six volumetric smooth wall bins, a dry fertilizer storage, blending and loading facility, an AWSA-certified agrichemical warehouse and an office building, collectively referred to as the Bulk Agro Centre.

The Bulk Agro Centre will rely on a drilled well at site for its water needs and an on-site septic tank which will be cleaned out as needed by a contracted septic tank services provider. Office waste generated at the Project Site will be disposed of at the RM of St. Clements WDG. Granular fertilizer waste (e.g., from damaged packaging) will be spread on agricultural fields for disposal, per standard industry practice.

As the Bulk Agro Centre will be located on a previously developed site, and in an area zoned for industrial development, noise and dust generation are not anticipated to affect surrounding residential areas. For security purposes, a 24-hour monitored burglar and fire alarm system will be installed in the facility along with CCTV equipment, proper lighting and ventilation to ensure a safe working environment. The entrance to the property is secured with a gate.

A slight increase in the number of vehicles using both PTH 44 and PTH 12 and accessing the Project Site during the construction and the eventual operation of the Bulk Agro Centre is anticipated. However, the vehicles travelling to and from the Project Site (employees, delivery semi-trucks and consumer vehicles) are not expected to exceed current service capacity levels of either PTH 44 or PTH 12.

Assessment of Projects Effects and Mitigation

The proposed Bulk Agro Centre demonstrates Beausejour Co-op's continued economic investment in Eastern Manitoba and has direct and indirect positive socio-economic effects. These benefits include wages paid to employees, an adequate supply of granular fertilizers and agrichemicals for local and surrounding area agricultural producers, and contributions to municipal, provincial and federal tax revenue.

Beausejour Co-op will implement appropriate mitigation and preventative measures to minimize potential adverse effects to the environment during the construction and operation of the Bulk Agro Centre.

The potential for adverse effects at the Project Site would primarily be related to accidents or malfunctions (e.g., fires, spills and transportation accidents). The Bulk Agro Centre's operational procedures, emergency response plan, mitigation measures, and safe work practices will reduce the potential likelihood as well as the severity of these events.

Potential adverse effects of the construction and operation of the proposed Bulk Agro Centre are primarily related to the following:

- Dust generation during construction (i.e., construction vehicles traffic, soil stripping and stockpiling) and operation (on-site traffic, fertilizer delivery and customer vehicles).
- An increase in noise levels at or near the Project Sitethe Project Site could occur due to the anticipated slight increase in traffic to and from the Project Site during Bulk Agro Centre construction and operation, and potentially affect people and wildlife in the surrounding area.
- Greenhouse gas (GHG) emissions generated by vehicles and equipment during construction and operation activities (e.g., delivery of construction materials; preparation of the Bulk Agro Centre footprint; construction of the Bulk Agro Centre; delivery of granular fertilizers and agrichemicals, and associated customer traffic).
- Changes to soil quality within the Bulk Agro Centre components' footprints during the construction attributable to soil compaction and rutting, erosion and admixing.
- The additional traffic during construction and operation of the Bulk Agro Centre will increase traffic using PTH 44 and PTH 12 and accessing the City of Beausejour's lagoon with potential for localized congestion near the Bulk Agro Centre.

Beausejour Co-op commits to implement the following mitigation and prevention measures to reduce the effects to the environment attributable to the construction and operation of the Bulk Agro Centre:

- Minimizing soil disturbance at the Project Site with soil disturbance limited to the fertilizer bins, chemical shed, bulk seed facility, and office building footprints, including parking areas and driveways.
- Limiting the heights of stockpiled materials on site.
- Using soil stabilizers for soil stockpiles exposed for prolonged periods of time.
- Suppressing dust through use of water or other approved control agents, if needed.
- Limitation of construction hours as required to normal working daylight hours.
- Provision of appropriate hearing protection to workers/employees and encouraging proper use of hearing protection among workers during construction.
- Regular maintenance of vehicles and equipment.
- Minimizing the number of vehicles or equipment in use as far as is practical.
- Disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical where required.
- Construction equipment and vehicle movements will be limited to designated roads/pathways within and around work areas.
- Designated speed limits within the Project Site
- In the event of adverse weather that could result in rutting or compaction (heavy rainfall), the contractor in consultation with Beausejour Co-op should implement contingency measures including use of matting for access through wet areas and limiting or suspension of activities until soil conditions are appropriate.
- Colour change should be used to guide stripping between topsoil (A horizon) and subsoil (B or C horizon) within the Bulk Agro Centre components' footprints to prevent admixing.
- The contractor will be responsible for the appropriate repair of any areas where equipment has compacted soils, with the repairs including appropriate grading and site restoration (if required).
- Traffic should be limited as much as possible during smoothing and levelling of soils to prevent further compaction. Smoothing and levelling should also be avoided if soils are near saturation.
- Areas with vehicle ruts should be de-compacted and regraded.
- Soil stockpiles at the Project Site should be stabilized and adequately protected from erosion with good vegetation establishment or other protective measures.
- Appropriate erosion and sediment control measures should be implemented and maintained.
- During construction, if required, temporary fencing would be used to minimize the interaction of wildlife on the Project Site.

Based on the desktop studies undertaken, site observations and information available to date as presented in this report, the construction and operation of a Bulk Agro Centre at the Project Site is not expected to create significant adverse effects to the biophysical and socio-economic environment and is expected to yield economic benefits. The likelihood of fires, spills and transportation accidents occurring

at the Project Site is limited given the planned implementation of prevention measures and safe work practices at the Project Site.

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1.0 Introduction

This *Environment Act* Proposal (EAP) Report has been prepared by Wood Environment & Infrastructure Solutions, a Division of Wood Canada Ltd. (Wood) on behalf of Beausejour Consumers Co-operative Limited (Beausejour Co-op) in accordance with Manitoba Sustainable Development (MSD)'s *Information Bulletin – Environment Act Proposal Report Guidelines* and *Information Bulletin - Environment Act Proposals for Bulk Material Handling Facilities (Pesticide, Fertilizer and Seed Treatment Handling Facilities)* dated 2017. This EA Report forms part of Beausejour Co-op's EAP filing in pursuit of an *Environment Act* licence for the construction and operation of a bulk materials facility (the Project), which is a Class 1 Development, in the Rural Municipality (RM) of Brokenhead, Manitoba.

Accompanying this EAP Report are the Cover Letter, completed EAP Form, and Application Fee of $1,000 in fulfilment of MSD's EAP submission requirements for Class 1 Developments.

1.1 Project Overview

Beausejour Co-op is planning to construct and operate a new Bulk Agro Centre on land located within SE ¼ 12-13-7 EPM legal land location in the RM of Brokenhead, Town of Beausejour Manitoba (**Appendix A).**

The proposed Bulk Agro Centre will consist of a dry fertilizer loading facility, a bulk seed treating facility, an Agrichemical Warehousing Standards Association (AWSA) certified agricultural chemical warehouse (the chemical shed) and an office building.

1.2 The Proponent

The proponent information for the proposed Bulk Agro Centre is shown in **Table 1-1.**

Table 1-1: Project Proponent Information

Name of Project	New Bulk Agro Centre, Rural Municipality of Brokenhead
Name of Proponent	Beausejour Consumers Co-operative Limited
Address of Proponent	810 Park Avenue, Beausejour MB R0E 1C0
Principal Contact Person(s) for the EAPF	Mr. Kevin Van Den Bussche General Manager D +1 (204) 268-1805 C +1 (204) 799-3396 k.vandenbussche.bjcoop@mymts.net

1.2.1 Company Profile

Beausejour Co-op is a member owned entity which serves surrounding communities with various products and services through its retail operations focused on petroleum products, fertilizers, crop protection products, as well as food stores and gas bars.

Beausejour Co-op's agricultural operations will be run by four full-time employees, and up to four more employees during the busy season (spring and fall).

1.3 Land Ownership and Property Rights

The Project Site is currently in the process of being purchased by Beausejour Co-op (**Appendix B**).

The Project Site is located 405m north of the intersection of Provincial Trunk Highway (PTH) 44 and PTH 12, in the RM of Brokenhead, and approximately 1km north of the Town of Beausejour. Currently in the southeast area of the Project Site there is single-story building within a graveled yard area surround by agricultural land. Photos of the existing Site are found in **Appendix C**.

According to a Phase I Environmental Site Assessment completed at the Project Site (Wood 2020), the Project Site is surrounded by the following neighbouring properties within the RM of Brokenhead:

- North – agricultural land
- South – agricultural land and a residential/farmstead followed by PTH 44
- East – PTH 12 followed by agricultural land
- West – agricultural land followed by the Town of Beausejour lagoon

1.4 Purpose of the Project

The purpose of the proposed project is to construct and operate a new Bulk Agro Centre that will enable Beausejour Co-op to store and sell fertilizer and agrichemical products to producers in the RM of Brokenhead and surrounding areas.

1.5 Regulatory Framework

As the proposed development will consist of a bulk material handling facility for the storage and distribution of dry fertilizer and other agricultural chemicals with an AWSA-certified agricultural chemical warehouse, it is a Class 1 Development per the *Classes of Development Regulation* of the *Environment Act*. As required by Section 10 of the *Environment Act*, construction and operation of the proposed development should be preceded by the filing of an EAP with MCC and receipt of a valid and subsisting licence from MSD for the development.

The activities proposed as a part of the Project are not listed under the Physical Activities Regulations, SOR 2019/285 under the federal *Impact Assessment Act* and as such, it does not require any federal assessment.

Following receipt of an *Environment Act* Licence, Beausejour Co-op will apply for a Development Permit from the RM of Brokenhead to construct the Bulk Agro Centre (**see Section 5.2**).

1.6 Funding

The construction and operation of the Bulk Agro Centre will be funded by Beausejour Co-op.

2.0 Proposed Development

2.1 Current Site Conditions

The proposed development consists of the construction and operation of a Bulk Agro Centre within the Project Site, which was previously partially developed in anticipation of the development of a biodiesel facility. Wood completed a reconnaissance at the Project Site on 28 April 2020 as part of the Phase I Environmental Site Assessment (ESA). The Project Site was found to be partially developed in the

southeast section of the property consisting of a single-story building on a gravelled yard. Photos of the Project Site can be found in **Appendix C**.

The Project Site along with other nearby properties zoned for industrial land-use.

2.2 The Proposed Bulk Agro Centre

2.2.1 Bulk Agro Centre Components

The Beausejour Co-op's proposed Bulk Agro Centre will consist of a fertilizer storage with a dry fertilizer loading facility, an AWSA certified chemical warehouse a bulk seed treating facility and an office building (**Appendix A**). Each component listed is further described below. For security purposes, a 24-hour monitored burglar and fire alarm system will be installed in the facility along with CCTV equipment, proper lighting and ventilation to ensure a safe working environment. The entrance to the property is secured with a gate.

Fertilizer Facility

The fertilizer facility will consist of an 11,214 ft^2 building for granular fertilizer storage, containing approximately 4,000 metric tonnes of capacity. All fertilizer products will be blended inside the shed on an impervious concrete floor which minimizes risk of spills being released externally and any subsequent potential contamination. The fertilizer handling areas will be covered by concrete slabs to reduce the potential for fertilizer losses into the ground and contamination of soil. Concrete pads will be constructed underneath both the truck inload and outload areas, providing another layer of containment in the event of a release. The types of granular fertilizers that will be stored in the fertilizer facility include nitrogen (urea), phosphate, potash, and sulphur. Fertilizer products will be received by bulk truckloads and stored in designated compartments prior to blending and sale to end users.

Agrichemical Warehouse

The existing warehouse on the Project Site will be converted into a chemical warehouse. This building the Project Site is self-contained, with self-supporting steel walls on a concrete floor and footing. The ground-level AWSA certified chemical building has dimensions of 60 feet (ft) wide x 96 feet (ft) long (i.e. 18m x 28m). The agrichemical warehouse includes an 11-inch retention curb around the perimeter inside the agrichemical warehouse to prevent leaking of spilled products to the outside. On the outside surrounding the agrichemical warehouse, to provide secondary containment, there will be a perimeter clay berm. The intent of the construction of any exterior secondary containment structure is to restrict the downward percolation of contaminated run off in the event of a catastrophic failure of the facility (fire, tornado, etc.) (Krystal Penner, MCC, personal communication). **Figure 2-1** below illustrates the most recent clay berm constructed for another Coop facility in the Province.

Figure 2-1: Typical Clay Berm

The volume of the containment within the building is estimated to be 5,225 cubic feet or 147,955 litres. Considering the equipment and pallets, a 10% reduction in the liquid volume is applied, reducing the volume of required containment to 133,160 litres. As per AWSA protocol, the floor and perimeter berm will be treated to render them impervious to liquid in order to contain the product in the event of a spill. The local fire department has indicated that it is able to provide 16,400 litres of water in the event of a fire. The outside berm containment will be located 5-10 meters from the warehouse and can hold an estimated 363,240 litres of liquid.

The facility will meet AWSA warehousing standards, both for the physical structure and the safe operating procedures. **Table 2-1** below contains information on the products to be stored within the warehouse.

Table 2-1: List of Goods in AWSA Warehouse

DANGEROUS GOODS	MAXIMUM AMOUNT KGS OR LITRES		NUMBER OF PALLETS
Flammable Liquids (Class 1B & 1C)	10,000	Litres	10
Flammable Solids (Class 1B & 1C)	10,000	KGs	10
Class II products	30,000	Litres	30
Class IIIA products	100,000	Litres	100
Dangerous Goods PG I	52,000	Litres	52
Dangerous Goods PG II	104,000	Litres	104

Dangerous Goods PG III	156,000	Litres	156
Corrosive TDG Class 8	2,000	Litres	2,000 litres
Non-Regulated Products	480,000	Litres	480

The Bulk Agro Centre will not manufacture or blend any agrichemicals on site but will sell agrichemicals in as-received sealed containers and packaging. The maximum volume of an individual product container is limited to 1,000 L totes with most of the products received stored in smaller individual package volumes. The probability of complete failure of multiple individual containers is deemed extremely low.

Bulk Seed Treating Facility

The bulk seed treating facility will be erected on a 16-inch concrete slab with treating equipment being located within the chemical warehouse. The facility will consist of 6 steel bins, an under bin and outload conveyor system, along with a seed treater and scale. The operation and physical construction of the bulk seed storage / treatment facility will also meet the AWSA standards and audit protocols that have been established.

Office

A 31' x 63' (approximately 9.4 m x 19.2 m) office will be constructed on site. New utility services to the office site will include a 2,000-gal septic tank and domestic water well. Parking stalls will be located on the northside of the building, including parking stalls designated as accessible only, as well as stalls on the eastern side of the building. There will be a meeting room, Co-op personnel offices, reception area, washrooms, storage facilities and a lunchroom. A drawing of the office structure and its associated components is found in **Appendix A**.

2.2.2 Construction of the Bulk Agro Centre

The Bulk Agro Centre will be constructed by an independent contractor that will be retained by Beausejour Co-op. The contractor would provide construction materials and complete the needed construction and installations on site. Construction is anticipated to be completed during the fall and winter from September 2020 to February 2021.

Construction traffic would be minimal as the geotechnical report for the Project Site (**Appendix F)** indicated the Project Site to be on solid ground and additional fill for the project Site is expected to be minimal. A total of 27 vehicles over a six-week period are expected for delivery of Bulk Agro Centre components, i.e., 8 vehicles to deliver the fertilizer bins and equipment, three to deliver the office materials and 16 for the chemical shed. On average there will be up to two vehicle deliveries per day during the six-week material delivery period. It is anticipated that there will be a slight increase in the number of vehicles using PTH 44 and PTH 12 during the construction and operation of the Bulk Agro Centre.

2.2.3 Operation of the Bulk Agro Centre

The Bulk Agro Centre will be run by eight employees, four full-time and four part-time. The Bulk Agro

Centre is expected to be operational throughout the year, with peak periods in the spring through to fall months. It will operate from 8:00 a.m. to 4:30 p.m. from Monday to Friday. However, it is anticipated that during the spring seeding and the fall fertilizer application periods the Agro Centre could operate for 12 to 14 hours per day, seven days a week. During operation, delivery of retail products to the Bulk Agro Centre will be via semi-trucks and possibly B-trains

As a crop supplies outlet, traffic is expected to have seasonal peaks throughout the year. The highest intensity will be during May and October with an estimated 20-30 trucks per day and then five trucks throughout the remaining months between April and November. Only one truck a day is expected over the winter months of December to March. However, the vehicles travelling to and from the Project Site (employees, delivery semi-trucks and consumer vehicles) are not expected to exceed current service capacity levels of both PTH 44 and PTH 12. There will not be a need for modification of the access to the Project Site from PTH 12 due to the proposed construction and operation of the Bulk Agro Centre, as there is a service road in place that currently services the Project Site

Traffic to and from the Bulk Agro Centre will consist of delivery trucks, and customer and staff vehicles. The use of rail transportation for product delivery is not anticipated.

2.2.3.1 Granular Fertilizers

The six granular fertilizer storage bins will each have a capacity of approximately 200 metric tonnes (**Appendix A).** The anticipated types of fertilizers to be stored are nitrogen (urea), phosphate, potash, and sulphur.

Granular fertilizer delivery to the Project Site is anticipated to be done via 265 Super B loads per year.

2.2.3.2 Agrichemical Warehouse

The agrichemical warehouse will be a fully contained portable chemical shed which will be audited to confirm it meets AWSA standards before storage of chemicals is commenced. It is anticipated that the chemical shed will store up to approximately 480,000 L of agrichemical. **Table 2-2** below outlines the potential name brand pesticides and herbicides that could be stored in the warehouse.

Table 2-2: Brand Name Pesticides/Herbicides

AG SURF	FINISH	POUNCE 384	VECTOR 540
AMMONIUM SULPHATE	HEAT LQ	PROSARO XTR	VELOCITY
AG SURF	FINISH	POUNCE 384	VECTOR 540
ARES	LIBERTY	PUMA ADVANCE	VIPER ADV
AXIAL	MANIPULATOR	REZUVANT	XTENDIMAX
BUCTRIL M	MIRAVIS	ROUNDUP TRANSORB HC	2 4-D ESTER LV700
CARAMBA	OCTTAIN	SEVIN XLR PLUS NOVA	CORAGEN
CENTURION	PATRON II	SIERRA 3.0 AG	PROLINE
CRUISERMAXX	PIVOT 418EC	SIMPLICITY	
CURTAIL M	PIXXARO	VARRO	

2.2.4 Water and Energy

Water required for the office and Site will be obtained through an installed groundwater well on Site. The well will be constructed according to *Groundwater and Water Well Act* and its supporting regulations and in the accordance with the standards developed for the construction of wells. It is not anticipated that the rate of water use will exceed 25,000 litres per day.

There is already hydroelectricity at site from the previous development.

2.2.5 Waste Generation and Disposal

The R.M. of Brokenhead does not have a landfill or transfer station of its own. Residents are permitted to use the following landfills and transfer stations in neighboring municipalities of RM of St. Clements (Landfill and Transfer Station) and RM of Springfield (Oakwood Transfer Station). The RM of St Clements' landfill is designated as a Class I Waste Disposal Ground (WDG).

While an appreciable proportion of agrichemicals that will be sold at the Bulk Agro Centre will be packaged in reusable containers, there will be some agrichemicals that will be packaged in disposable jugs. The RM of St Clements' WDG accepts these types of jugs for disposal as does CleanFARMS a non-profit environmental stewardship organization (https://cleanfarms.ca/).

A modern washroom with an on-site septic tank will be constructed as part of the Bulk Agro Centre's office building. The sanitary waste generated at the Project Site will be disposed of as needed by a contracted septic tank services provider.

The Bulk Agro Centre will not store or distribute anhydrous ammonia. The Bulk Agro Centre's anticipated air emission sources are considered minor and include fugitive dust from on-site roadways, exhaust from transport trucks and staff and customer vehicles on site.

2.2.6 Site Emergency Response Plan

Accidents or malfunctions that could arise at the Project Site include fire, serious injury or fatality, granular fertilizer spill and burglary. Beausejour Co-op understands the safety and health hazards associated with bulk agro centres from their knowledge with the construction and operation of several such facilities in Manitoba. Drawing from their learnings, Beausejour Co-op will develop an emergency response plan (ERP) outlining response procedures for the various emergencies that could arise at the Project Site. Once the ERP has been finalized it will be a living document that Beausejour Co-op will update the ERP as needed to ensure its continued appropriacy for the Bulk Agro Centre's operations and activities. As the Project Site was found to have stiff to very hard clay till underlying the shallow layers of granular fill, organic clay, and compacted engineered gravel fill, the potential for fertilizer and agrichemical contaminants to migrate through groundwater beneath the Project Site is deemed low. Should any fires involve the chemical shed, such fires will not be extinguished using water due to the varied chemical nature of the products, and additional fire water storage for the chemical shed is not anticipated to be required. The largest single storage vessel within the agrichemical shed is 1000 L. The integral containment structure of the shed provides a storage capacity of approximately 150,000 L (which is 150% greater that the aggregate container storage within the shed), thus reducing the likelihood of an uncontained release from the shed. With the chemical shed being an AWSA approved shed, the potential for flood water interacting with and affecting the stored agrichemicals is deemed negligible.

Staff at the Bulk Agro Centre will be trained on operational, safety and emergency response procedures. Emergency contact information would be made readily available on-site.

2.3 Project Schedule

Construction of the Bulk Agro Centre is anticipated to be begin in the fall of 2020 (i.e., August to September 2020) with site preparation for the construction and installation of the concrete pads. It is anticipated that the Project will be fully completed by early 2021. Beausejour Co-op will retain an independent contractor for all construction related activities for the Project Site. A qualified contractor will complete the on-site installation of the Bulk Seed equipment, fertilizer shed and the office. Operation of the Bulk Agro Centre would start in the Spring of 2021.

2.4 Decommissioning

The design life of the proposed Bulk Agro Centre components is at least 30 years. Regardless of when the Bulk Agro Centre would be decommissioned, a decommissioning plan including the removal of installed equipment and reclamation of the Project Site, will be completed and approved by the appropriate regulatory authority and in accordance with the applicable legislation at that time.

3.0 Scope of the Assessment

To assess the potential environmental impact of the construction and operation of the Bulk Agro Centre, the following spatial and temporal boundaries were considered appropriate.

3.1 Spatial boundaries

Spatial boundaries used for the assessment are described below and the figures for the Project Site, the Local and Regional Assessment Areas are found in **Appendix A**.

Project Site

The Project Site refers to the land on which the Bulk Agro Centre would be constructed (i.e., the legal description SE ¼ 7-13-12 EPM).

Local Assessment Area

The Local Assessment Area (LAA) refers to the area within which most direct potential Project residual effects are likely occur. The LAA for the Project is defined as a 1.5-km radius around the Project Site.

Regional Assessment Area

The Regional Assessment Area (RAA) represents the area within which direct residual effects are assessed to provide a context for the Project in terms of significance of potential project residual effects.

- The RAA for biophysical components was defined as a 10 km (6.2 mile) radius beyond the Project Site boundaries, intended to account for the maximum spatial extent of potential impacts of the Bulk Agro Centre.
- The Municipality was used as the RAA for socioeconomic valued components. Because it is not practical to assess the effects of greenhouse gas emissions over a 10-km radius, the province is considered the RAA for greenhouse gas effects.

3.2 Temporal boundaries

The temporal boundaries of the assessment are:

- Construction Phase – The period over which the Bulk Agro Centre will be constructed or installed is anticipated to span September 2020 to end of February 2021.
- Operation Phase – The period over which the Bulk Agro Centre will be operational is at least 30 years (i.e., from spring 2021 to 2051).
- Decommissioning Phase – When the Bulk Agro Centre needs to be decommissioned at some point in the future, a site decommissioning plan will be filed, and decommissioning conducted according to Licence conditions and regulatory requirements at the time.

4.0 Existing Biophysical Environment in Project Area

4.1 Physiography, Drainage and Climate

The Project Site occurs in the Gimli Ecodistrict (the Ecodistrict) of the Interlake Plain Ecoregion within the Boreal Plains Ecozone (Smith et al., 1998) (**Figure 4-1**). The Ecodistrict is a level of depressional glaciolacustrine lowland and a gently undulating lake terrace, characterized by fluvioglacial, shallow glaciolacustrine deposits and water-worked glacial till. It is characterized by lowland soils are poorly drained Peaty Gleysols and shallow organic soils (Smith et al., 1998). Forests in the ecodistrict are dominated by stands and coppices of trembling aspen, with some white spruce interspersed. Principal sources of water are variable quality groundwater from shallow, stratified sand and gravel aquifers associated with till and inter-till deposits, and surface water from Lake Winnipeg and the Red, Icelandic, and Fisher rivers (Smith et al., 1998). Well development in the underlying Ordovician limestone bedrock is poor because of variable concentrations of soluble salts in these aquifers.

Figure 4-1: Gimli Ecodistrict and Surrounding Ecodistricts

Based on weather data from Beausejour, the Project Site's regional area has a mean annual temperature of 0.5°C and mean annual precipitation of 450 mm (**Table 4-1**).

Table 4-1: Climate Normals for Beausejour, MB (1981-2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature °C													
Daily Avg.	-16.9	-12.8	-5.7	4.2	11.4	16.7	19.3	18.5	12.5	5.0	-4.8	-14.1	2.8
Daily Max	-11.3	-7.0	-0.3	10.5	18.4	23.1	25.6	25.2	18.5	10.2	-0.4	-9.1	4.9
Daily Min.	-22.4	-18.5	-11.2	-2.2	4.3	10.2	12.9	11.6	6.4	-0.3	-9.1	-19.1	8.6
Rainfall (mm)	.3	2.5	9.2	20.7	55.0	87.5	87.1	76.3	65.1	38.6	8.5	1.7	452.4
Snowfall (cm)	24.3	13.1	14.2	9.0	3.1	0	0	0	0	7.5	21.2	25.5	117.8
Total (mm)	24.6	15.5	23.4	29.7	58.1	87.5	87.1	76.3	65.1	46.0	29.7	27.2	570.3

Source: Canadian Climate Normals 1981 – 2010, available at http://climate.weather.gc.ca/climate_normals

4.2 Ambient Air Quality

The closest air quality monitoring station to the Project Site are the Winnipeg monitoring stations. The latest data from the Winnipeg stations was collected in 2013 (MCWS 2013). At a provincial scale, air quality concerns due to pollutants tend to be of a localized nature, with sources of pollutants including industrial operations, vehicle emissions, man-made substances and other specific activities (Manitoba Sustainable Development 2015). Given the Project Site's siting in proximity to active agricultural areas and the Town of Beausejour, the Project Site's air quality could be affected by agricultural operations as well, with short term increases in particulate due to harvesting at certain times of the year.

Maximum short-term and annual mean concentrations of air pollutants for Winnipeg, stations in 2013 are outlined in **Table 4-2**.

Manitoba's air quality objectives for carbon monoxide (CO) or nitrogen dioxide (NO_2) were not exceeded at the two Winnipeg stations in 2013. There were exceedances of the 24-hour average Canada Wide Standard for Particulate Matter 2.5 ($PM_{2.5}$) as well as exceedances of the ground level ozone (O_3) guidelines in 2013 (MCWS 2013). The production of CO, NO_2 and O_3 pollutants are mainly associated with vehicle emissions.

Table 4-2: Summary of 2013 Annual Pollution Concentrations

Pollutant		Manitoba Air Quality Monitoring Stations		Manitoba Air Quality Objectives (2005)		
	Period	Ellice Street (Winnipeg Downtown)	Scotia and Jefferson (Winnipeg Residential)	MTL	MAL	MDL
Carbon Monoxide (CO) parts per million (ppm)	1-hr	1.6	3.3	n/a	31	13
	24-hr	0.59*	0.66*	17	13	5
	Annual mean	0.24	0.16	n/a	n/a	n/a
Nitrogen Dioxide (NO_2) parts per billion (ppb)	1-hr	62.7	52.0	530	213	n/a
	24-hr	34.17^	33.98^	n/a	106	n/a
	Annual mean	7.79	7.32	n/a	53	32
Ozone (O_3) ppb	1-hr	**61.0**	**64.5**	200	82	50
	24-hr	47.93	57.04	n/a	n/a	n/a
	Annual mean	**23.7**	**28.9**	n/a	15	n/a
Sulphur Dioxide (SO_2) ppb	1-hr	n/a	n/a	n/a	170	n/a
	24-hr	n/a	n/a	310	60	n/a
	Annual mean	n/a	n/a	n/a	34	n/a
Particulate Matter 2.5 ($PM_{2.5}$) microgram per cubic metre ($\mu g/m^3$)	1-hr	52.4	124.8	n/a	n/a	n/a
	24-hr	**34.7**	**35.1**	n/a	30	n/a
	Annual mean	6.6	5.6	n/a	n/a	n/a

4.3 Greenhouse Gas Emissions

Greenhouse gas (GHG) emission sources in Manitoba, in order of decreasing magnitude, are transportation, agriculture, stationary combustion, waste, industrial process and product use, and fugitive emissions (Environment and Climate Change Canada 2018b). At a national level, Canada's GHG emission sources, in order of decreasing magnitude, are transportation, buildings, electricity, heavy industry, agriculture, and waste and others (Environment and Climate Change Canada 2018b). According to the National Inventory Report for the period spanning 2005 to 2016, during this period, Manitoba's GHG emissions have increased by 3.5% (Environment and Climate Change Canada 2018b). In 2016, Manitoba

contributed 20.9 million tonnes (Mt) of carbon dioxide equivalent (CO_2 eq) GHG emissions to Canada's total GHG emissions of 704 Mt CO_2 eq and ranked 6th among the provinces and territories (Environment and Climate Change Canada 2018b).

The Bulk Agro Centre is anticipated to contribute to GHG emissions through mobile combustion (diesel and gasoline in vehicles and equipment). Because the Bulk Agro Centre will rely on electricity for its energy needs, it will not contribute to GHG emission due to stationary combustion (e.g., natural gas combustion for heating). Relative to the Province of Manitoba's total GHG emissions, the Bulk Agro Centre's GHG emissions are considered to negligible.

4.4 Geology

4.4.1 Bedrock Geology

The bedrock geology of the RM of Brokenhead consists dominantly of rock types from the Palaeozoic Era, with further subdivision of the geology in this area placing it in the (Upper) Ordovician Period of geologic time. The major portion of the study is underlain by dolomitic limestone and dolomite of the Red River Formation. Moving eastward, the area encounters sandstone and shale of the Winnipeg Formation.

4.4.2 Surficial Geology

Surficial geological deposits in the Beausejour region are described as silty clay, with nearby exposed till described as calcareous silt diamicton, 1 to 75 m thick; low-relief, commonly streamlined deposits; subglacial deposits largely derived from carbonate rocks; thicker sequences consist of multiple units of varying texture; commonly scoured by icebergs; covered discontinuously by thin veneers (<1 m) of glaciolacustrine and glaciofluvial sediments (Burt, 2004).

The surficial geology of the Beausejour area is further described as Offshore Glaciolacustrine Sediments: clay, silt, minor sand; 1–20 m thick; very low relief massive and laminated deposits; deposited from suspension in offshore, deep water of glacial Lake Agassiz; commonly scoured and homogenized by icebergs (Matile & Keller, 2004).

4.4.2.1 On-Site Geotechnical Investigation

Wood conducted a geotechnical investigation at the Project Site in May 2020 (**Appendix F**). The purpose of the geotechnical investigation was to evaluate the soil and groundwater conditions at the Project Site, in order to provide geotechnical recommendations for the design and construction of foundations for the building structures, pavement structures for traffic areas and general site development recommendations. The geotechnical investigation involved the drilling of 12 test holes to auger refusal at maximum depths that ranged from 4.3 to 7.3 metres below grade level (m bgl). Sloughing or seepage was observed upon drilling. **Table 4-3** provides a summary of the drilling program.

Table 4-3: Summary of Sloughing and Groundwater Observations

Test Hole ID	Drilled Depth (m)	During Drilling		Upon Completion	
		Sloughing Zone	Seepage Zone	Depth to Slough	Depth to Groundwater
TH20-01	4.3 (AR)	2.6 to 3.0 m (Till)	2.6 to 3.0 m (Till)	3.7 m	2.7 m

TH20-02	5.8 (AR)	2.1 to 3.4 m (Sand and Till)	2.1 to 3.4 m (Sand and Till)	5.5 m	5.5 m (trace)
TH20-03	4.6 (AR)	2.6 to 3.0 m (Till)	2.6 to 3.0 m (Till)	4.6 m	4.6 m (trace)
TH20-04	5.5 (AR)	2.4 to 3.0 m (Till)	2.4 to 3.0 m (Till)	5.5 m	4.6 m
TH20-05	5.0 (AR)	Below 4.0 m (Till)	2.7 to 2.9 m (Till)	4.0 m	3.4 m
TH20-06	3.0	None	None	None	None
TH20-07	3.0	2.9 m (Till)	None	2.9 m	None
TH20-08	3.0	None	None	None	None
TH20-09	3.0	Caving 0-0.5m (Gravel Fill)	None	2.7 m	None
TH20-10	3.0	None	None	None	None
TH20-11	3.0	None	None	None	None
TH20-12	7.3 (AR)	Caving 4.0-4.3m (Gravel)	2.7-3.0 m (Till)	7.1 m	5.8 m

AR = Auger Refusal

The general stratigraphy at the Project Site consisted mainly of granular fill, organic clay, clay, and silt till (Wood, 2020). The individual layers are discussed in further detail below.

Granular Fill

Granular fill was present at the ground surface at TH20-04, TH20-05, TH20-08 and TH20-09 and was 150 to 455 mm thick. The granular fill was generally classified as gravel and sand, or gravel with some sand, and was poorly graded, fine grained, moist, inferred as compact, and brown to light brown. Sand fill was present at the ground surface at TH20-08 and was poorly graded, fine to medium grained, moist, inferred as compact and brown. All moistures tested in the gravel fill or sand fill were 7%.

Organic Clay

At the remaining test holes, organic clay was present at the ground surface ranging in thickness from 100 to 450 mm. The organic clay was silty, high plastic, moist, inferred as firm to stiff, dark brown, blocky, and contained trace rootlets.

Clay

Clay was encountered below the fill and organic clay layers described above and extended to 2.1 to 2.9 m below grade. The clay was silty, high plastic, moist, very stiff to hard becoming firm to stiff with depth and brown, with occasional to abundant silt or silt till inclusions, and occasional sulphate inclusions. In TH20-05 and in TH20-10 from 0.5 to 1.1m, the clay was classified as silt and clay, or as silty clay, and was medium to high plastic. Moisture contents in the clay were 24 to 45%, with an outlier value of 13% in TH20-03 where abundant silt till inclusions were present. The results of Unconfined Compressive Strength (UCS) tests on the clay are provided in **Table 4-4**.

Table 4-4: Summary of Unconfined Compressive Strength Tests

Test Hole	Depth (m)	UCS (kPa)	Strain (%)		Dry Density (kg/m^3)	Moisture Content
			@UCS	@50% of UCS		

TH20-01	1.5	72.9	5.7	0.7	1349	37.9
TH20-04	1.5	77.1	5.6	0.8	1245	44.4

Undrained shear strengths of the clay, as determined from the UCS tests in **Table 4-1**, were lower than Torvane and Pocket Penetrometer readings on the same samples; while commonly are somewhat higher due to silt inclusions in the clay. This discrepancy can be attributed to some degree to slickensides (i.e. weak, pre-existing shear surfaces) in the UCS specimens.

Silt Till

Silt till was encountered below the clay at every test hole and extended to the auger refusal depths or termination depths. The silt till contained minor soil types described as trace sand to and sand, trace clay to clayey, and trace to some gravel, and was moist to wet, loose to compact and light brown to grey. With increasing depth in the test holes advanced to auger refusal, i.e. TH20-01 to TH20-05 and TH20-12, the silt till became damp to moist and dense to very dense. Moisture contents in the silt till were 9 to 17%.

In TH20-12 only, a gravel layer and a silt layer were present within the till. The gravel layer extended from 4.0 to 4.3m from grade and was classified as gravel and silt, and was poorly graded, fine to medium grained, wet, inferred as compact to dense, and light brown. The silt layer, which was present at 4.6 to 6.4 m, was low to non-plastic, damp, compact and light grey, becoming dense to very dense below 6.1 m. The moisture content of the silt was 15%.

A natural sand layer was encountered in TH20-02 only, at 2.1 to 2.4 m from grade, was described as sand and silt to silty sand, and was poorly graded, fine grained, very moist to wet, inferred as loose to compact, and light brown.

4.5 Soils

A description of the soil parent materials in the vicinity of the Project site by Podolsky (1979), consists mainly of lacustrine clay veneers underlain by till, glacial till, deep lacustrine clay sediments, sand deposits and lesser amounts of sand and gravel outwash, outwash overlying till, glacial till over bedrock and organic soils. A major portion of the area is underlain by dolomitic limestone and dolomite of the Red River Formation. The dominant soils in the study area consist of imperfectly drained Gleyed Rego Blacks, poorly drained Rego Humic Gleysols, imperfectly drained Gleyed Dark Grays and well drained Orthic Dark Grays. Minor amounts of Terric Mesisols, Gleyed Blacks and Orthic Gray Luvisols constitute the remainder Podolsky (1979) noted that in some areas the soils would pose an issue related to engineering and recreation development due to soil drainage, stoniness, high seasonal water table, high shrink-swell potential and slow permeability.

Agricultural capability for soils in the vicinity of the Project Site falls under Class 2 and Class 3, with crop productivity limited by excess moisture with the moisture limitations resulting on the soils having a low water-holding capacity and stoniness. (Podolsky, 1979).

4.6 Hydrogeology and Groundwater

Groundwater refers to water that is beneath the surface of the soil in the zone of saturation. Rain collects and flows through the pores of the soil during infiltration until it eventually reaches a zone of saturation.

The upper surface of this zone in unconfined aquifers is called the water table. Since the water table generally conforms to the topography, groundwater in unconfined aquifers tends to flow from topographic highs to topographic lows. In general, water tables fluctuate throughout the year with seasonal highs and lows. Water table levels are generally lowest during the winter months from December to March, with the levels rising in April and May as a result of snowmelt and rainfall. The more permeable soils such as snowmelt and high rainfall while in the less permeable there usually is a greater time lag between infiltration and levels generally reach their maximum height in the latter part of May or the beginning of June and recede slowly over the course of the growing season (Podolsky, 1979). The surficial deposits and bedrock which form the major aquifers in the Brokenhead study area are sand and gravel outwash, carbonate and sandstone bedrock. Aquifer identified in the RM of Brokenhead are primarily carbonate with some sand and gravel (Rutulis, 29074). In general, water in the carbonate and sand and gravel aquifers is of good quality with the concentration of dissolved solids ranging from 500 to less than 1,000 ppm and hardness ranging from 200 to 500 ppm (Rutulis, 1974)

4.6.1 Groundwater Use at and Near the Project Site

There are no groundwater wells at the proposed Project Site. Within the vicinity of the Project Site there are domestic water wells (**Appendix D**) however none will be impacted by the Project. In addition, the Town of Beausejour has a sewage expansion cell approximately 0.2 km west of the proposed Project however, given the distance, the lagoon shouldn't impact the Project.

4.7 Surface Water

The Project Site occurs within the Brokenhead River Watershed (Betcher et al. 1995). While surface drainage in the regional area is largely influenced by the Saskatchewan River which flows west to east and is located about 7 km north of the Facility at its closest point, surface drainage at the Facility is more influenced by nearby dugout ponds and drainage ditches within and around the industrial park, as well as Cemetery Lake which is about 1.2 km northwest of the Project Site and Grace Lake which is about 5.3 km northeast of the Project Site.

A survey of the Project Site was completed in May 2020. A municipal ditch is adjacent to the eastern and southern boundaries of the Project Site (**Appendix E**).

4.8 Vegetation

The Project Site is in the Gimli Ecodistrict (the Ecodistrict) of the Interlake Plain Ecoregion within the Boreal Plains Ecozone (Smith et al., 1998). With the larger Interlake Plain Ecoregion, this ecoregion is predominantly dominated by forest in the south and commercial agriculture in the north and northeast. Closed trembling aspen forests with balsam polar (*Populas balsamifera*) as a secondary species and understory of shrubs such as hawthrom (*Crataegus* spp), willow, ,western snowberry, Wood's rose (Rosa woodsia), pin cherry (Prunus pensylvanica), choke cherry (*Prunus virginiana*) is the predominant vegetation. Jack pine (*Pinus banksiana*) forests are found the dry sandy sites and as it transitions into the boreal forest ecozone, sedges, willows, black spruce and tamarack (Smith et al, 1998). This ecoregion as a transition zone also contains a variety of wetland types such as bogs, fens, swamps and freshwater marshes along with some rivers and streams (Smith et al, 1998).

Within the Gimli ecodistrict, the northern portion forms part of the Lake Winnipeg drainage basin. The RM of Brokenhead falls within the Cooks Creek Conservation District (now called the Northeast Red

Watershed District) which discharges into the Red River, as well as parts of the Carr's Creek and the Lower Seine River watersheds, both which flow into the Red River Floodway.

4.9 Wildlife

The Project Site is within a developed area and just outside of the Town of Beausejour. Given the developed nature of the Project Site and surrounding properties, wildlife populations and activity are not anticipated to be substantive. Wildlife species commonly identified in the Ecodistrict include moose, black bear, various members of the weasel family, and woodland caribou (Smith et al 1998).

At the time of the Project Site visit no wildlife species were observed at the Project Site.

4.10 Migratory birds

Waterfowl, including various ducks, geese, white pelicans, and cormorants are common in the ecoregion and are protected under Article I of the Migratory Birds Convention Act, SC 1994, c 22. Other common birds include sandhill crane, various raptors, and ruffed grouse (Smith et al 1998).

According to the Bird Studies Canada (BSC) Breeding Bird Atlas (BBA) online database, 113 bird species were identified as having demonstrated breeding behaviour within the Project area. A search of the Conservation Data Centre's (CDC) database indicates that the piping plover (*Charadrius melodus circumcinctus)*, a federally and provincially listed species, has been observed within the proposed Project site. Other provincially and federally listed species found in within a 2km radius of the proposed Project site include the Bobolink (SARA threatened), and the Red headed woodpecker (SARA and MESA threatened) (Colin Murray ARD, personal communication).

4.11 Reptiles and Amphibians

According to the CDC the northern leopard frog (*Lithobates pipiens*) has been identified within the project footprint. This species is noted to be a species of special concern under SARA.

At the time of the Project Site visit no reptiles of amphibians were observes at the Project Site.

4.12 Protected Species

A variety of sources were consulted to identify species at risk that could potentially occur within the Project Region, including the Manitoba Conservation Data Centre (CDC) the BSC, BBA, and the MHA. The occurrence data from these sources were compared to Schedule 1 of the Federal Species at Risk Act (SARA) SC 2002, C29 and The Endangered Species and Ecosystems Act (Manitoba), CCSM c E111 to determine which federally and/or provincially listed rare or sensitive species have the potential to occur in the Project Region. Distribution maps were referenced, and habitat requirements were considered to determine the probability that listed species would occur in the Project Region.

Based on this search, there are 7 Provincially and Federally listed species that may occur in the Project RAA (**Table 4-5**). Wood submitted an information request to Manitoba Conservation Data Centre (MCDC) for records of rare species recorded at or near the Project Site. In their response MCDC indicated that at that time, there was only the occurrences recorded for the Project Site footprint the potential presence of piping plover and the Northern Leopard frog. Given that Piping Plover habitat is primarily lakeshores and river sandbars it is not expected that this bird will be found within the Project footprint or the immediate vicinity around the Project Site. Northern Leopard frogs are found primarily within moist upland meadows

and prairies in the summer it is not expected that this species will be found within the Project footprint.

Table 4-5: Potential Listed Species in the Project Area

Species	SARA Status	MESA Status	Habitat Description	Potential to Occur in the Project Region
Plants				
Western slivery aster *Symphyotrichum sericeum*	Threatened	Threatened	Dry prairies, fields and openings in bur oak/trembling aspen woodlands. Western silvery aster is most abundant when growing in relatively undisturbed grasslands. [1]	**Low**: while noted that this plant was noted in the broader Project area (i.e. Birds Hill Park [1]), there are no known occurrences within the Project footprint
Invertebrates				
Yellow-banded bumble bee *Bombus terricola*	Special Concern	Not Listed	Diverse range of habitats, including mixed woodlands, farmlands, urban areas, montane meadows, prairie grasslands and boreal habitats. **[2]**	**Low**: noted to occur within a 2km radius of Project footprint boundary **[4]**; however, given the extensive industrial landscape within the Project boundaries it is unlikely to occur.
Gypsy cuckoo bumble bee *Bombus bohemicus*	Endangered	Not Listed	Diverse habitats, including open meadows, mixed farmlands, urban areas, boreal forest and montane meadows. The species feeds on pollen and nectar from a variety of plant genera.[2]	**Low**: noted to occur within the general area of the Project footprint boundary [4]; however, given the extensive industrial landscape and lack of vegetative cover within the Project boundaries it is unlikely to occur.
Vertebrates				
Piping plover *Charadrius melodus circumcinctus*	Endangered	Endangered	Lakeshores and river sandbars. It nests on gravel shores of shallow, saline lakes and on the sandy shores of larger prairie lakes. **[1]**	**Low**: not known to breed in the Project Region. In Manitoba, Piping Plovers are most consistently found nesting on broad beaches along Lake Winnipeg, Lake Manitoba, West Shoal Lake, and occasionally Oak Lake and Whitewater Lake. **[1]**
Bobolink *Dolichonyx oryzivorus*	Endangered	Not listed	Native grasslands and pastures. [2]	**Low**: not known to breed in the Project Region. No noted occurrences in the Project Region. [3]
Red headed woodpecker *Melanerpes erythrocephalus*	Threatened	Threatened	Oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, beaver ponds and burns. [2]	**Low**: while noted that the Red Headed Woodpecker is found in the broader Project area, there are no occurrences within the Project footprint due primarily to a lack of appropriate habitat. [3]
Northern leopard frog *Lithobates pipeiens*		Threatened	Overwinter in cold waterbodies that do not freeze solid. Breed in pools ponds, marshes and	**Low**: listed as occurring in the ecozone by MB CDC, but no occurrences noted in the Project

			lakes. Moist upland meadows and prairies are used in the summer. [1]	Region on the MHA. [4 5]

Sources:
[1] **Species at Risk Public Registry (Province of Manitoba)**
https://www.gov.mb.ca/sd/environment_and_biodiversity/species_ecosystems/index.html
[2] Species at Risk Public Registry (Government of Canada 2019) https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html
[3] Artuso et al 2010 -2014.
[4] Manitoba Conservation Data Centre
[5] Manitoba Herps Atlas Database 2018

5.0 Existing Socio-Economic Environment in Project Area

5.1 Land Use, Population and Well-Being

The Rural Municipality of Brokenhead is located just 44 kilometres east of Winnipeg and is named for the Brokenhead River that passes through the municipality. Brokenhead is comprised of eight townships which surround the municipality's largest town, Beausejour. Other villages in the municipality include the village of Garson, and the unincorporated village of Tyndall. Approximately 6% of residents are employed in the agricultural businesses and services: Agricore (fertilizer), Agritel (seed plant) and Ag-Pro (fertilizers and agricultural chemicals) are some of the agricultural businesses that sustain the local economy. Beausejour is a major retail and shopping centre within eastern Manitoba. Tourism is becoming more prominent, since the municipality is approximately 85km from the Whiteshell Provincial Park. The RM of Brokenhead covers a land area of approximately 752 square kilometres (km^2) with a population of 5,122 (Statistics Canada, 2016).

Table 5-1: Population Statistics for the RM of Brokenhead and the Town of Beausejour

	RM of Brokenhead	Town of Beausejour
Population in 2016	5,122	3,219
Population in 2011	4,635	3,126
% change in population between 2016 and 2011	10.5	3.0
Total private dwellings	2,115	1,518
Population per km^2	6.8	593.8
Source: Statistics Canada (2016)		

The Brokenhead River Planning District was established by Order-in-Council on June 11, 1977 under the authority of *The Planning Act of Manitoba* (1976). The District encompasses the Town of Beausejour as well as the Rural Municipality of Brokenhead which includes the communities of Tyndall and Garson. The District's Board is comprised of two representatives each from the Town of Beausejour and the Rural Municipality of Brokenhead. The District is responsible for the preparation, adoption and administration of district land use plans and related by-laws. The District is also responsible for the day-to-day responsibilities for the administration of Zoning By-laws, Zoning Amendments and Rezoning, Zoning Enforcement, Variation Orders and Conditional Use Orders for both the Town of Beausejour and Rural Municipality of Brokenhead. Building permits are also issued from this office for both municipalities.

Emergency services in the Project Site's regional area, are carried out through 911 and are provided by the Town of Beausejour fire department and the Royal Canadian Mounted Police (RCMP).

For healthcare, the Municipality is serviced by Interlake Eastern Health Authority, with a Beausejour District Hospital providing acute care (e.g., high care needs, in-patient beds, palliative care, surgery), outpatient services including emergency services, and diagnostic services.

5.2 Employment, Economy, Infrastructure and Services

Most businesses were in the primary sector of Agriculture, forestry, fishing and hunting. The RM of Brokenhead falls under MASC Risk Area 14 and the primary crops grown are canola and wheat.

Beausejour Co-op's proposed construction and operation of a Bulk Agro Centre is as substantial economic investment in the RM of Brokenhead with numerous benefits. These benefits include wages paid to employees; supply of fertilizers and agrichemicals to local and surrounding area agricultural producers; work for local contractors; cash back and equity payments through annual patronage allocations; and contributions to municipal, provincial and federal tax revenue.

The Town of Beausejour, the nearest service centre to the Project Site is serviced by PTH 44 a major highway that runs from Lockport to Beausejour where it turns north to join with PTH 12. The Project Site can be accessed via PTH 12. PTH 12 is largely a two-lane, non-divided highway,

Like the existing onsite building, the Granular fertilizer facility, Bulk Agro Centre office and volumetric smooth wall bins will be constructed at a higher elevation than the rest of the Project Site. A contour map of existing site conditions as well as a drainage design for the Project Site are shown in **Appendix E.**

A total of 27 vehicles over a six-week period are expected for delivery of Bulk Agro Centre components, i.e., 8 vehicles to deliver the fertilizer bins and equipment, three to deliver the office materials and 16 for the chemical shed. On average there will be up to two vehicle deliveries per day during the six-week material delivery period. It is anticipated that there will be a slight increase in the number of vehicles using PTH 44 and PTH 12 during the construction and operation of the Bulk Agro Centre.

Traffic volumes for main regional thoroughfares within the project area were obtained from the Manitoba Highway Traffic Information System, 2016 Traffic on Manitoba Highways (Manitoba Infrastructure and Transportation and University of Manitoba, 2017). For 2016, the Average Daily Traffic (ADT) recorded on at station 12 on PTH 44, was 3,950 eastbound and westbound traffic and included all traffic types (i.e. cars, trucks).

The Bulk Agro Centre will rely on an onsite well for supply of water for its operations. A modern washroom with an on-site septic tank will be constructed as part of the Bulk Agro Centre's office building and the generated sanitary waste will be disposed of as needed by a contracted septic tank services provider. Office waste generated at the Bulk Agro Centre will be disposed of at a licensed WDG (i.e. RM of St Clements' WDG). Granular fertilizer waste (e.g., from spills or damaged packaging) will be spread on agricultural fields for disposal, per standard industry practice.

5.3 Parks and Protected Areas

There are no immediate provincial parks located within the Project area, however Birdshill Provincial Park is located southwest of Beausejour near Winnipeg and Grand Beach Provincial Park is located at the north

end of PTH 12 and Whiteshell provincial park is approximately 85 kilometers west of Beausejour.

The Wally Chryplywy Nature Park is located on the south-west outskirts of the Town of Beausejour. It features approximately 5 km of nature trails with over 2 km of all-weather surfacing allowing for walking, hiking, biking, and groomed cross-country skiing trails in the winter. In the winter snowmobiling is one of the main recreational activities within the RM of Brokenhead with a large network of Snoman trails.

5.4 First Nation Communities

The Brokenhead Ojibway First Nation is within the RM of Brokenhead boundaries and is located in Scanterbury approximately 50 km northwest of the Project Site.

5.5 Heritage Resources

Wood did not submit a screening request to the Manitoba Historic Resources Branch (the Branch) for the proposed Bulk Agro Centre, as the Project Site was previously licenced as a Bio-Diesel Fuels facility (EA licence #2852). Given the already-developed nature of the Project Site, it is unlikely that heritage resources will be encountered at the Project Site during the construction of the Bulk Agro Centre and the completion of a HRIA is not deemed to be required during construction. During construction, the following measures will be implemented:

- If artifacts or historical features of skeletal remains are encountered during construction activities, work activities will stop immediately around the affected area with the find reported to the Project Site supervisor. A qualified archaeologist would investigate and assess the find prior to continuation of work.
- If skeletal remains are encountered, the find would be immediately reported to the Project Site supervisor and the RCMP.

6.0 Public Engagement

Beausejour Co-op has consulted with the Municipality regarding the planned Bulk Agro Centre. The RM of Brokenhead has rezoned this area from A-80 Rural and Agricultural to M Industrial. The RM does not have concerns about the proposed Bulk Agro Centre and was responsive to the idea of Beausejour Co-op investing in the RM of Brokenhead and providing agro retail services to producers in the municipality.

7.0 Assessment Approach

This assessment was completed to meet the requirements of an EAP and considers project-specific environmental effects. For this assessment, the term "environment" refers broadly to both biophysical and socio-economic elements of the environmental setting.

The assessment is focused on valued components (VCs) which are elements identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. The selection of VCs is based on consideration of several factors, namely, input from regulators, the public, as well as professional judgement of the Beausejour Co-op and environmental assessment team, combined with the assumed implementation of industry standard, environmentally responsible construction techniques and operating procedures during project construction, operation and closure. The MSD *Information Bulletin – Environment Act Proposal Report Guidelines* and *Information Bulletin - Environment Act Proposals for Bulk Material Handling Facilities (Pesticide, Fertilizer and Seed Treatment Handling Facilities)* dated 2018 was

used as guidance in the determination of likely interactions between the Project and biophysical and socio-economic elements of the environment.

7.1 Selection of Project Interactions and Valued Components

To concentrate the assessment on matters of the most importance, potential interactions of the Project with the surrounding biophysical and socio-economic environment are identified using a variety of sources, including:

- Applicable provincial regulatory requirements and guidance pertaining to the proposed Bulk Agro Centre from regulators.
- Existing information on biophysical and socio-economic components within the local and regional areas of the Facility (e.g., air quality, surface water quality, and human and ecological health) and results of desktop studies.
- Professional judgment of the environmental assessment and Beausejour Co-op teams, based on knowledge with similar projects elsewhere and other projects and activities in the project area

Biophysical and socio-economic VCs that could be affected due to interactions between the Project and environment are identified to scope the assessment. The selected VCs embody one or more of the following:

- represent a broad biophysical or socio-economic component that might be affected by the Project;
- are a part of the heritage of First Nation communities or a part of their current use of lands for traditional purposes; and
- are of scientific, historical or archaeological importance.

For those VCs where a potential interaction is identified, but, which based on past experience and professional judgement, will result in an environmental effect that can be reduced to acceptable levels through use of standard operating or industry best management practices, the VC was excluded from further assessment.

The designation of VCs is shown in **Table 7-1**. Project-related effects on the VCs and corresponding mitigation measures are assessed in Section 8. Residual effects are characterized using specific predetermined criteria (e.g., direction, magnitude, geographical extent, duration, frequency) as outlined in **Table 7-2.**

Table 7-1: Designation of Valued Components

Component Name	Potential Project Interaction	Included/ Excluded	Value Component	Rational for Exclusion of Inclusion and Project Potential Effect
Air Quality and Noise	✓	**Incl**	**Yes**	**The Bulk Agro Centre will have a gravel surface outside of building footprints. On-site traffic including product delivery and customer vehicles will generate fugitive dust emissions. Construction activities for the proposed Bulk Agro Centre will temporarily generate dust emission due to physical disturbance of soil, including topsoil stripping and stockpiling, and movement of construction-related vehicles. Noise level generation is deemed acceptable for a bulk agro retail facility within an industrial park.**
Greenhouse gas emissions	✓	**Incl**	**Yes**	**The Bulk Agro Centre will contribute to GHG largely due to emissions from fertilizer and agrichemical delivery and customer vehicles.**
Soil quality	✓	**Incl**	**Yes**	**Construction activities within the Bulk Agro Centre footprint will have the potential to affect soil quality. There would be potential for compaction and rutting, erosion and admixing which adversely affect soil quality. Such effects would be restricted to the construction phase.**
Vegetation	x	Excl	No	The Project Site is already developed and covered by gravel outside of existing buildings' footprints. As a result, there will not be potential for interaction with natural vegetation.
Surface Water Quality	✓	Incl	No	Surface drainage at the Project Site is influenced by nearby trenches, ditches and nearby off-site dugout ponds. The closest surface water body that could support aquatic life is Brokenhead River which is approximately 10 km northeast of the Project Site. The Project Site does not appear to have a direct link to this and other nearby water channels and thus the potential for surface water contamination by fertilizers associated with the Facility is deemed negligible.
Groundwater Quantity and Quality	✓	Incl	No	For its water needs, the Bulk Agro Centre will rely on a proposed site well.
Fish and Fish Habitat	x	Incl	No	There is no fish habitat present within the Project Site and immediately surrounding areas and there is no direct discharge proposed to surface water bodies.

Component Name	Potential Project Interaction	Included/ Excluded	Value Component	Rational for Exclusion of Inclusion and Project Potential Effect
Wildlife and wildlife habitat	✓	**Incl**	**Yes**	**The Project Site and immediately surrounding properties are already developed with reduced potential for interaction with wildlife. The Bulk Agro Centre will be gated and surrounded by a security fence topped with barbed wire resulting in limited access to the Project Site. The Project Site is not expected to provide suitable nesting habitat for birds therefore the potential for effects to the migratory, and/or protected species is deemed low.**
Land and Resource Use	x	Incl	No	The Project Site is already zoned industrial and is a former licenced Bio-diesel facility, as a result, there will not be need for land use zone change to facilitate the construction and operation of the Bulk Agro Centre.
Heritage Resources	✓	Incl	No	Project activities during construction (e.g., clearing or trenching) can potentially affect heritage resources, particularly in previously non-disturbed areas. Given the developed nature of the Project Site, the potential for effects to heritage resources is deemed negligible.
Human Health and Aesthetics	x	Incl	No	The Project Site is in a commercial highway industrial area, and not in immediate proximity to private residences.
Infrastructure and Services	✓	**Incl**	**Yes**	**The additional traffic due to the Bulk Agro Centre product deliveries and customers may increase traffic on PTH 12.** Municipal services (energy, water, waste disposal ground) have sufficient capacity to accommodate the proposed Bulk Agro Centre.
Employment and Economy	✓	Incl	No	Positive effects attributable to the proposed Bulk Agro Centre are expected and include benefits related to employment, increased and ready supply of fertilizers and agrichemicals to local agricultural producers, and tax generation.

Table 7-2: Residual Effects Description Criteria

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The long-term trend of the residual effect	**Positive**— an improvement in the valued component compared with existing conditions and trends

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		Adverse— a decline in the valued component compared with existing conditions and trends **Neutral**— no change in the valued component from existing conditions and trends
Magnitude	The amount of change in the VC relative to existing conditions	**Negligible**—no measurable change **Low**— a change that falls within the level of natural variability **Moderate**— a measurable change which is unlikely to affect the valued component **High**— a measurable change which is likely to affect the valued component
Geographic Extent	The geographic area in which an environmental effect occurs	**PS**– residual effects are restricted to the (Project Site, PS) **LAA** - residual effects extend into the LAA (i.e., 1.5 km radius of the Project Site boundary. **RAA** - residual effects extend to a 10-km radius of the Facility; for Socio-Economic VCs the applicable RAA is the RM of Kelsey; for greenhouse gases the applicable RAA is the province of Manitoba
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	**Single event** - residual effect occurs once throughout the life of the Project **Multiple irregular event** - residual effect occurs sporadically and intermittently (no set schedule) throughout **Multiple regular event** - residual effect occurs repeatedly and regularly throughout **Continuous** - residual effect occurs continuously throughout the life of the Project
Duration	The period of time required until the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	**Short-term** - residual effect restricted to the duration of two years **Medium-term** - residual effect extends up to 25 years **Long-term** - residual effect extends for longer than 25 years
Reversibility	Pertains to whether the VC can return to its existing condition after the project activity ceases	**Reversible** - the effect is likely to be reversed after activity completion and decommissioning/remediation **Irreversible** - the effect is unlikely to be reversed even after decommissioning/remediation
Ecological and Socio-Economic Context	Existing condition and trends in the area where environmental effects occur	**Undisturbed** - area is relatively undisturbed or not adversely affected by human activity **Disturbed** - area has been previously disturbed by human development or human development is still present

8.0 Environmental Effects Assessment and Mitigation

This section contains the results of the environmental assessment. Applying professional judgement and a thorough understanding of the components of the proposed Bulk Agro Centre (outlined in Section 2 of

this report); Wood determined the potential for physical, biological and socio-economic components to interact with project components (presented in **Table 7-1**).

The assessment includes any effects on social components resulting from residual adverse environmental effects. The assessment also considers mitigation measures that Beausejour Co-op plans to incorporate as design aspects, as well as environmental protection practices and procedures included in the proponent's standard of operation. Environmental effects that may be caused as a result of accidents and malfunctions are discussed separately in Section 8.7. Definitions of the terms used to guide the effects assessment are provided in **Table 7-2**.

8.1 Air Quality and Noise

8.1.1 Dust

The Project will involve construction activities that generate dust, namely vehicle movement, clearing, excavation, stockpiling of materials, and grading within the proposed Bulk Agro Centre components' footprints (see Figure 4, Appendix A). Air quality may be affected by dust and particulates with potential for subsequent effects on human health (including respiratory issues) and off-site vegetation (dust deposition).

During operation of the Bulk Agro Centre, fugitive dust generation is anticipated from on-site traffic (delivery and customer vehicles).

To reduce dust emissions during construction of the Project, the following mitigation measures will be implemented:

- Minimizing soil disturbance at the Project Site with soil disturbance limited to the fertilizer bins, chemical shed, and office building footprints.
- Limiting heights of stockpiled materials on site.
- Using soil stabilizers for soil stockpiles exposed for prolonged periods of time.
- Suppressing dust through use of water or other approved control agents, if needed.

8.1.2 Noise Emissions

An increase in noise levels at or near the Project Site could occur due to the anticipated traffic accessing the Project Site and potentially affect people and wildlife in the surrounding area. Sources of noise during construction would be typical of heavy equipment such as graders, excavators, and haulage trucks. However, given the occurrence of the Project Site within an industrial zoned area, and its proximity to both PTH 44 and PTH 12, the effect of the Bulk Agro Centre's construction or operation activities on noise levels in the area is anticipated to be negligible.

During the operation phase, sources of noise at the Bulk Agro Centre would primarily be movement of trucks delivering fertilizers and customers' vehicles. Given the Project Site's proximity to PTH 44 and PTH 12, the delivery of fertilizers and agrichemicals at the Bulk Agro Centre is anticipated to result in negligible residual noise effects.

The implementation of the following measures will mitigate potential adverse effects.

- Limitation of construction hours as required to normal working hours.
- Provision of appropriate hearing protection to workers/employees and encouraging proper use of

hearing protection among workers during construction.

- Regular maintenance of vehicles and equipment.

Summary

With the implementation of the mitigation and prevention measures identified above, the potential adverse effects on air quality during construction and operation are expected to be negligible, limited to the Project Site, short-term in duration, irregular in frequency, and reversible upon decommissioning. The potential adverse effects of noise are expected to be low, limited to the immediate vicinity of the Project Site, short-term in duration, multiple regular in frequency, and reversible upon decommissioning.

8.2 Greenhouse Gas Emissions

During construction, exhaust emissions containing greenhouse gases (GHGs) will be generated by vehicles and equipment during delivery of construction materials; preparing the footprint of the Bulk Agro Centre; construction of the Bulk Agro Centre components and during reclamation or landscaping activities following construction. These emissions could also adversely affect air quality by increasing the local concentrations of carbon monoxide, carbon dioxide, particulate matter, and nitrogen oxides in the air with potential for subsequent effects on human health.

During construction, approximately 27 construction vehicles (**Section 2.2**) will access public roads near the Project Site. This traffic will be temporary and restricted to the construction phase of the Project.

During operation of the Bulk Agro Centre, fertilizer and agrichemical delivery and customer vehicles will generate GHG emissions. This traffic would be restricted to the operational days and hours (typically Monday to Friday, 8:00 to 17:00 hours).

The following mitigation measures will be implemented to mitigate GHG emissions due to exhaust emissions:

- Vehicles and equipment will be properly maintained.
- Minimizing the number of vehicles or equipment in use as far as is practical.

Summary

The construction and operation of the Bulk Agro Centre will result in GHG emissions. However, relative to the provincial total emissions, the project related GHG emissions are expected be negligible and short-term in duration, of multiple irregular frequency, and irreversible upon decommissioning.

8.3 Soil Quality

Changes to soil quality attributable to the Bulk Agro Centre would be largely restricted to the construction phase. Following construction and during operation of the Bulk Agro Centre, the additional footprint will be covered by gravel. If

8.3.1 Compaction and Rutting Risk

Vehicles and heavy equipment traffic in the proposed Bulk Agro Centre could cause compaction and rutting of topsoil and subsoil, adversely affecting soil quality. Soil compaction is largely influenced by soil texture so that finer-textured soils are more susceptible to compaction than coarser-textured soils. Rutting is primarily driven by moisture so that as soil moisture increases, the soil's susceptibility to rutting also

increases. Given the reported predominant occurrence of gravel fill at the surface within the Project Site, there is low potential for soil compaction and rutting.

8.3.2 Admixing

Admixing refers to the dilution of topsoil with subsoil resulting in topsoil of reduced quality (Powter 2002). Admixing can cause soil quality deterioration due to changes in topsoil texture, soil aggregation and structure, organic matter content and consistence when topsoil is inadvertently mixed with subsoil. For the Project, while topsoil stripping is anticipated to be limited in extent, the overstripping of topsoil within the Bulk Agro Centre footprints is a potential mechanism for admixing at the Project Site.

8.3.3 Wind and Water Erosion Risk

Physical disturbance of soil during construction activities (e.g., topsoil stripping, excavation, backfilling, grading, and clean-up can reduce soil thickness, due to wind or water erosion. The exposure of soil makes it more vulnerable to the elements and can cause soil loss from exposed soils (e.g., in stockpiles). Such losses could be associated with a one-time weather event, like strong winds or high intensity rainfall and the associated reduction in soil thickness might be permanent.

Due to the predominant gravel fill at the surface within the Project Site, water and wind erosion risk for soils is deemed to be low. However, given the occurrence of sand beneath thin layers of peat and clay within portions of the Project Site, such sandy soils may be susceptible to wind erosion. Erosion of soil and material stockpiles due to wind has the potential to cause subsequent effects on air quality (dust and particulate matter).

To reduce potential effects to soil quality, the following mitigation measures will be implemented:

- Disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical where required.
- Construction equipment and vehicle movements will be limited to designated roads/pathways within and around work areas.
- During construction, in the event of adverse weather that could result in rutting or compaction (heavy rainfall), the contractor in consultation with Beausejour Co-op should implement contingency measures including use of matting for access through wet areas and limiting or suspension of activities until soil conditions are appropriate.
- Colour change should be used to guide stripping between topsoil (A horizon) and subsoil (B or C horizon) within the Bulk Agro Centre components' footprints to prevent admixing.
- The contractor will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and site restoration (if required).
- Traffic should be limited as much as possible during smoothing and levelling of soils to prevent further compaction. Smoothing and levelling should also be avoided if soils are near saturation.
- Areas with vehicle ruts should be decompacted and regraded.
- Soil stockpiles at the Project Site should be stabilized and adequately protected from erosion with good vegetation establishment or other protective measures.
- Appropriate erosion and sediment control measures should be implemented and maintained, as needed, until spreading of topsoil is complete.

Summary

The proposed Bulk Agro Centre footprint is in an already developed industrial park within a highway commercial zoned area. The mitigation measures outlined above are considered sufficient to mitigate potential adverse effects due to soil compaction, rutting, admixing, and erosion during construction, operation and decommissioning phases. Residual effects on soils are therefore assessed to be adverse, of low magnitude, limited to the areas where soil will be disturbed within the Project Site, span medium to long-term duration, occur once, and irreversible.

8.4 Wildlife and Wildlife Habitat

The Project Site and immediately surrounding area occur on land zoned as Highway Commercial. The Project Site has historically been operated to support a bio-diesel facility, and therefore the interactions with vegetation and wildlife are expected to be minimal.

In order to ensure that there are no impacts to migratory bird and to reduce the potential for harm to ground nests and other interactions with wildlife during construction at the Project Site, the following mitigation will be implemented:

- Prior to commencement of construction activities surveys for potential ground nests and occurrences of breeding birds will be conducted at the Project Site, and buffers established around nesting sites to protect breeding bird populations, if nests are found.
    - During construction temporary fencing would also be used as required to keep wildlife from accessing the Project Site.

Summary

The proposed Bulk Agro Centre footprint is a previously disturbed area due to the construction of limited infrastructure related to a bio-diesel facility and the area is zoned industrial. The mitigation measures outlined above are deemed sufficient to mitigate potential adverse effects to wildlife due to construction activities. Residual effects on wildlife and wildlife habitat are assessed to be adverse, of low magnitude, limited to the Project Site, span short to medium-term duration, of single occurrence, and reversible.

8.5 Infrastructure and Services

The Bulk Agro Centre's use of municipal services (i.e., energy, waste disposal and recycling) is not anticipated to result in residual effects as the RM of Brokenhead and Manitoba Hydro services are in place with sufficient capacity to accommodate the increase anticipated for the demands of the Bulk Agro Centre.

Considering the forecasted additional traffic attributable to the Bulk Agro Centre's construction and operation as well as the reported traffic volumes near the Project Site along PTH 44 and PTH 12, which will be used to access the Bulk Agro Centre, the Bulk Agro Centre's potential impact on traffic is deemed adverse, low in the LAA/negligible in the RAA, multiple irregular, short-term and reversible.

Summary

The potential adverse residual effects on infrastructure and services are expected to be negligible in the RAA, short-term in duration, multiple irregular in frequency, and reversible upon the Bulk Agro Centre's decommissioning.

8.6 Summary of Residual Effects Characterization

A summary of residual environmental effects characterization is found in **Table 8-1**. Positive effects are not addressed, only adverse effects are characterized.

Table 8-1: Summary of Residual Environmental Effects

Project Effects	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographical Extent	Duration	Frequency	Reversibility	Ecological or Socio-Economic context
Construction							
Air Quality and Noise							
Fugitive dust generation	A	L	PS	S	MI	R	D
Outdoor noise generation	A	L	LAA	S	MI	R	D
GHG Emissions							
Emissions during construction of Bulk Agro Centre	A	N	RAA	L	MI	IR	D
Soil Quality							
Soil compaction and rutting, admixing and erosion	A	L	PS	M-L	S	IR	D
Infrastructure and Services							
Construction-related traffic	A	N	RAA	S	MI	R	D
Operation							
Air Quality and Noise							
Fugitive dust generation	A	N	LAA	S	MI	R	D
Outdoor noise generation	A	N	LAA	S	MI	R	D
GHG Emissions							
Increased GHG emissions associated with Bulk Agro Centre operations	A	N	RAA	L	MI	IR	D
Infrastructure and Services							
Fertilizer and agrichemicals delivery and customer traffic	A	N	RAA	S	MI	R	D

KEY (see Table 7-2 for definitions)

Direction
P Positive
A Adverse
N Neutral

Magnitude
N Negligible
L Low
M Moderate
H High

Geographical Extent
PS Project Site
LAA Local Assessment Area
RAA Regional Assessment Area

Duration
S Short-term
M Medium-term
L Long-term

Frequency
S Single event
MI Multiple irregular
MR Multiple regular
C Continuous

Reversibility

R Reversible
IR Irreversible

Ecological/Socio-Economic Context
U Undisturbed
D Disturbed

N/A = Not applicable

8.7 Accidents and Malfunctions

The effects of accidents and malfunctions for the proposed Bulk Agro Centre largely pertain to the potential for mechanical equipment failure and granular fertilizer or agrichemical spills during warehouse handling or customer pick-up. Beausejour Co-op will develop and have an on-site emergency response plan and employees will be trained in the daily operations of the Bulk Agro Centre. The presence of prevention measures and procedures for managing adverse effects associated with accidents and malfunctions will minimize the effects in the event of an emergency. With the implementation of safe work practices, the likelihood of such events occurring is reduced.

8.7.1 Fires/Explosions

During operation of the Bulk Agro Centre, there will be potential for fires involving mechanical equipment and other combustible materials/substances. Effects due to fires include harm or injury to on-site personnel, damage to equipment, and the potential release of contaminants and hazardous materials.

Beausejour Co-op will take precautions necessary to prevent fire hazards at the Bulk Agro Centre, including:

- Removal of flammable waste from the Project Site on a regular basis and disposal of such waste at an appropriate disposal site.
- Availability of and easy access to appropriate fire extinguisher(s) at the Bulk Agro Centre. Such equipment will comply with and be maintained to, the manufacturers' standards.
- Fire prevention/response equipment will be checked on a regular basis, as required, in accordance with local fire safety regulations, to ensure the equipment is in proper working order.
- The emergency response plan will be provided to and reviewed with the municipal fire department to discuss response and containment in the event of a fire impacting the self-contained chemical shed.

With implementation of the above-mentioned mitigation measures and typical safe work practices, the risk of fires and explosions is deemed to be appropriately mitigated.

8.7.2 Leaks and Spills

Leaks (e.g., vehicle or equipment fuel and oils) and spills of fertilizers or agrichemical could occur during construction and/ or operation. Leak and spill-related effects on air quality, soil quality, birds or other wildlife, and human health and safety are possible.

To reduce the potential for leaks and spills at the Bulk Agro Centre, the following measures will be implemented:

- During construction activities, refueling of heavy equipment will be conducted off-site or will adhere to proper procedures such as using a designated area defined by Beausejour Co-op with spill kits located at the refueling area.
- Storage (bins and chemical shed) infrastructure will be inspected periodically for continued compliance with requirements.
- Dry fertilizer transfer and handling will be completed over concrete pads to allow for

containment and cleanup of minor handling spills.

- Agrichemicals will be sold in as received packaging to reduce the potential for leaks and spills which is associated with product transfer into separate packaging.
- On-site staff will be trained on how to deal with leaks and spills, including knowledge of how to properly deploy site spill kit materials.
- Appropriate type and size of spill kits will be available at the Bulk Agro Centre.
- Service and minor repairs of equipment performed on-site will be performed by trained personnel.
- Vehicles and equipment will be maintained to reduce the potential for leaks. Regular inspections of hydraulic and fuel systems on machinery will be completed on a routine basis, when detected, leaks will be repaired immediately.

Adherence to standard environmental management practices will minimize the risks of accidental leaks and spills and adverse effects. In the event of an accidental spill, Beausejour Co-op will proceed as per the emergency response plan for the Project Site and file a regulatory report with MCC within required timelines. Following a spill, an appropriate spill kit or other suitable alternative would be utilized to prevent migration of the spilled material. Recovery measures would be implemented as necessary in consultation with the appropriate provincial authorities. Following initial response, a remediation program will be undertaken if needed with contaminated material appropriately managed (in accordance with federal and provincial regulations).

With the implementation of the above mitigation measures as necessary and assuming the implementation of safe work practices, the risk of spills is considered appropriately mitigated.

8.7.3 Flooding

Overland flooding is a potential emergency scenario for the Project Site and surrounding areas. However, with the proposed drainage plan for the Project Site, the risk of flooding is considered appropriately mitigated.

8.7.4 Transportation Accidents

Transportation accidents can result in the release of vehicle fluids (i.e., diesel, gasoline, oils, etc.) and the materials the vehicles were transporting (i.e., fertilizers, agrichemicals) to the environment. Effects related to such releases can include air, surface water, groundwater, and soil quality effects with potential for subsequent effects on the environment and human health.

The potential for transportation accidents at the Bulk Agro Centre during construction and operational activities will be reduced by the following measures:

- Traffic at the Project Site (i.e., deliveries and pickups) will operate at a slow speed that will be posted near the entrance and within the Project Site.
- Beausejour Co-op will utilize qualified transportation companies and personnel to transport its retail products.

8.8 Effects of the Environment on the Project

Potential effects of the environment that can affect the proposed Bulk Agro Centre include damage from

fires originating from adjacent properties and wildfires. Climate change will increase the risk over time of extreme weather events, such as tornados and strong winds, and grass fires.

9.0 Summary and Conclusion

Wood has prepared this EAP Report on behalf of Beausejour Co-op as supporting documentation for Beausejour Co-op's EAP for a new development that will be located in the RM of Brokenhead near PTH 44 and PTH 12, near the Town of Beausejour, in Manitoba. The proposed development will consist of the construction and operation of a bulk seed treating facility with six volumetric smooth wall bins, a dry fertilizer storage, blending and loading facility, an AWSA-certified agrichemical warehouse and an office building, collectively referred to as the Bulk Agro Centre.

The Bulk Agro Centre will rely on a drilled well at site for its water needs and an on-site septic tank which will be cleaned out as needed by a contracted septic tank services provider. Office waste generated at the Project Site will be disposed of at the RM of St. Clements WDG. Granular fertilizer waste (e.g., from spills or damaged packaging) will be spread on agricultural fields for disposal, per standard industry practice.

As the Bulk Agro Centre will be located on a previously developed site and in an area zoned for industrial development noise or dust generation are not anticipated to affect surrounding residential areas.

A slight increase in the number of vehicles using both PTH 44 and PTH 12 and accessing the Project Site during the construction and the eventual operation of the Bulk Agro Centre is anticipated. However, the vehicles travelling to and from the Project Site (employees, delivery semi-trucks and consumer vehicles) are not expected to exceed current service capacity levels of either PTH 44 or PTH 12.

Beausejour Co-op will implement appropriate mitigation and preventative measures to minimize potential adverse effects to the environment during the construction and operation of the Bulk Agro Centre.

The potential for adverse effects from accidents and malfunctions at the Project Site would primarily be related to accidents or malfunctions (e.g., fires, spills and transportation accidents). The Bulk Agro Centre's operational procedures, emergency response plan, mitigation measures, and safe work practices will reduce the potential likelihood/severity of these events.

Based on the desktop studies undertaken, site observations and information available to date as presented in this report, the construction and operation of the proposed Bulk Agro Centre is not expected to create significant adverse effects to the biophysical and socio-economic environment and is expected to provide economic benefits to the region.

10.0 References

Artuso C, A. R. Couturier, K. D. De Smet, R. F. Koes, D. Lepage, J. McCracken, R. D. Mooi, and P. Taylor (editors.). The Atlas of the Breeding Birds of Manitoba, 2010-2014. Bird Studies Canada. Winnipeg, Manitoba < http://www.birdatlas.mb.ca/ e > [2018 Mar 29].

Betcher R., G. Grove, C. Pupp. 1995. Groundwater in Manitoba: Hydrogeology, Quality Concerns, Management. NHRI Contribution No. CS-93017.

Burt, A.K., 2004. Geological Survey of Canada Map 2053A, Surficial geology, Beausejour, Manitoba, by Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey, Geoscientific Map MAP2003-5, scale 1:1000,000.

Cleanfarms. 2020. Available online at: https://cleanfarms.ca/ (accessed on 30 June 2020).

Das, S.R. 2011. Estimation of Greenhouse Gases Emissions from Biological Wastewater Treatment Plants at Windsor. Electronic thesis and Dissertations. Paper 77.

Environment Canada. 2018. Canadian Climate Normals 1981-2010 Station Data – Beausejour 2, Manitoba, Government of Canada Website: http://climate.weather.gc.ca/climate_normals/index_e.html (accessed 26 March 2018).

Environment and Climate Change Canada 2018b. National Inventory Report 1990-2016 - Greenhouse Gas Sources and Sinks in Canada.

Foster, C. 2008. Rare Plant Surveys and Stewardship Activities by the Manitoba Conservation Data Centre, 2007. MS Report 08-01. Manitoba Conservation Data Centre, Winnipeg, Manitoba. 35 pp.

Government of Canada. 2018. Species at Risk Public Registry - Schedule 1 -List of Wildlife Species at Risk. Available online at: http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=1. (Accessed 17 April 2018)

Hopkins L.A. and R.E. Smith. 1982. Soils of The Pas Area. Soils Report No. 22. Canada-Manitoba Soil Survey.

Manitoba Breeding Bird Atlas. 2018. Species at Risk – Barn Swallow. Available online at: http://www.birdatlas.mb.ca/speciesatrisk/species/BarnSwallow/species.htm. Accessed 17 April 2018.

Manitoba Conservation Data Centre. 2016. Occurrence of Species by Ecoregion - Boreal Transition. Accessed online at: https://www.gov.mb.ca/sd/cdc/ecoreg/boreal.html

Manitoba Conservation and Water Stewardship. 2005. Manitoba Air Quality Objectives.

Manitoba Conservation and Water Stewardship. 2013. Manitoba Air Quality Data – 2013 Annual Pollutant Summary – Continuous Monitoring. Available online at: https://www.gov.mb.ca/conservation/envprograms/airquality/pdf/2013_data_table.pdf (accessed on 1 July 2020).

Manitoba Flood Information. No date. Manitoba Flood Facts. Available online at https://www.gov.mb.ca/flooding/history/index.html (accessed on 30 June 2020).

Manitoba Sustainable Development. 2020a. Species Listed Under the Endangered Species and Ecosystems Act. Available online at: https://www.gov.mb.ca/sd/wildlife/sar/sarlist.html (Accessed 30 June 2020)

Manitoba Sustainable Development. 2020b. Parks and Protected Spaces. Available online at: https://www.gov.mb.ca/sd/parks/popular_parks/northwest/clearwater_info.html (accessed on 30 June 2020).

Manitoba Sustainable Development. 2020c. Wildlife Management Areas. Available online at: http://www.gov.mb.ca/sd/wildlife/habcons/wmas/gMap/ (accessed 30 June 2020).

Manitoba Sustainable Development. 2017. Waste Disposal Grounds Valid Permits as of 04 August 2017. Available online at: https://www.manitoba.ca/sd/envprograms/swm/pdf/facility_permit_listing.pdf (accessed on 1 July 2020).

Matile G.L.D., G.R. Keller. 2004. Surficial geology of the Selkirk map sheet (NTS 621), Manitoba. Manitoba

Industry, Economic Development and Mines, Manitoba Geological Survey. Surficial Geology Compilation Map Series, SG-621, scale 1:250 000.

Michalyna W., R.E. Smith, R.A. Milne. 1972. Soils of the Portage la Prairie Area. Manitoba Soil Survey. Soils Report No. 17.

Padolvsky, G. Soils of the Brokenhead Area, Report D26. Canada-Manitoba Soil Survey

Smith R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser, G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba. An Ecological Stratification of Manitoba's Natural Landscapes. Land Resource Unit. Brandon Research Centre, Research Branch. Agriculture and Agri-Food Canada.

Wood, 2020a. Phase 1 Environmental Site Assessment Parcel A & B within SE ¼ 12-13-7 EPM.

Wood, 2020b. Geotechnical Investigation Beausejour Co-op Proposed Agro Site SE ¼ 12-13-7 EPM.

10.1 Personal Communications

Colin Murray. Coordinator, Manitoba Conservation Data Centre. Email correspondence on recorded occurrences of rare species at the Project Site (NE 12-13-7 EPM) and surrounding areas in the Rural Municipality of Brokenhead.

Krystal Penner. Pesticide and Agricultural Program Specialist. Manitoba Conservation and Climate Change. Email correspondence regarding the requirements for secondary containment around the AWSA warehouse.

Richard Tattersall. Groundwater (ARD). Email correspondence on recorded well locations within the Project area (NE12-13-7 EPM) and surrounding area.

Appendix A

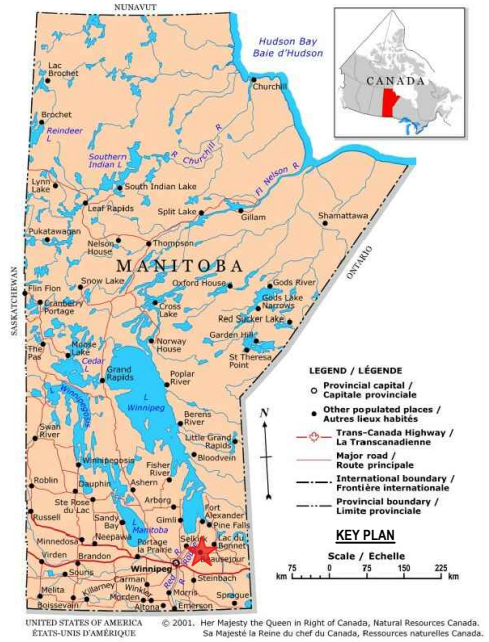
Site Figures and Drawings

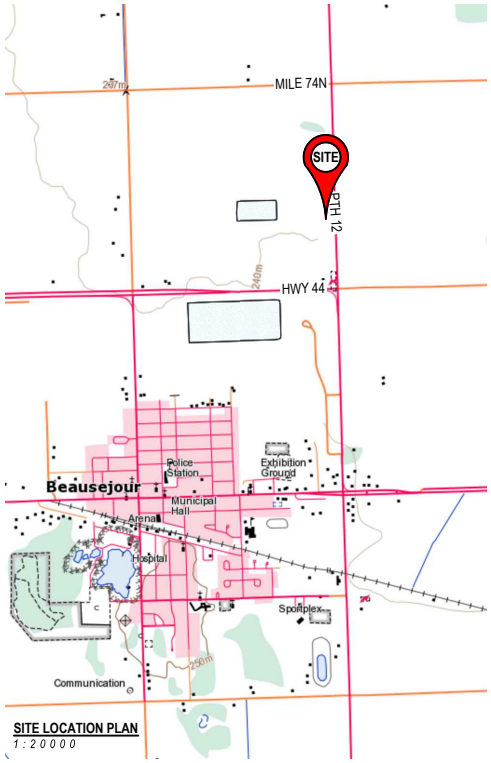
Figure 1: Overview of Site

Figure 2: Local Assessment Area

Figure 3: Regional Assessment Area

Figure 4: Proposed Agro Facility Site and Infrastructure Layout





wood.
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

CO-OP

LEGEND:
APPROXIMATE PROPERTY LINE

NOTE:
- SITE FEATURES AND LOCATIONS ARE APPROXIMATE.
- IMAGES FROM AUTODESK IMAGERY AND TOPO MAP.

NO.	REVISION	DATE	BY

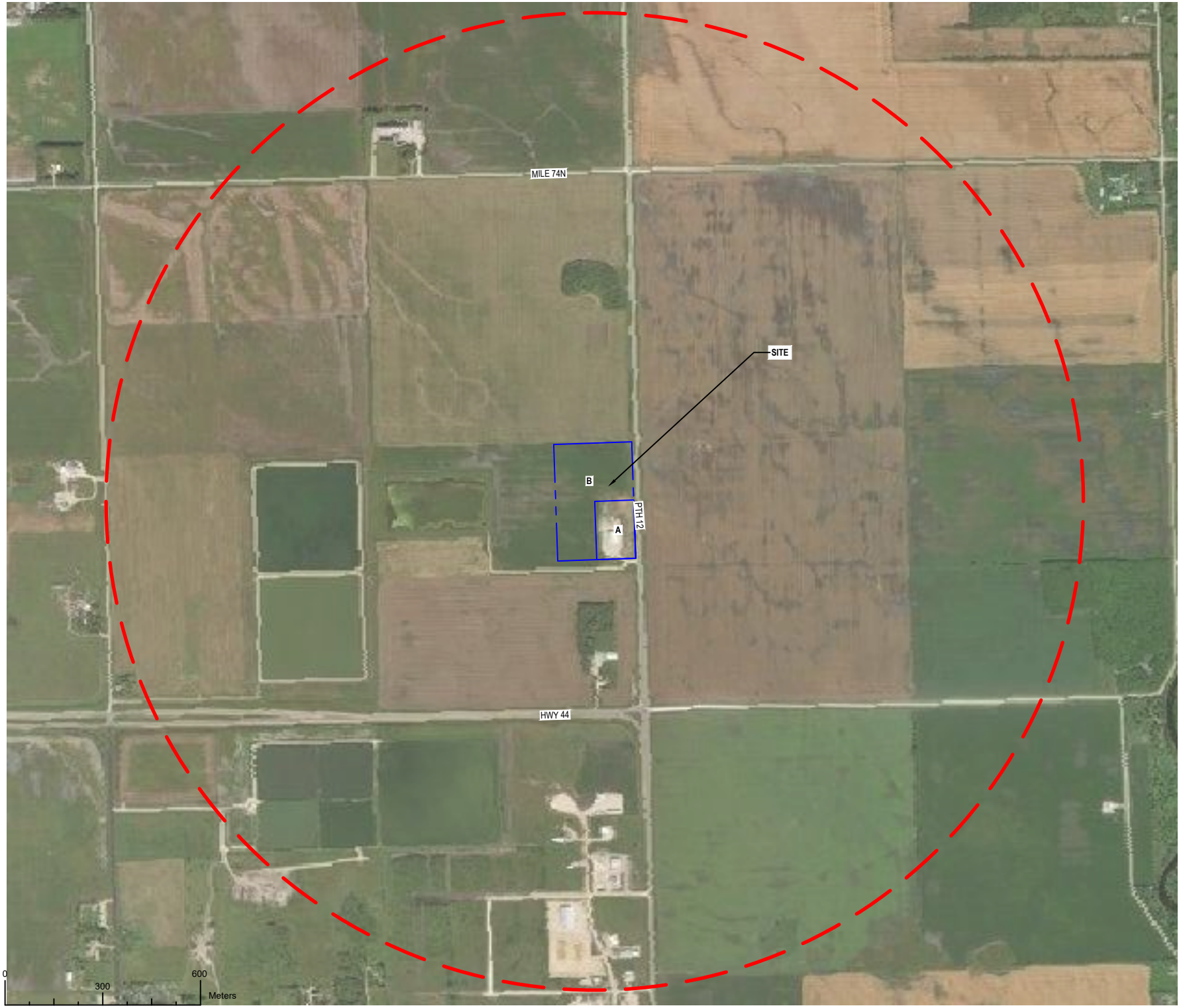
ENVIRONMENT ACT PROPOSAL

SE-12-13-07-E1
BEAUSEJOUR, MANITOBA

SITE PLAN

SCALE:	AS SHOWN
DATE:	JULY 2020
DRAWN BY:	MD
PROJECT NO.:	WX19102

FIGURE 1



wood.
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

CO-OP

LEGEND:
APPROXIMATE PROPERTY LINE
1.5km RADIUS BUFFER ZONE

NOTE:
- SITE FEATURES AND LOCATIONS ARE APPROXIMATE.
- IMAGES FROM AUTODESK IMAGERY AND TOPO MAP.

NO.	REVISION	DATE	BY

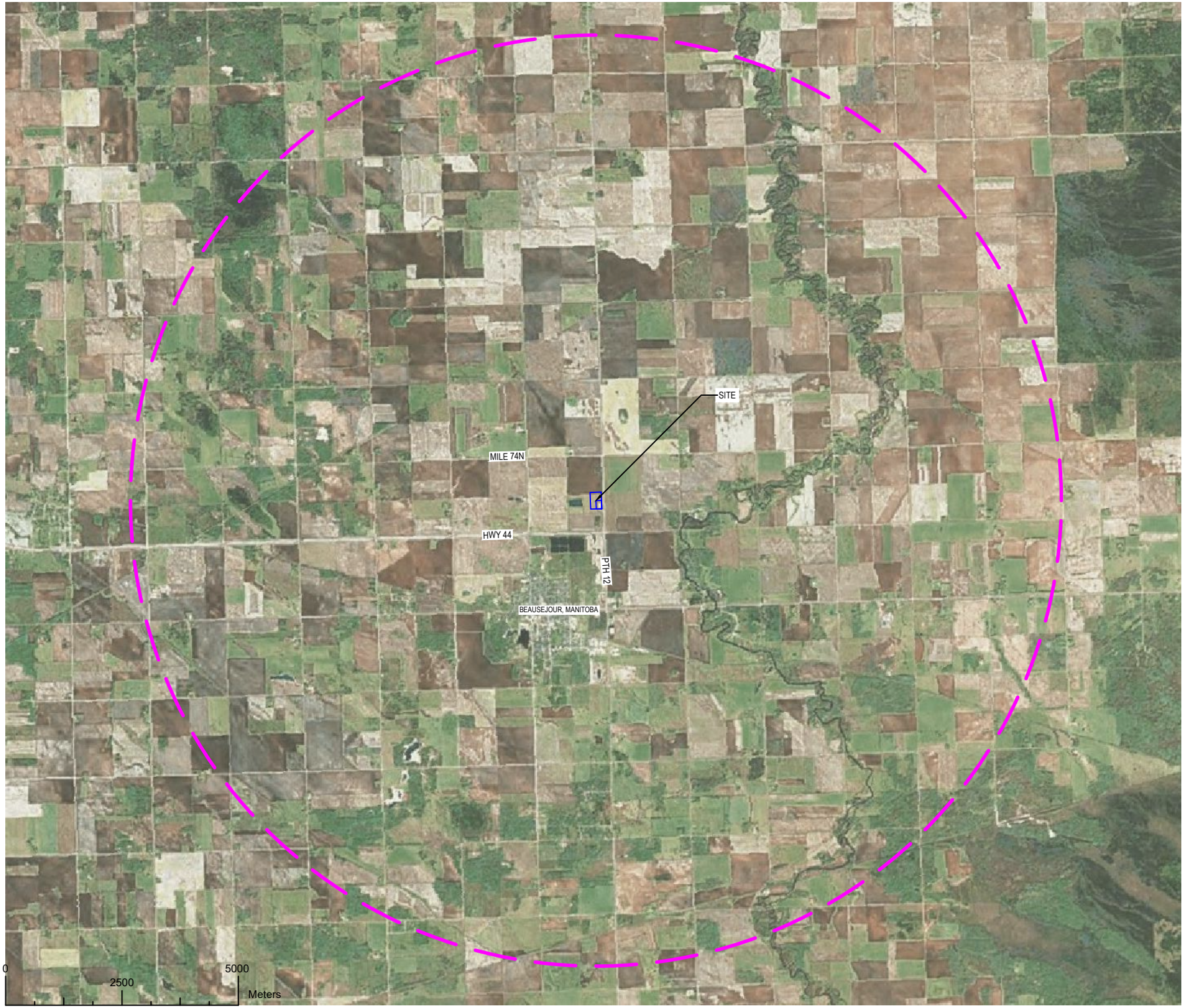
ENVIRONMENT ACT PROPOSAL

SE-12-13-07-E1
BEAUSEJOUR, MANITOBA

LOCAL ASSESSMENT AREA

SCALE:	AS SHOWN
DATE:	JULY 2020
DRAWN BY:	MD
PROJECT NO.:	WX19102

FIGURE 2



wood.
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

CO-OP

LEGEND:
APPROXIMATE PROPERTY LINE
10km RADIUS BUFFER ZONE

NOTE:
- SITE FEATURES AND LOCATIONS ARE APPROXIMATE.
- IMAGES FROM AUTODESK IMAGERY AND TOPO MAP.

NO.	REVISION	DATE	BY

ENVIRONMENT ACT PROPOSAL

SE-12-13-07-E1
BEAUSEJOUR, MANITOBA

REGIONAL ASSESSMENT AREA

SCALE:	AS SHOWN
DATE:	JULY 2020
DRAWN BY:	MD
PROJECT NO.:	WX19102

FIGURE 3

BEAUSEJOUR CO-OP

BEAUSEJOUR - AG OFFICE BUILDING

FEDERATED CO-OPERATIVES LIMITED

LIST OF DRAWINGS:

DRAWING #	SHEET NAME
000.1	DRAWING CHANGE LOG
101.1	SITE PLAN
103.1	PYLON SIGN
104.1	PROPOSED FLOOR PLAN
401.1	EXTERIOR ELEVATIONS
403.1	TILE LEGENDS AND LAYOUTS
404.1	PAINT LEGENDS AND LAYOUTS

FINAL FLOOR PLAN APPROVAL:

DATE:

Retail General Manager

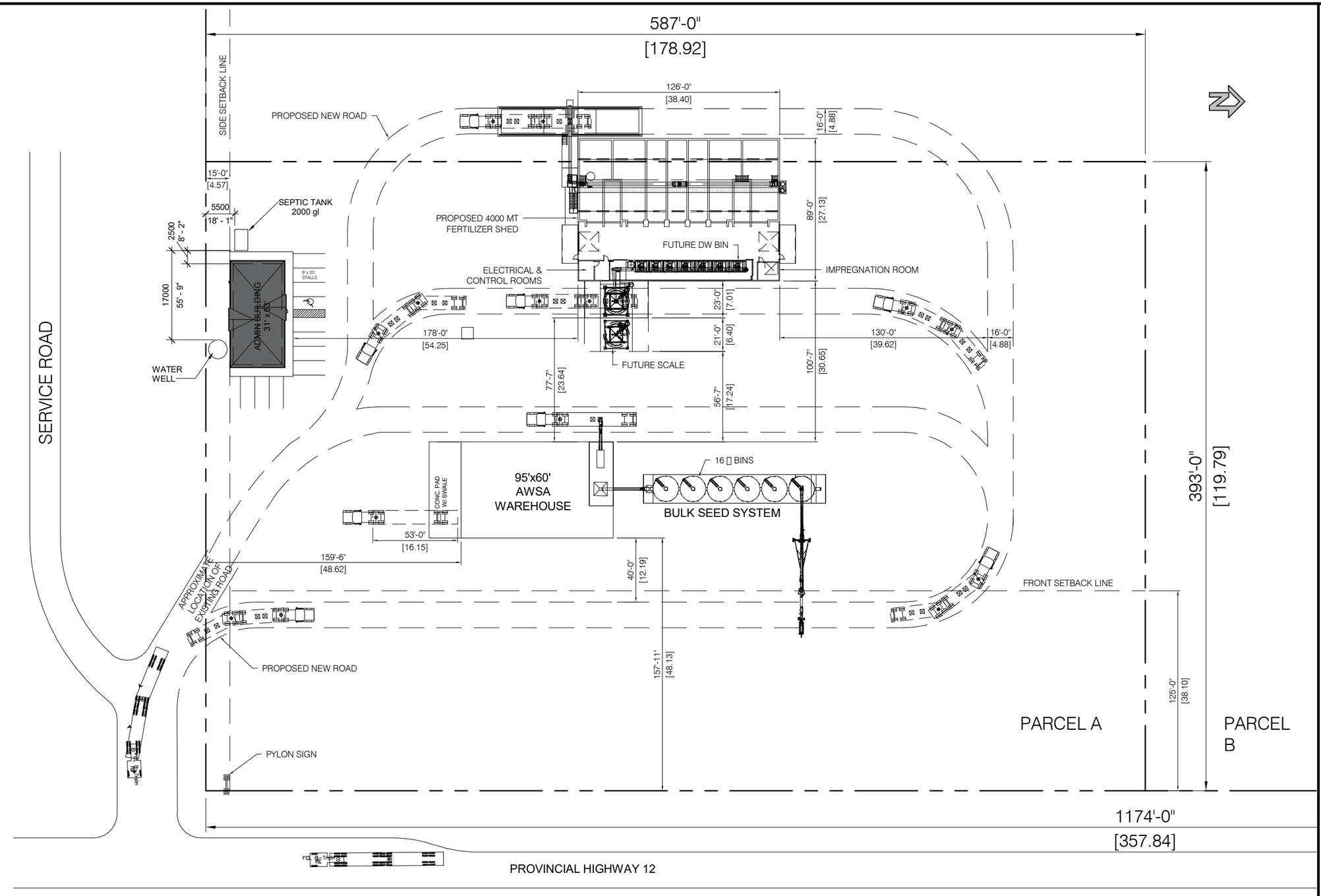
Region Commodity Manager

HO Commodity Manager

Project Manager

CHECKED BY:

REV: F



1 SITE PLAN
1 : 750

CONCEPTUAL DRAWING
NOT FOR CONSTRUCTION

FEDERATED CO-OPERATIVES LIMITED

NOTES:
1. All DIMENSIONS IN MILLIMETERS, UNLESS OTHERWISE NOTED.
2. THIS DRAWING IS FOR REFERENCE ONLY; ALL DIMENSIONS SHALL BE CONFIRMED, ON SITE, BY THE ARCHITECT BEFORE COMMENCING WORK OR ORDERING MATERIALS.
3. CONSTRUCTION SHALL BE COMPLETED IN ACCORDANCE WITH THE NATIONAL BUILDING CODE OF CANADA.

REVISION SCHEDULE

REV #	DATE	LOCATION

PROJ. # BEAUSEJOUR 2020

DATE 21 APRIL 2020

DRAWN ATG

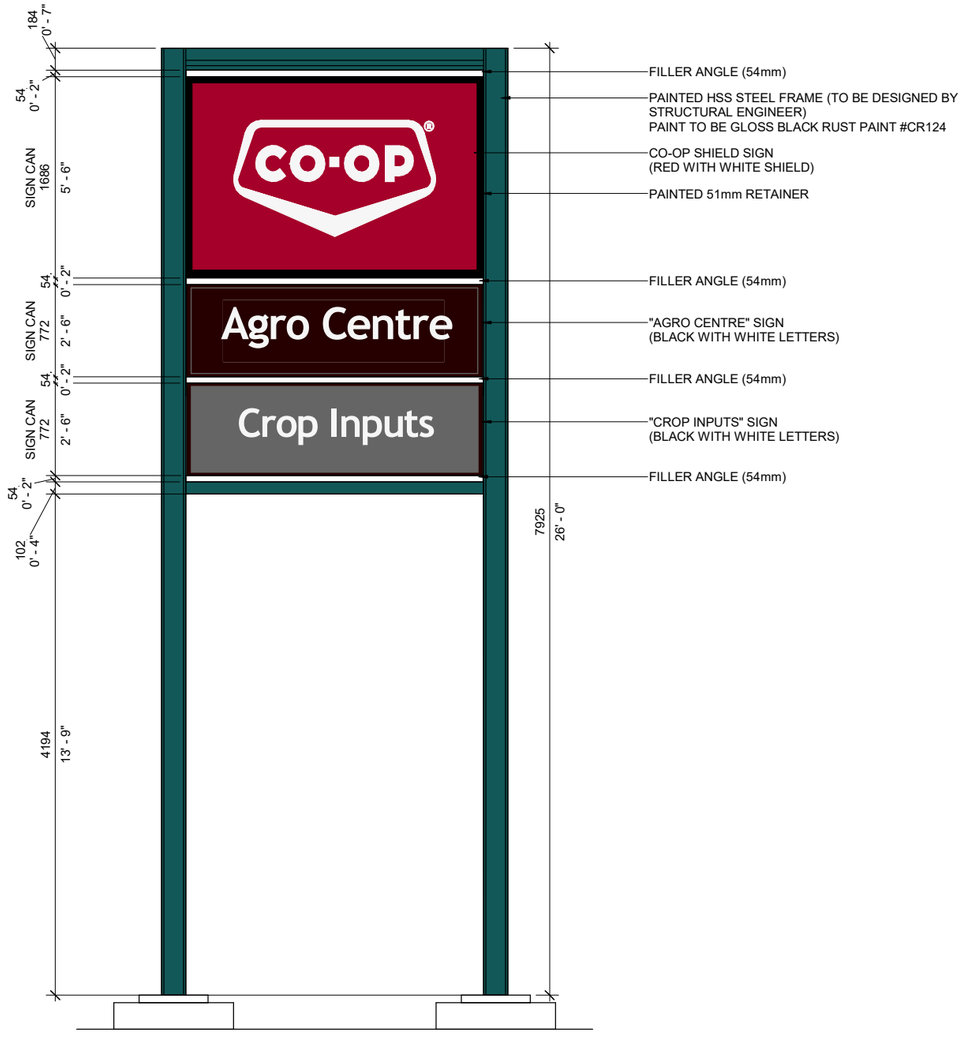
RETAIL: BEAUSEJOUR CO-OP

FACILITY: ADMIN BUILDING

LOCATION
LOT(S)
BLOCK(S)
PLAN
LEGAL DESC.
CIVIC ADD.
CITY
PROVINCE

SHEET SITE PLAN

DWG. # 101.1 **REV. F**



1 Unlit Pylon Sign

1 : 50

CONCEPTUAL DRAWING

NOT FOR CONSTRUCTION

FEDERATED CO-OPERATIVES LIMITED

NOTES:

1. All DIMENSIONS IN MILLIMETERS, UNLESS OTHERWISE NOTED.
2. THIS DRAWING IS FOR REFERENCE ONLY; ALL DIMENSIONS SHALL BE CONFIRMED, ON SITE, BY THE ARCHITECT BEFORE COMMENCING WORK OR ORDERING MATERIALS.
3. CONSTRUCTION SHALL BE COMPLETED IN ACCORDANCE WITH THE NATIONAL BUILDING CODE OF CANADA.

REVISION SCHEDULE

REV #	DATE	LOCATION

PROJ. # BEAUSEJOUR 2020

DATE 21 APRIL 2020

DRAWN ATG

RETAIL: BEAUSEJOUR CO-OP

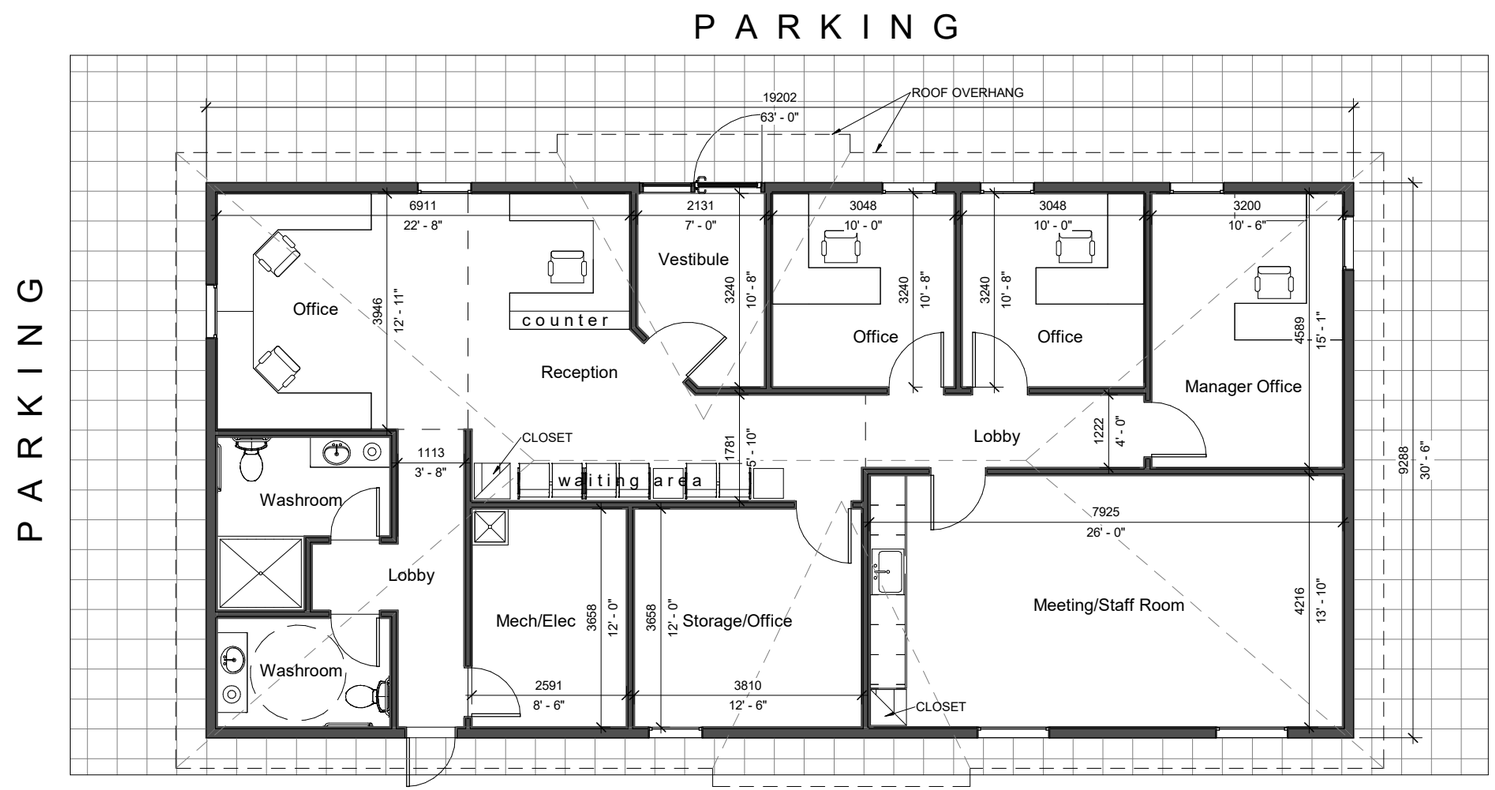
FACILITY: ADMIN BUILDING

LOCATION

LOT(S)
BLOCK(S)
PLAN
LEGAL DESC.
CIVIC ADD.
CITY
PROVINCE

SHEET PYLON SIGN

DWG. # 103.1 **REV. F**



1 PROPOSED FLOOR PLAN

1 : 100

CONCEPTUAL DRAWING

NOT FOR CONSTRUCTION

FEDERATED CO-OPERATIVES LIMITED

NOTES:

1. All DIMENSIONS IN MILLIMETERS, UNLESS OTHERWISE NOTED.
2. THIS DRAWING IS FOR REFERENCE ONLY; ALL DIMENSIONS SHALL BE CONFIRMED, ON SITE, BY THE ARCHITECT BEFORE COMMENCING WORK OR ORDERING MATERIALS.
3. CONSTRUCTION SHALL BE COMPLETED IN ACCORDANCE WITH THE NATIONAL BUILDING CODE OF CANADA.

REVISION SCHEDULE

REV #	DATE	LOCATION

PROJ. # BEAUSEJOUR 2020

DATE 21 APRIL 2020

DRAWN ATG

RETAIL: BEAUSEJOUR CO-OP

FACILITY: ADMIN BUILDING

LOCATION

LOT(S)

BLOCK(S)

PLAN

LEGAL DESC.

CIVIC ADD.

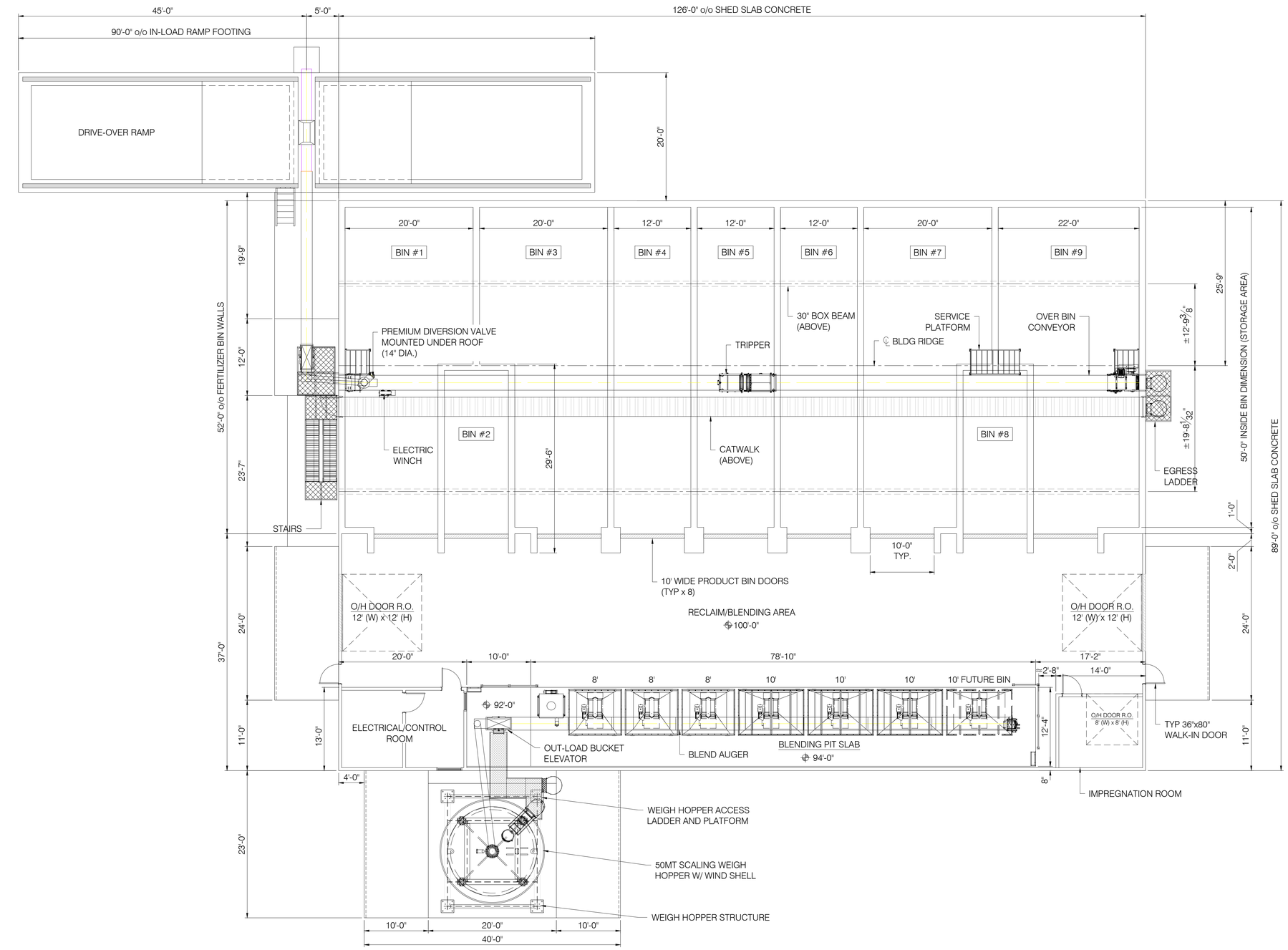
CITY

PROVINCE

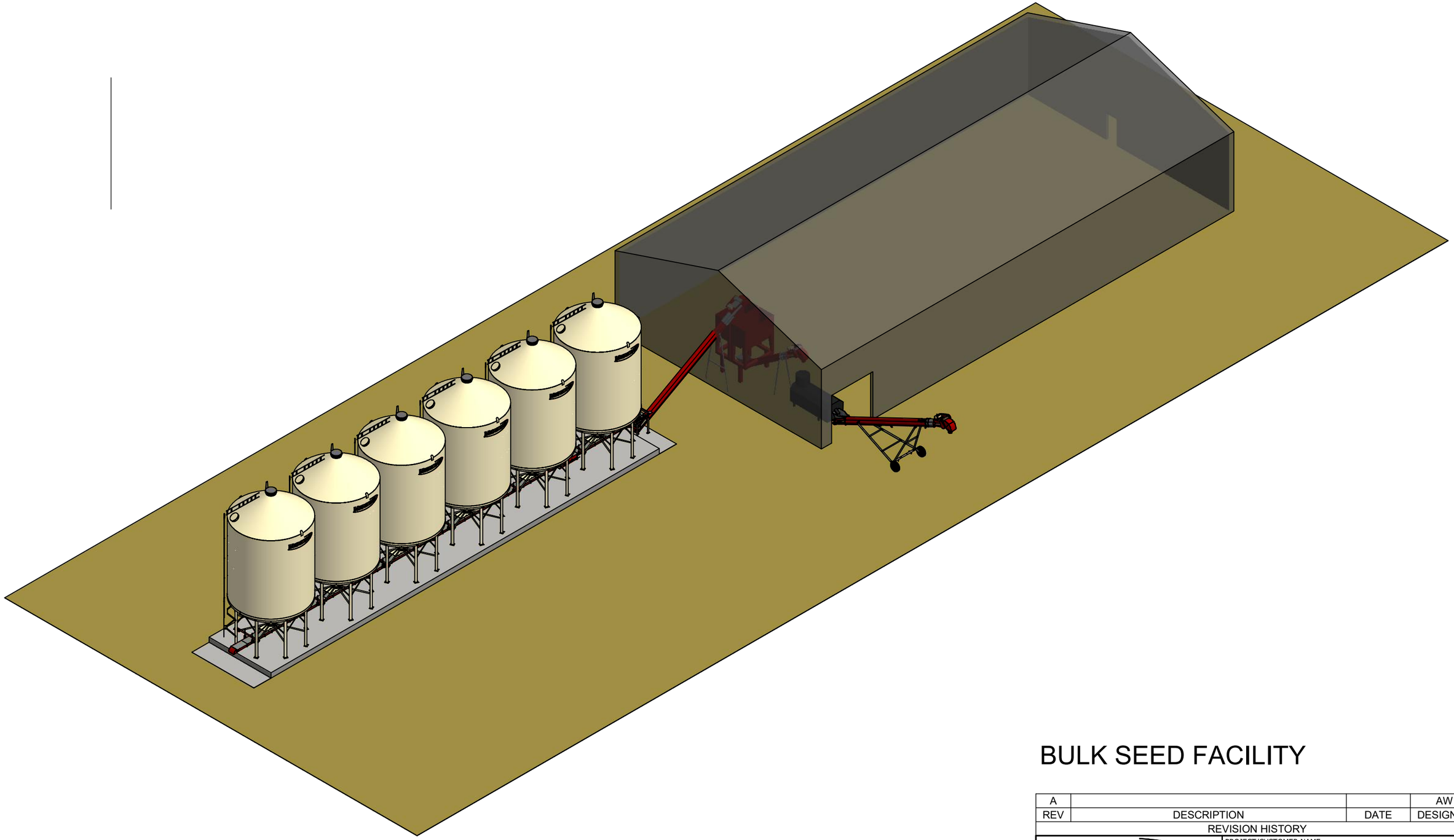
SHEET PROPOSED FLOOR PLAN

DWG. # 104.1 **REV. F**

NORTH



FERTILIZER
SHED



BULK SEED FACILITY

REV	DESCRIPTION	DATE	DESIGNER
A			AW

REVISION HISTORY

MERIDIAN
www.meridianmfg.com

PROJECT/CUSTOMER NAME: FARMCHEM - BEAUSEJOUR CO-OP (BEAUSEJOUR, MB)

PART DESCRIPTION: SEET SITE LAYOUT

MATERIAL:

WEIGHT: 2260812.14 lbmass

FABRICATION: XXX

DRAWN BY:	DRAWN BY DATE:	CHECKED BY:	PART/DRAWING NUMBER:	REV:	SCALE:	SHEET No:
DS	12/06/2019	*BP*	Q315771	A	1 / 230	1 OF 4

GENERAL NOTES:

1. DO NOT SCALE DRAWINGS
2. USE LATEST REVISED DRAWINGS ONLY.
3. REPORT ANY DISCREPANCIES, ERRORS, OR OMISSIONS TO MERIDIAN MFG BEFORE PROCEEDING.
4. CONTRACTOR SHALL VERIFY ALL SITE DIMENSIONS PRIOR TO CONSTRUCTION AND ENSURE MERIDIAN MFG IS INFORMED OF ANY DISCREPANCIES.

Appendix B

Land Titles

STATUS OF TITLE

Title Number **2880514/1**
Title Status **Accepted**
Client File La Valley

The Property Registry
A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON
IN THE FOLLOWING DESCRIBED LAND:

LOT 1 PLAN 60417 WLTO
IN SE 1/4 12-13-7 EPM

The land in this title is, unless the contrary is expressly declared, deemed to be subject to the reservations and restrictions set out in section 58 of *The Real Property Act.*

2. ACTIVE INSTRUMENTS

Instrument Type:	**Caveat**
Registration Number:	**3631466/1**
Instrument Status:	**Accepted**
Registration Date:	2008-06-20
From/By:	MTS ALLSTREAM INC.
To:	
Amount:	
Notes:	No notes
Description:	EASEMENT

Instrument Type:	**Mortgage**
Registration Number:	**4574330/1**
Instrument Status:	**Accepted**
Registration Date:	2015-02-02
From/By:	THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.
To:	SUNOVA CREDIT UNION LIMITED
Amount:	$200,000.00
Notes:	No notes
Description:	No description

INSTRUMENTS THAT AFFECT THIS INSTRUMENT

Registration Number	Instrument Type	Status
4623593/1	Amending Agreement	Accepted
4804048/1	Amending Agreement	Accepted

Instrument Type: **Amending Agreement**
Registration Number: **4623593/1**
Instrument Status: **Accepted**

Registration Date: 2015-07-13
From/By: SUNOVA CREDIT UNION LIMITED
To: THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.

Amount:
Notes: No notes
Description: No description

Instrument Type: **Amending Agreement**
Registration Number: **4804048/1**
Instrument Status: **Accepted**

Registration Date: 2017-01-09
From/By: SUNOVA CREDIT UNION LIMITED
To: THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.

Amount:
Notes: No notes
Description: No description

3. ADDRESSES FOR SERVICE

THE BROKENHEAD RIVER BIOFUELS
CO-OP LTD.
BOX 284
BEAUSEJOUR MB
R0E 0C0

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Winnipeg

6. DUPLICATE TITLE INFORMATION

Duplicate not produced

7. FROM TITLE NUMBERS

2709475/1	All
2709499/1	Partial

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type:	**Transfer Of Land**
Registration Number:	**4804047/1**
Registration Date:	2017-01-09
From/By:	THE TOWN OF BEAUSEJOUR
To:	THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.
Consideration:	$30,000.00

10. LAND INDEX

Lot 1 Plan 60417

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 2880514/1

DATE: 2015/01/15
TIME: 16:24

MANITOBA

STATUS OF TITLE

TITLE NO: 2709475/1

STATUS OF TITLE..... ACCEPTED
ORIGINATING OFFICE... WINNIPEG
REGISTERING OFFICE... WINNIPEG
REGISTRATION DATE.... 2014/02/12
COMPLETION DATE..... 2014/02/26

PRODUCED FOR.. NA
ADDRESS.....

CLIENT FILE... NA
PRODUCED BY... J.CHARTRAND

LEGAL DESCRIPTION:

THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

ALL THAT PORTION OF THE NLY 1171 FEET PERP OF
THE SE 1/4 OF SECTION 12-13-7 EPM LYING WEST OF THE WESTERN LIMIT
OF PUBLIC ROAD PLAN 5457 WLTO
WHICH LIES EAST OF A LINE DRAWN WEST OF, PARALLEL WITH AND PERP
DISTANT 371 FEET FROM THE SAID WESTERN LIMIT

ACTIVE TITLE CHARGE(S):

3631466/1 ACCEPTED CAVEAT **REG'D:** 2008/06/20
DESCRIPTION: EASEMENT
FROM/BY: MTS ALLSTREAM INC.
TO:
CONSIDERATION: **NOTES:** AFFECTS: ELY 12 MTRS PERP

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	THE BROKENHEAD RIVER BIOFUELS CO-OP LTD. BOX 824 BEAUSEJOUR MB	ROE 0C0

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
4456114/1	T	2014/02/12	$24,357.00	$24,357.00

PRESENTED BY: MIDDLETON & MIDDLETON
FROM: THE TOWN OF BEAUSEJOUR
TO: THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.

FROM TITLE NUMBER(S):

2709467/1 ALL

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/15 OF TITLE NUMBER 2709475/1

********** STATUS OF TITLE 2709475/1 CONTINUED ON NEXT PAGE **********

DATE: 2015/01/15
TIME: 16:27

MANITOBA

STATUS OF TITLE

TITLE NO: 2709467/1

PAGE: 1

STATUS OF TITLE..... **CANCELLED**
ORIGINATING OFFICE... WINNIPEG
REGISTERING OFFICE... WINNIPEG
REGISTRATION DATE.... 2014/02/12
COMPLETION DATE..... 2014/02/26

PRODUCED FOR.. NA
ADDRESS.....

CLIENT FILE... NA
PRODUCED BY... J.CHARTRAND

LEGAL DESCRIPTION:

THE TOWN OF BEAUSEJOUR

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

ALL THAT PORTION OF THE NLY 1171 FEET PERP OF
THE SE 1/4 OF SECTION 12-13-7 EPM LYING WEST OF THE WESTERN LIMIT
OF PUBLIC ROAD PLAN 5457 WLTO
WHICH LIES EAST OF A LINE DRAWN WEST OF, PARALLEL WITH AND PERP
DISTANT 371 FEET FROM THE SAID WESTERN LIMIT

ACTIVE TITLE CHARGE(S):

3631466/1 ACCEPTED CAVEAT **REG'D:** 2008/06/20
DESCRIPTION: EASEMENT
FROM/BY: MTS ALLSTREAM INC.
TO:
CONSIDERATION: **NOTES:** AFFECTS: ELY 12 MTRS PERP

4456114/1 ACCEPTED TRANSFER OF LAND **REG'D:** 2014/02/12
FROM/BY: THE TOWN OF BEAUSEJOUR
TO: THE BROKENHEAD RIVER BIOFUELS CO-OP LTD.
CONSIDERATION: $24,357.00 **NOTES:**

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	THE TOWN OF BEAUSEJOUR BOX 1028 BEAUSEJOUR MB	ROE OCO

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
4456112/1	TREQ	2014/02/12	$0.00	$0.00

PRESENTED BY: MIDDLETON & MIDDLETON
FROM: THE TOWN OF BEAUSEJOUR
TO:

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/15 OF TITLE NUMBER 2709467/1

********** STATUS OF TITLE 2709467/1 CONTINUED ON NEXT PAGE **********

MANITOBA

STATUS OF TITLE

STATUS OF TITLE.....	**CANCELLED**	PRODUCED FOR..	NA
ORIGINATING OFFICE...	WINNIPEG	ADDRESS.....	
REGISTERING OFFICE...	WINNIPEG		
REGISTRATION DATE....	2014/02/12		
COMPLETION DATE.....	2014/02/26		
		CLIENT FILE...	NA
		PRODUCED BY...	J.CHARTRAND

FROM TITLE NUMBER(S):

1127367/1 PART

LAND INDEX:

LOT	QUARTER SECTION	SECTION	TOWNSHIP	RANGE
	SE	12	13	7E

NOTE: PT N1171'P W OF ROAD 5457 & E OF LINE 371' FROM ROAD

**ACCEPTED THIS 12TH DAY OF FEBRUARY, 2014
BY G.PHILLIPS FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF WINNIPEG.**

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/15 OF TITLE NUMBER 2709467/1.

********** END OF STATUS OF TITLE 2709467/1 **********

DATE: 2015/01/16
TIME: 08:32

MANITOBA

STATUS OF TITLE

TITLE NO: 1127367/1

PAGE: 1

STATUS OF TITLE..... **CANCELLED**
ORIGINATING OFFICE... WINNIPEG
REGISTERING OFFICE... WINNIPEG
REGISTRATION DATE.... 1989/10/24
COMPLETION DATE..... 1989/11/06

PRODUCED FOR.. NA
ADDRESS.....

CLIENT FILE... NA
PRODUCED BY... M.TRONINA

LEGAL DESCRIPTION:

THE TOWN OF BEAUSEJOUR

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

N 1/2 OF SE 1/4 12-13-7 EPM
EXC FIRSTLY: PUBLIC ROAD PLAN 5457 WLTO
SECONDLY: DRAIN PLAN 7430 WLTO

ACTIVE TITLE NOTE(S):

DUP CT PRODUCED AND CANCELLED - 12 FEB 2014 - G PHILLIPS

ACTIVE TITLE CHARGE(S):

1230206/1 ACCEPTED CAVEAT **REG'D:** 1989/11/17
FROM/BY: GARRY EARL RECKSIEDLER & KENNETH FREDERICK RECKSIEDLER
TO:
CONSIDERATION: **NOTES:**

3631466/1 ACCEPTED CAVEAT **REG'D:** 2008/06/20
DESCRIPTION: EASEMENT
FROM/BY: MTS ALLSTREAM INC.
TO:
CONSIDERATION: **NOTES:** AFF: PART

4456112/1 ACCEPTED REQUEST TO ISSUE TITLE **REG'D:** 2014/02/12
DESCRIPTION: CERTIFICATE OF APPROVAL ATTACHED
FROM/BY: THE TOWN OF BEAUSEJOUR
TO:
CONSIDERATION: **NOTES:** PART

4459653/1 ACCEPTED REQUEST TO ISSUE TITLE - INTERNAL **REG'D:** 2014/02/26
DESCRIPTION: RESIDUAL TITLE
FROM/BY: THE TOWN OF BEAUSEJOUR
TO:
CONSIDERATION: **NOTES:** BALANCE

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/16 OF TITLE NUMBER 1127367/1

********** STATUS OF TITLE 1127367/1 CONTINUED ON NEXT PAGE **********

MANITOBA

STATUS OF TITLE

STATUS OF TITLE.....	**CANCELLED**	PRODUCED FOR..	NA
ORIGINATING OFFICE...	WINNIPEG	ADDRESS.....	
REGISTERING OFFICE...	WINNIPEG		
REGISTRATION DATE....	1989/10/24		
COMPLETION DATE.....	1989/11/06		
		CLIENT FILE...	NA
		PRODUCED BY...	M.TRONINA

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	THE TOWN OF BEAUSEJOUR BOX 1028 BEAUSEJOUR, MANITOBA	ROE 0C0

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1219760/1	T	1989/10/24	$70,000.00	$70,000.00

PRESENTED BY: MIDDLETON & HAWRANIK
FROM: KENNETH FREDERICK RECKSIEDLER & GARRY EARL RECKSIEDLER
TO: THE TOWN OF BEAUSEJOUR

FROM TITLE NUMBER(S):

G27025/1 ALL

LAND INDEX:

LOT	QUARTER SECTION	SECTION	TOWNSHIP	RANGE
	SE	12	13	7E

NOTE: N 1/2 EXC PLAN 7430 & 5457

**ACCEPTED THIS 24TH DAY OF OCTOBER, 1989
BY D.ABBOTT FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF WINNIPEG.**

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/16 OF TITLE NUMBER 1127367/1.

********** END OF STATUS OF TITLE 1127367/1 **********

Cert. No. G 27025

MANITOBA

Certificate of Title

UNDER "THE REAL PROPERTY ACT"

KENNETH FREDERICK RECKSIEDLER, and GARRY EARL RECKSIEDLER,

both of Beausejour Post Office, in Manitoba, Farmers,

are / now seized of/an estate in fee simple in possession subject to such encumbrances, liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all that piece or parcel of land known and described as follows,

each an undivided one-half interest, in

The North half of the South East quarter of Section Twelve in the Thirteenth Township and Seventh Range, East of the Principal Meridian in Manitoba, excepting thereout, Firstly: All that portion taken for a Public Road as same is shewn on a plan deposited in the Winnipeg Land Titles Office as No 5457 and Secondly: All that portion thereof taken for a drain as same is shewn on a plan deposited in the said Office as No. 7430.

The land mentioned in a certificate of title shall by implication and without special mention in the certificate, unless the contrary be expressly declared, be deemed to be subject to:

(a) Any subsisting reservation contained in the original grant of the land from the Crown.
(b) Any municipal charge, rate, or assessment, existing at the date of the certificate, or subsequently imposed on the land;
(c) Any right-of-way or other easement howsoever created upon, over or in respect of the land;
(d) Any existing lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of the land thereunder;
(e) Any drainage levy or mechanics' lien affecting the land.
(f) Any order of attachment, judgment, or order for the payment of money, against the registered owner of the land, registered since the date of the certificate of title, and which has been maintained in force under the provisions of any Act of the province relating thereto;
(g) Any certificate of lis pendens issued out of a court in the province and registered since the date of the certificate of title.
(h) Any right of expropriation by statute.
(i) The title of a person adversely in actual occupation, of and rightly entitled, to the land at the time it was brought under the Act, and who continues in such occupation;
(j) Caveats affecting the land registered since the date of the certificate, and
(k) Any town planning scheme or by-law authorized under The Town Planning Act or under the provisions of the charter of any city and any by-law passed by any municipal corporation under "The Municipal Act" or the charter of any city relating to residential areas or zoning.
(l) Any zoning regulation as that expression is defined in the Aeronautics Act (CANADA) made under that act and deposited in the Land Titles Office.
(m) Any limitation or restriction under The Highways Protection Act or a permit issued under The Highways Protection Act.

Public highways embraced in the description of the land included in a certificate shall be deemed to be excluded unless the certificate is to the Crown or a municipality.

INST TYPE: T/L NO: 1219760
1219381
FOR: all
REG. 29 10 54
NEW TITLE:
See Computerized Daily Record

@@@@@

IN WITNESS WHEREOF I have hereunto signed my name and affixed my Seal of office this Twenty-fifth day of June One thousand nine hundred and seventy - nine

Signed in the presence of

Deputy or Assistant District Registrar for Winnipeg

Cert. No. E 13000

MANITOBA

Certificate of Title.

UNDER "THE REAL PROPERTY ACT."

LORNE PESCITELLI, of the City of Winnipeg, in Manitoba, Plant Foreman, and HENRY PESCITELLI, of East St. Paul, in Manitoba, Punch Press Operator, as Executors under the Last Will of John Pescitelli, late of the Post Office of Beausejour, in Manitoba, Retired, deceased

are now seized of an estate in fee simple in possession subject to such encumbrances, liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all that piece or parcel of land known and described as follows,

the North half of the South East quarter of Section Twelve in the Thirteenth Township and Seventh Range, East of the Principal Meridian in Manitoba, excepting thereout, Firstly: all that portion thereof taken for a Public Road as same is shewn on a plan deposited in the Winnipeg Land Titles Office as No. 5457 and Secondly: all that portion thereof taken for a drain as same is shewn on a plan deposited in the said Office as No. 7430.

No. T 114730 TRANSMISSION by ~~DEATH~~ V.O
In consequence of the death of John Pescitelli all the estate in the within All
became transmitted to Henry Pescitelli et al (exec.)
Cancelled June 25/79 @ 12:15
Vide Cert. No.
W Knight
DEPUTY DISTRICT REGISTRAR

TRANSMISSION
No. T 114730
CHANGE OF EXECUTOR
From LORNE PESCITELLI
To WILLIAM PESCITELLI
BY JUDGE'S ORDER
REGISTERED
June 25/79
At 12:15
W Knight
DEPUTY DISTRICT REGISTRAR

NO CERTIFICATE ISSUED
SEE TRANSFER NO. T 37183

NO. T 37183 TRANSFER OF All
TO Kenneth F. Reckseidler et al
REG. June 25/79
NEW CERT. G 27025
W Knight
DEP. DIST. REGISTRAR

The District Registrar hereby certifies that this is a true copy of a record maintained in the public records of The Property Registry of Manitoba

JAN 16 2015

ooo

IN WITNESS WHEREOF I have hereunto signed my name and affixed my Seal of office this Sixteenth day of January One thousand nine hundred and seventy - six

Signed in the presence of

Deputy District Registrar
for Winnipeg,

The land mentioned in a certificate of title shall by implication and without special mention in the certificate, unless the contrary be expressly declared, be deemed to be subject to:

(a) Any subsisting reservation contained in the original grant of the land from the Crown.
(b) Any municipal charge, rate, or assessment, existing at the date of the certificate, or subsequently imposed on the land;
(c) Any right-of-way or other easement, howsoever created, upon, over or in respect of the land;
(d) Any subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of the land thereunder;
(e) Any drainage levy or mechanics' lien affecting the land.
(f) Any order of attachment, judgment, or order for the payment of money, against the registered owner of the land, registered since the date of the certificate of title, and which has been maintained in force under the provisions of any Act of the province relating thereto;
(g) Any certificate of lis pendens issued out of a court in the province and registered since the date of the certificate of title.
(h) Any right of expropriation by statute.
(i) The title of a person adversely in actual occupation, of and rightly entitled, to the land at the time it was brought under the Act, and who continues in such occupation;
(j) Caveats affecting the land registered since the date of the certificate, and
(k) Any town planning scheme or by-law authorized under The Town Planning Act or under the provisions of the charter of any city and any by-law passed by any municipal corporation under "The Municipal Act" or the charter of any city relating to residential areas or zoning.
(l) Any zoning regulation as that expression is defined in the Aeronautics Act (CANADA) made under that act and deposited in the Land Titles Office.
(m) Any limitation or restriction under The Highways Protection Act or a permit issued under The Highways Protection Act.

Public highways embraced in the description of the land included in a certificate shall be deemed to be excluded unless the certificate is to the Crown or a municipality.

Cert. No. 608055

MANITOBA

Certificate of Title

UNDER "THE REAL PROPERTY ACT."

JOHN PESCITELLI

OF BEAUSEJOUR POST OFFICE IN MANITOBA, FARMER

18

now seized of an estate in fee simple in possession subject to such encumbrances, liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all th piece or parcel of land known and described as follows THE NORTH HALF OF THE SOUTH EAST QUARTER OF SECTION TWELVE IN THE THIRTEENTH TOWNSHIP AND SEVENTH RANGE EAST OF THE PRINCIPAL MERIDIAN IN MANITOBA.

(a) Any subsisting reservation contained in the original grant of the land from the Crown.
(b) Any municipal charge, rate or assessment existing at the date of the certificate, or subsequently imposed on the land.
(c) Any right-of-way or other easement, howsoever created, upon, over or in respect of the land.
(d) Any subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of the land thereunder.
(e) Any drainage levy or mechanics' lien affecting the land.
(f) Any order of attachment, judgment or order for the payment of money against the registered owner of the land, registered since the date of the certificate of title, and which has been maintained in force under the provisions of any Act of the province relating thereto.
(g) Any certificate of lis pendens issued out of a court in the province and registered since the date of the certificate of title.
(h) Any right of expropriation by statute.
(i) The title of a person adversely in actual occupation of and rightly entitled to the land at the time it was brought under the Act, and who continues in such occupation.
(j) Caveats affecting the land registered since the date of the certificate, and
(k) Any town planning scheme or by-law authorised under "The Town Planning Act" or under the provisions of the charter of any city and any by-law passed by any municipal corporation under "The Municipal Act" or the charter of any city relating to residential areas or zoning.
Public highways embraced in the description of the land included in a certificate shall be deemed to be excluded.

The District Registrar hereby certifies that this is a true copy of a record maintained in the public records of The Property Registry of Manitoba

JAN 16 2015

Request No. 45201 to issue new Certificate of Title for Part fee Regd Plan 5457 to St. Crepin (Man) 8 Sept 1952
Vide Cert. No. 76622
[signature]
Deputy District Registrar

IN WITNESS WHEREOF *I have hereunto signed my name and affixed my Seal of office this* TENTH *day of* APRIL *One thousand nine hundred and* FORTY-FIVE

Signed in the presence of

G. Doherty

[signature]

Deputy District Registrar for Winnipeg

Cert. No. 335001

MANITOBA

Certificate of Title

UNDER THE REAL PROPERTY ACT

JOHN PISCITELLI and DOMENICO PISCITELLI.

both of the Rural Municipality of Brokenhead in Manitoba, Farmers

are now seized of an estate in fee simple in possession subject to such encumbrances liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all that piece or parcel of land known and described as follows the North half of the South East quarter of Section Twelve in the Thirteenth Township and Seventh Range east of the Principal Meridian in Manitoba.

against this land.
1. Any unregistered subsisting right of way or other easement over this land.
4. Any unregistered subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of this land under the same.
5. Any mechanic's lien affecting this land.
6. Any judgments, decrees or orders for the payment of money against the registered owner, registered since the date of this Certificate and properly maintained in force.
7. All public highways embraced in the description of this land.
8. Any right of expropriation by statute.
9. The title of any person adversely in actual occupation of and rightly entitled to this land when it was first brought under said Act.
10. Caveats affecting this land registered since the date of this Certificate of Title.

The District Registrar hereby certifies that this is a true copy of a record maintained in the Land Titles Office for the Province of Manitoba

JAN 15 2015

No. 828391 TRANSFER of
all
To John Piscitelli
Registered April 10-1945
Vide Cert. No. 6080551

IN WITNESS WHEREOF I have hereunto signed my name and affixed my Seal of office this Sixteenth day of December One thousand nine hundred and Twenty-one

Signed in the presence of

Deputy District Registrar for Winnipeg

Subject to all liens under the Manitoba Builders' Act

Cert. No. 240032.

MANITOBA

Certificate of Title

UNDER "THE REAL PROPERTY ACT"

The land mentioned in this Certificate of Title is under the Real Property Act subject by implication to:
1. Any subsisting reservation contained in the original grant of this land from the Crown.
2. Any municipal charges, rates or assessments at the date of this Certificate, or thereafter, chargeable against this land.
3. Any unregistered subsisting right of way or other easement over this land.
4. Any unregistered subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of this land under the same.
5. Any mechanic's lien affecting this land.
6. Any judgments, decrees or orders for the payment of money against the registered owner registered since the date of this Certificate and properly maintained in force.
7. All public highways embraced in the description of this land.
8. Any right of expropriation by statute.
9. The title of any person adversely in actual occupation of and rightly entitled to this land when first brought under said Act.
10. Caveats affecting this land registered since the date of this Certificate of Title

JOHN HICKS

of the Town of Beausejour, in Manitoba, Farmer, is now seized of an estate in fee simple in possession subject to such encumbrances, liens and interests as are notified by memorandum underwritten or endorsed hereon, in all that piece or parcel of land known and described as follows. The North half of the South East quarter of Section Twelve, in the Thirteenth Township and Seventh Range East of the principal meridian, in Manitoba.

No. 460733 TRANSFER of the within Land to [illegible] Registered [illegible] Cancelled as to [illegible] Vide Cert. No. 333001

IN WITNESS WHEREOF I have hereunto signed my name and affixed my seal of office this Ninth day of May, One thousand nine hundred and fourteen.

Signed in the presence of

C W Martin

Deputy District Registrar

for Winnipeg

MANITOBA

STATUS OF TITLE

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	NA
ORIGINATING OFFICE...	WINNIPEG	ADDRESS.....	
REGISTERING OFFICE...	WINNIPEG		
REGISTRATION DATE....	2014/02/12		
COMPLETION DATE.....	2014/02/26		
		CLIENT FILE...	NA
		PRODUCED BY...	J.CHARTRAND

LAND INDEX:

LOT	QUARTER SECTION	SECTION	TOWNSHIP	RANGE
	SE	12	13	7E

NOTE: PT N1171'P W OF ROAD 5457 & E OF LINE 371' FROM ROAD

**ACCEPTED THIS 12TH DAY OF FEBRUARY, 2014
BY G.PHILLIPS FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF WINNIPEG.**

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2015/01/15 OF TITLE NUMBER 2709475/1.

********** END OF STATUS OF TITLE 2709475/1 **********

Appendix C

Site Photos

PHOTOGRAPH 1: Overview of Site buildings, facing west.

PHOTOGRAPH 2: Interior of Site building.

wood.	**SITE PHOTOGRAPHS**	DATE TAKEN: 28 APR 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 1

PHOTOGRAPH 3: Interior of Site building, near the northwest corner

PHOTOGRAPH 4: North of the Site building facing south.

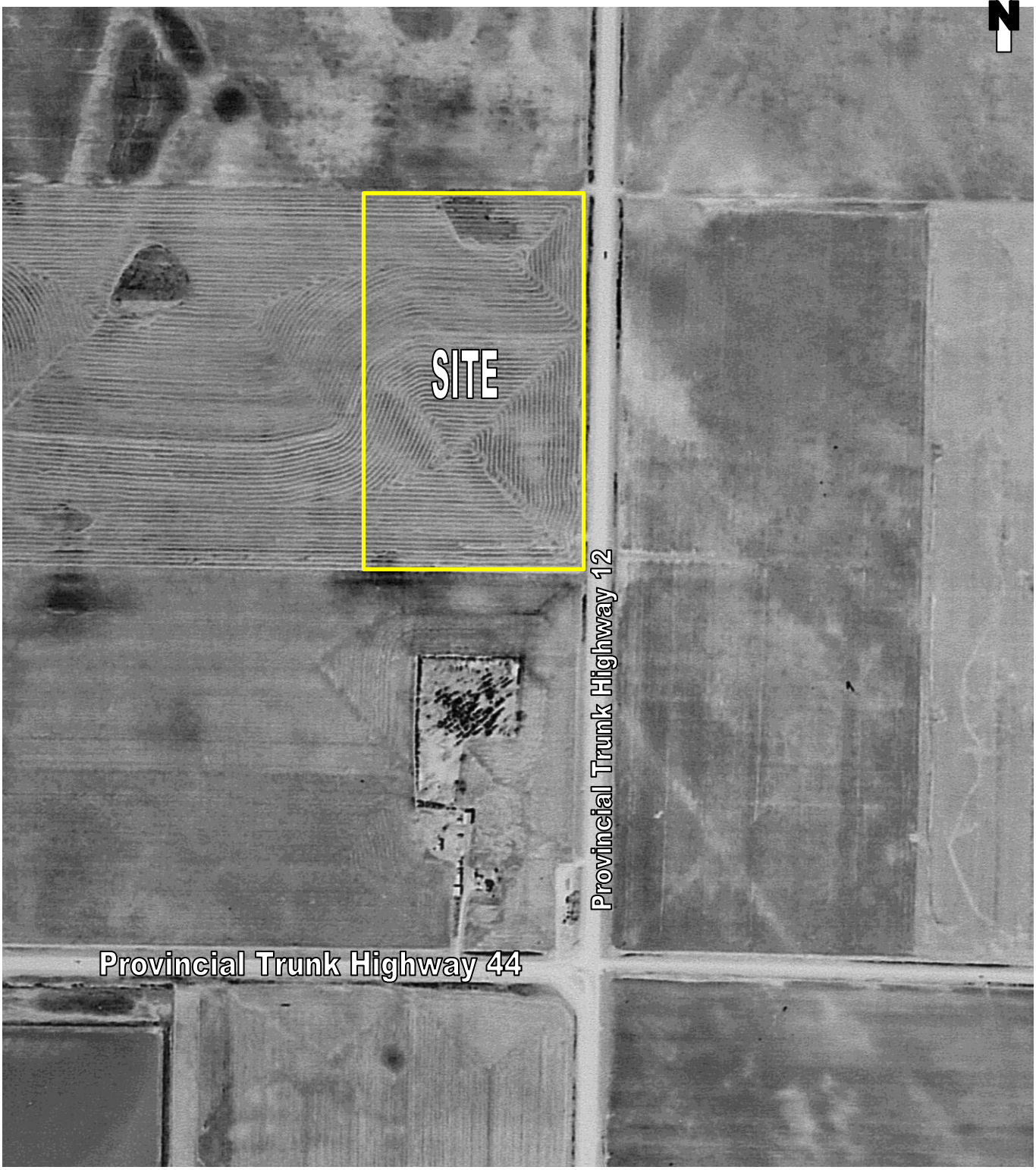
wood.	**SITE PHOTOGRAPHS**	DATE TAKEN: 28 APR 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: **Error! Reference**
		FIGURE 2

PHOTOGRAPH 5: West of the Site building facing west. General area of silo (seed storage).

PHOTOGRAPH 6: Near the northwest corner facing north.

wood.	**SITE PHOTOGRAPHS**	DATE TAKEN: 28 APR 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 3

wood.	**1949 AERIAL PHOTOGRAPH**	DATE: JULU 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 1



wood.	**1979 AERIAL PHOTOGRAPH**	DATE: JULU 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 2

wood.	**1992 AERIAL PHOTOGRAPH**	DATE: JULU 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 3

wood.	**2005 SATELLITE IMAGE**	DATE: JULU 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 4

wood.	**2011 SATELLITE IMAGE**	DATE: JULU 2020
	BEAUSEJOUR CONSUMERS CO-OP LTD. ENVIRONMENT ACT PROPOSAL SE ¼ 12-13-7 EPM	PROJECT No.: WX19102
		FIGURE 5

Appendix D

Well Logs for Groundwater Wells near the Project Site

LOCATION: NE12-13-7E

Well_PID: 74060
Owner: J BAKER
Driller: Paul Slusarchuk Well Drilling LTd.
Well Name: FARMYARD
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 678562.765
UTMY: 5551353.38
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1992 May 25

WELL LOG

From (ft.)	To (ft.)	Log
0	20.0	CLAY
20.0	34.0	TILL SOME SILTY LAYER
34.0	39.5	RUBBLE LIMESTONE SOME CLAY
39.5	74.0	LIMESTONE
74.0	75.0	SHALE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	40.0	casing	4.00			INSERT	GALVANIZED
40.0	74.0	open hole	4.00				
3.0	30.0	casing grout					CEMENT

Top of Casing: 2.5 ft. below ground

PUMPING TEST

Date: 1992 May 25
Flowing Rate: 15.0 Imp. gallons/minute
Water level before pumping: 5.0 ft. above ground
Pumping level at end of test: ?? ft. below ground
Test duration: hours, minutes
Water temperature: ?? degrees F

REMARKS

LOT 2

LOCATION: NW12-13-7E

Well_PID: 13187
Owner: UNIV OF MANITOBA
Driller: UNKNOWN DRILLER
Well Name: TH #21
Well Use: TEST WELL
Water Use:
UTMX: 677758.848
UTMY: 5551329.13
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1969 Jan 01

WELL LOG

From (ft.)	To (ft.)	Log
0	5.0	MODERATE YELLOWISH BROWN SANDY SILT
5.0	20.0	OLIVE GREY LAKE CLAY, NUMEROUS SILT POCKETS
20.0	48.0	LIGHT OLIVE GREY CALCAREOUS, SILTY TILL, GRANITIC AND CARBONATE ROCK FRAGMENTS, TOO ROCKY TO DRILL PAST 48 FEET

No construction data for this well.

Top of Casing: ft. below ground

No pump test data for this well.

REMARKS

1968-1969 BEAUSEJOUR AREA, MCPHERSON PHD THESIS GROUND LEVEL ELEV EST 790 FT

LOCATION: SW12-13-7E

Well_PID: 20973
Owner: M MORRIS
Driller: AQUARIUS WELL DRILLING
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 677780.52
UTMY: 5550517.42
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1974 Jun 13

WELL LOG

From (ft.)	To (ft.)	Log
0	14.0	CLAY
14.0	50.0	GRAVEL& TILL
50.0	81.9	GREY LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	68.5	casing	4.50			INSERT	BLACK IRON
68.5	81.9	open hole	4.00				

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: 30.0 Imp. gallons/minute
Water level before pumping: 4.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, 30 minutes
Water temperature: ?? degrees F

LOCATION: SW12-13-7E

Well_PID: 137315
Owner: SHIRLEY MCTAVISH
Driller: Echo Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 677400
UTMY: 5550161
Accuracy XY: 1 EXACT [<5M] [GPS]
UTMZ:
Accuracy Z:
Date Completed: 2005 Aug 04

WELL LOG

From (ft.)	To (ft.)	Log
0	2.0	FILL
2.0	54.0	TILL
54.0	118.0	LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	58.0	CASING	5.00	5.50		INSERT	PVC
58.0	118.0	OPEN HOLE	4.00				
20.0	50.0	CASING GROUT					OTHER

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2005 Aug 04
Pumping Rate: 50.0 Imp. gallons/minute
Water level before pumping: 6.0 ft. below ground
Pumping level at end of test: 40.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

BEAUSEJOUR. WELL MUST BE VENTED.

LOCATION: NW1-13-7E

Well_PID: 56976
Owner: MWSB - BEAUSEJOUR
Driller: COSENS DRILLING LTD.
Well Name: TH-2
Well Use: TEST WELL
Water Use:
UTMX: 677804.934
UTMY: 5549680.73
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1986 Sep 11

WELL LOG

From (ft.)	To (ft.)	Log
0	1.0	SOIL
1.0	3.0	SAND
3.0	5.0	CLAY
5.0	12.0	SAND; MEDIUM
12.0	15.0	SAND AND GRAVEL, THIN LAYER OF CLAY AT 15 FEET
15.0	20.0	SAND; FINE
20.0	46.0	SAND; VERY FINE TO SILT; WHITE
46.0	51.0	TILL; STONY, SILTY; LIGHT GREY
51.0	53.0	GRAVELLY SAND
53.0	58.0	SAND; MEDIUM

58.0	59.5	CARBONATE ROCK
59.5	61.0	LOOSE; RUBBLE OR FRACTURED
61.0	62.0	CARBONATE ROCK
62.0	63.0	LOOSE; CARBONATE ROCK RUBBLE WITH GRANITIC FRAGMENTS
63.0	67.0	CARBONATE ROCK
67.0	67.5	LOOSE; RUBBLE
67.5	70.0	CARBONATE ROCK AT 68 FEET
70.0	70.5	RED SHALE
70.5	73.5	CARBONATE ROCK; BROWN TO GREY
73.5	74.0	LOOSE; FRACTURED ROCK
74.0	96.9	CARBONATE ROCK; MORE, GREYISH- THIN LOOSE ZONE AT 86 FEET SHALY CARBONATE ROCK AT 97 FEET
96.9	127.9	CARBONATE ROCK, THIN SHALE LAYERS AT 105 AND 111 FEET, LAYER OF SHALE AND CARBONATE ROCK AT 115-116 FEET, THIN SHALE LAYERS AT 123 AND 126 FEET
127.9	130.9	SHALE; YELLOW BROWN

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	10.0	casing	2.00			T & C	BLACK IRON
10.0	20.0	perforations	2.00		0.018	WIRE WOUND	S. S.

Top of Casing: ft. below ground

PUMPING TEST

Date: 1986 Sep 11
Pumping Rate: 23.0 Imp. gallons/minute
Water level before pumping: 4.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: hours, 40 minutes
Water temperature: ?? degrees F

REMARKS

E. SIDE 5TH ST, AT SE CORNER OF NW 1/4, TESTED 10-20 FT T=26,400 IGPD/FT, HOWEVER THIS IS WATER TABLE, T VALUE ESTIMATED @ 13,000 IGPD/FT, EC=490 MM, H=20 GPG, FE=0.7 MG/L, CHEMICAL ANALYSIS AVAILABLE, PUMP TESTED ZONE 50-60 FT AT 11 IGPM FOR 35 MINS CHEMICAL ANALYSIS, EC=495 MM, H=19 GPG, FE=1.8 MG/L

LOCATION: NW7-13-8E

Well_PID: 140085
Owner: EDITH BOURBONNAIS
Driller: Perimeter Drilling Ltd.
Well Name:
Well Use: PRODUCTION

Water Use: Domestic
UTMX: 679392.442
UTMY: 5551394.2
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2006 Sep 19

WELL LOG

From (ft.)	To (ft.)	Log
0	25.0	CLAY TILL
25.0	30.0	BLUE CLAY
30.0	35.0	TILL
35.0	45.0	GRAVEL
45.0	50.0	TILL

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	34.0	CASING	5.00			INSERT	PVC
34.0	44.0	PERFORATIONS			0.010	WIRE WOUND	S. S.

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2006 Sep 19
Pumping Rate: 15.0 Imp. gallons/minute
Water level before pumping: 10.0 ft. below ground
Pumping level at end of test: 15.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

EVELYN DRIVE, BEAUSEJOUR, WELL SI NEAR THE NORTHWEST CORNER OF HOUSE, GROUTED.

LOCATION: 6-13-8E

Well_PID: 10482
Owner: A SELCH
Driller: Friesen Drillers Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY: UNKNOWN

UTMZ:
Accuracy Z:
Date Completed: 1967 Jul 14

WELL LOG

From (ft.)	To (ft.)	Log
0	35.0	HARD YELLOW SILT
35.0	45.0	GRAVEL
45.0	49.0	TILL AND BOULDERS
49.0	54.0	LIMESTONE, WATER AT 54 FEET

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	49.0	casing	4.00				
49.0	54.0	perforations	4.00			SL. PIPE	

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: 3.0 Imp. gallons/minute
Water level before pumping: 11.0 ft. below ground
Pumping level at end of test: 25.0 ft. below ground
Test duration: 10 hours, minutes
Water temperature: 41.000 degrees F

REMARKS

GROUND LEVEL ELEV EST 785 FT

LOCATION: 6-13-8E

Well_PID: 129962
Owner: BRUCE WILGOSH
Driller: Echo Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2004 Jun 30

WELL LOG

From (ft.)	To (ft.)	Log
0	20.0	CLAY
20.0	71.0	GREY TILL
71.0	85.0	WEATHERED LIMESTONE
85.0	93.0	LIMESTONE
93.0	94.0	SHALE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	73.0	CASING	5.00			INSERT	PVC
73.0	94.0	OPEN HOLE	4.50				
8.0	60.0	CASING GROUT					

BENTONITE

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2004 Jun 30
Pumping Rate: 18.0 Imp. gallons/minute
Water level before pumping: 12.0 ft. below ground
Pumping level at end of test: 60.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

LOT 18 BROKENHEAD RIVER

LOCATION: 6-13-8E

Well_PID: 129876
Owner: ANNE BARRETT
Driller: Echo Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2004 Aug 11

WELL LOG

From	To	Log

From (ft.)	To (ft.)	
0	9.0	CLAY
9.0	16.0	BROWN TILL
16.0	21.0	LIMESTONE GRAVEL
21.0	71.0	BROWN TILL
71.0	95.0	LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	72.0	CASING	5.00			INSERT	PVC
72.0	95.0	OPEN HOLE	4.50				
10.0	72.0	CASING GROUT					

BENTONITE

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2004 Aug 11
Pumping Rate: 50.0 Imp. gallons/minute
Water level before pumping: 9.0 ft. below ground
Pumping level at end of test: 60.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

LOTS 8 & 9 GOLF COARSE RD

LOCATION: 6-13-8E

Well_PID: 129875
Owner: ANNE BARRETT
Driller: Echo Drilling Ltd.
Well Name:
Well Use: TEST WELL
Water Use:
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2004 Aug 09

WELL LOG

From (ft.)	To (ft.)	Log
0	1.0	SOD AND BROWN LOAM

1.0	11.0	MEDIUM TO COARSE GRAVEL
11.0	16.0	CLAY
16.0	21.0	FINE SAND
21.0	53.0	FINE GREY TILL WITH GRANITE
53.0	57.0	SAND
57.0	74.0	TILL
74.0	77.0	LIMESTONE WITH NARROW SHALE LAYERS
77.0	98.0	LIMESTONE
98.0	102.0	SHALE, DARK GREEN

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	78.0	CASING	5.00			INSERT	PVC
78.0	102.0	OPEN HOLE	4.00				

Top of Casing: 2.0 ft. above ground

No pump test data for this well.

REMARKS

LOTS 8 & 9 GOLF COURSE RD

LOCATION: 6-13-8E

Well_PID: 125181
Owner: VINCE DEPAULO
Driller: Selkirk Drillers
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2000 Nov 01

WELL LOG

From (ft.)	To (ft.)	Log
0	13.0	BROWN CLAY
13.0	15.0	SAND
15.0	69.0	GREY TILL
69.0	73.0	LIMESTONE
73.0	100.0	LIMESTONE AND SHALE LAYERS WITH SAND

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	75.0	CASING	5.00				PVC
75.0	100.0	OPEN HOLE	4.50				

Top of Casing: 1.0 ft. above ground

PUMPING TEST

Date: 2000 Nov 01
Pumping Rate: 10.0 Imp. gallons/minute
Water level before pumping: 8.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

16 RIVER RD. N

LOCATION: 6-13-8E

Well_PID: 10483
Owner: A SELCH
Driller: Friesen Drillers Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1967 Jul 26

WELL LOG

From (ft.)	To (ft.)	Log
0	5.0	LIGHT BROWN SILT WITH BOULDERS
5.0	18.0	LIGHT BROWN SILT WITH SHATTERED LIMESTONE
18.0	20.0	GREY SILT WITH LIMESTONE
20.0	23.0	RED ROCK, GRANITE
23.0	26.0	GREY SILT WITH SHATTERED ROCK
26.0	29.0	BLUE ROCK, GRANITE
29.0	33.0	SHATTERED LIMESTONE AND GRAVEL
33.0	38.0	HARD TIGHT WHITE SILT
38.0	46.0	SHATTERED LIMESTONE AND WHITE
46.0	53.0	SAND AND GRAVEL AND GREY SILT
53.0	70.0	HARD WHITE LIMESTONE

70.0	101.9	HARD YELLOW LIMESTONE
101.9	119.9	HARD GREY LIMESTONE, WATER AT 119 FEET

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	56.0	casing	4.00				
56.0	119.9	open hole					

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: 50.0 Imp. gallons/minute
Water level before pumping: 8.0 ft. below ground
Pumping level at end of test: 9.0 ft. below ground
Test duration: 2 hours, minutes
Water temperature: 41.000 degrees F

REMARKS

GROUND LEVEL ELEV EST 785 FT

LOCATION: 6-13-8E

Well_PID: 63244
Owner: C M KENNY
Driller: Paul Slusarchuk Well Drilling LTd.
Well Name: TH.
Well Use: TEST WELL
Water Use:
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1988 May 12

WELL LOG

From (ft.)	To (ft.)	Log
0	8.0	CLAY
8.0	12.0	SILTY TILL
12.0	82.9	TILL AND BOULDERS
82.9	84.4	TILL AND SOME RUBBLE LIMESTONE
84.4	90.9	LAYER OF LIMESTONE AND SHALE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	82.9	casing				INSERT	GALVANIZED
38.0	87.9	perforations				WIRE WOUND	GALVANIZED

Top of Casing: 1.5 ft. above ground

PUMPING TEST

Date: 1988 May 12
Pumping Rate: 2.0 Imp. gallons/minute
Water level before pumping: ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, minutes
Water temperature: ?? degrees F

REMARKS

70 LOT BROKENHEAD RIVER PARK

LOCATION: 6-13-8E

Well_PID: 61946
Owner: C M KENNY
Driller: Paul Slusarchuk Well Drilling LTd.
Well Name: TH.
Well Use: PRODUCTION
Water Use: Domestic
UTMX: 679838.382
UTMY: 5549384.02
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1988 May 12

WELL LOG

From (ft.)	To (ft.)	Log
0	8.0	CLAY
8.0	12.0	SILTY TILL
12.0	82.9	TILL
82.9	90.9	LAYERS OF LIMESTONE AND SHALE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material

0	83.4	casing	4.20	INSERT GALVANIZED
83.4	90.9	open hole	3.80	

Top of Casing: 1.5 ft. above ground

PUMPING TEST

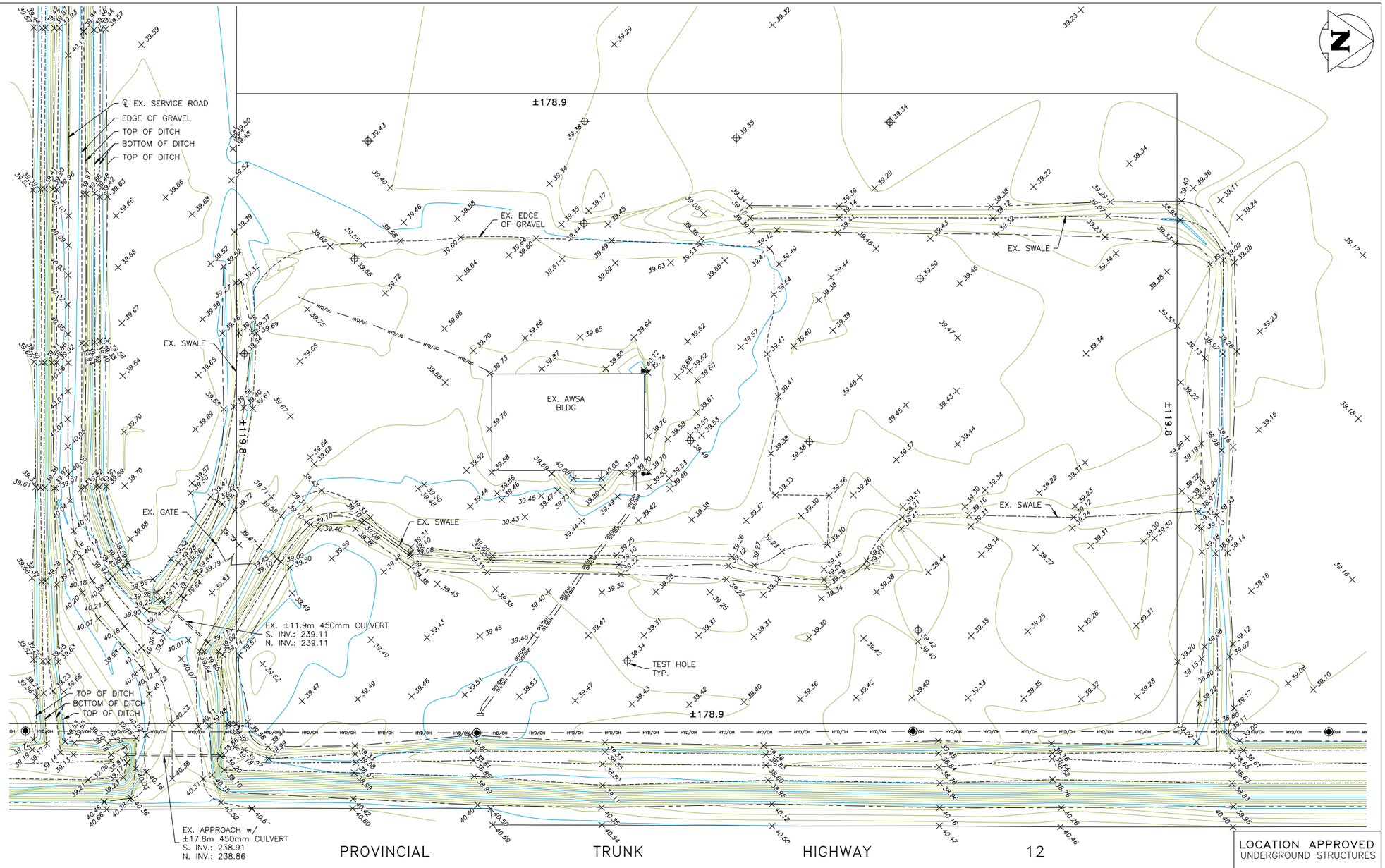
Date:	1988 May 12
Pumping Rate:	25.0 Imp. gallons/minute
Water level before pumping:	10.0 ft. below ground
Pumping level at end of test:	?? ft. below ground
Test duration:	1 hours, minutes
Water temperature:	?? degrees F

REMARKS

70 LOT BROKENHEAD RIVER PARK

Appendix E

Site Contour Map and Drainage Plan



NOTES:

1. General Notes

   All distances are in metres and may be converted to feet by multiplying by 3.28084.

   All plans referred to are of record in the Winnipeg Land Titles Office.

   All construction and testing shall be done in accordance with RM of Brokenhead By-Laws and Construction Standards.

   Contractor shall verify and be responsible for all dimensions and grades, any errors and/or omissions must be reported to an Engineer at Barnes & Duncan. Any claims resulting from the Contractor's failure to do so shall be at the Contractor's expense.

   Contractor shall obtain all permits to carry out the work and shall strictly adhere to the conditions of each permit.

2. Lot Grade Plan

   Building landscape grade(s) and all related lot grade elevations are to be set by a Designated Officer, in accordance with the RM of Brokenhead Lot Grading By-Law.

   Sump discharge pipes are to be located such that positive drainage away from the building is achieved and shall not be located nor directed so as to cause discharge water to drain onto adjacent property or directly onto the streets.

   Downspouts shall discharge onto splash pads, and shall not be located nor directed so as to cause storm water to drain onto adjacent property.

   Mimumum swale side slopes shall be at 4H:1V. Minimum swale bottoms shall be 1.0m. Minimum swale grades shall be 0.1%.

   Phase swale excavation as existing conditions require or permit:
   a. Fill swale/low areas to top of design swale requirements.
   b. Excavate to design grades.

   Culverts diameters are to be as shown, 1.6mm thick corrugated metal pipe. Place 100mm of uncompacted bedding material under culvert to fill corrugation. Place 150mm of compacted bedding material under 100mm uncompacted bedding material. Culvert inverts are to be 30mm below the ditch elevations.

3. Road and Boulevard Restoration

   All road and ditch restoration shall be made in accordance with RM of Brokenhead Standards. Reconstruct boulevard area, including boulevard, ditches and shoulder, in its original condition to match adjoining boulevard area.

EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PROFILE	PROPOSED
	PROPERTY BOUNDARY		150 WM	WATERMAIN	150 WM	150 WM	WATERMAIN	150 WM
	SUPPORTING BOUNDARIES			HYDRANT			HYDRANT VALVE	
	CENTERLINE ROAD			VALVE		600 LDS	LAND DRAINAGE SEWER	600 LDS
	DRAINAGE/DITCH		600 LDS	LAND DRAINAGE SEWER	600 LDS	300 WWS	WASTEWATER SEWER	300 WWS
GAS	GAS		300 WWS	WASTEWATER SEWER	300 WWS		GROUND	
HYD/UG	HYDRO			MANHOLE			ROAD GUTTER NORTH/WEST	
TEL/UG	MTS			CATCH BASIN			ROAD GUTTER SOUTH/EAST	
	CULVERT			CURB INLET			PROPERTY LINE NORTH/WEST	
× 232.20	ELEVATION	232.20		CURB STOP			PROPERTY LINE SOUTH/EAST	
× 232.20	DITCH/SWALE ELEVATION	232.20		PLUG			DITCH NORTH/WEST	
	PROPOSED GRADING SLOPE	–0.5%►		HYDRO POLE AND ANCHOR			DITCH SOUTH/EAST	

B.M. 63M294 2013
ELEV. 241.930

F.B. 1386–19

NO.	REVISIONS	D/M/Y	BY	1st	2nd
B	SUBMITTED FOR 90% COORDINATION	10/07/20	CRT	TV	BC

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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1) NOTIFY THE GAS COMPANY OF THE PROPOSED LOCATION OF EXCAVATION.
2) TAKE PRECAUTION TO AVOID DAMAGE TO GAS COMPANY INSTALLATIONS. SEE PROVINCIAL REGULATION 140/92 FOR DETAILS

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
BARNES & DUNCAN
No. 3726

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE _____ DATE _____

NOTE:
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BARNES & DUNCAN SURVEYING, ENGINEERING & GEOMATICS
6 Donald Street
Winnipeg, Manitoba
R3L 0K6

DESIGNED CRT	FIRST REVIEW TV
DRAWN CRT	SECOND REVIEW BC
HOR. SCALE (11x17") 1:800	PROJECT NUMBER 20–0296
DATE DRAWN JUL. 10, 2020	DATE OF SURVEY MAY 4, 2020

ENGINEER'S SEAL

CAD FILE DRAWING NAME
20–0296 BEAUSEJOUR CO–OP CIVIL

RM OF BROKENHEAD

EXISTING TOPOGRAPHY
WOOD GROUP PCL
PTS SE LOT 12 BLOCK 13 PLAN 7

RM OF BROKENHEAD, MB

C01

SHEET 1 OF 2

CITY DRAWING NUMBER

Jul 10, 2020 - 5:32pm
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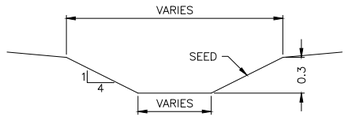
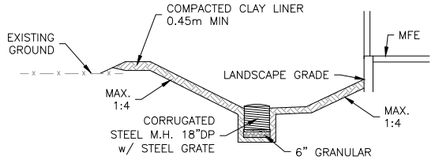
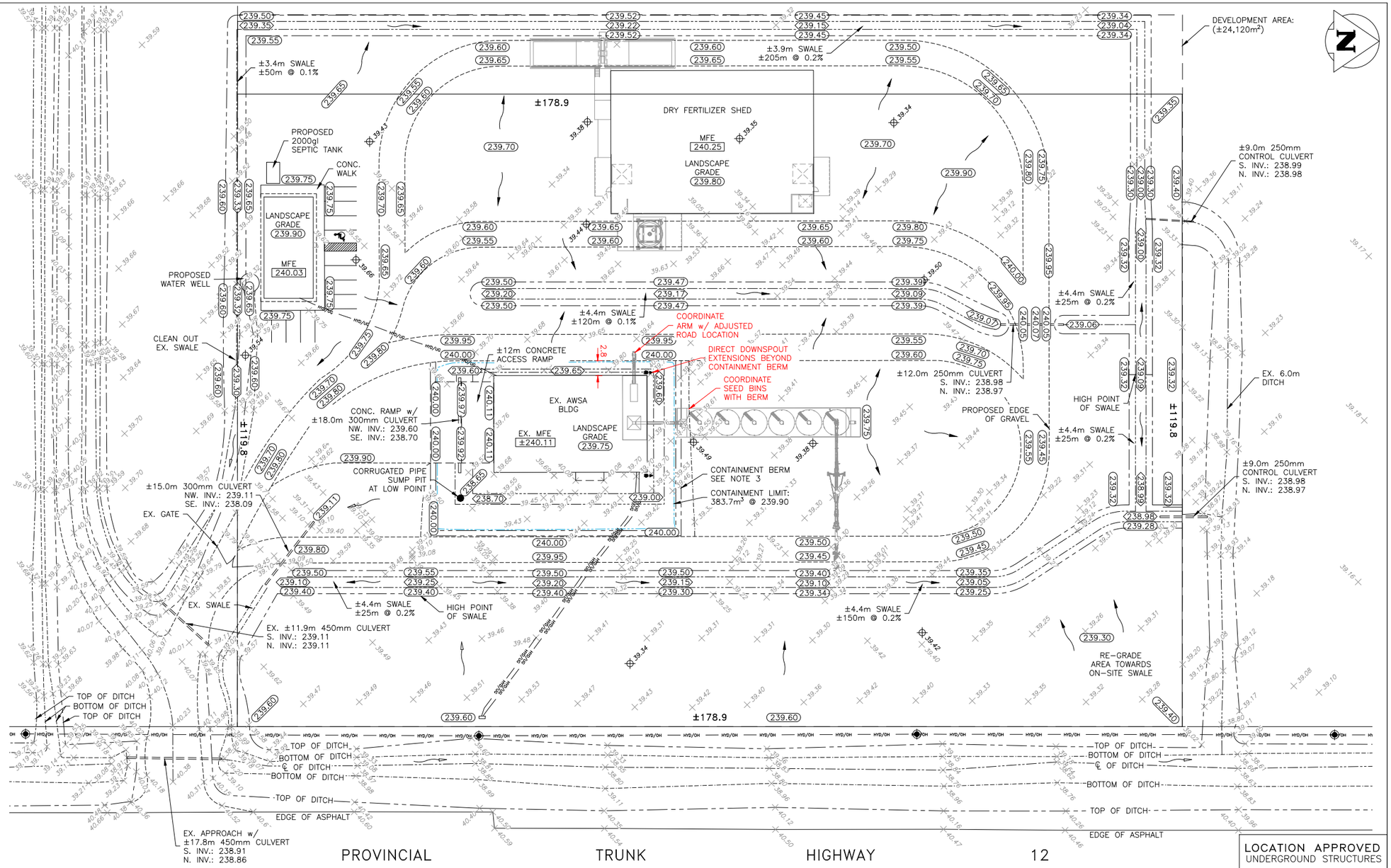


TYPICAL SWALE
NOT TO SCALE



SUMP PIT DETAIL
NOT TO SCALE



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3. Environmental Containment Berm

   Environmental containment berm around AWSA building to include compacted clay liner over containment area and in berms, minimum 45cm thick. Berms to be constructed with 4:1 side slopes and 1.0m minimum top width.

   Sump pit in containment area to be designed by others.

   Containment area to be capable of storing minimum 364m³.

4. Road and Boulevard Restoration

   All road and ditch restoration shall be made in accordance with RM of Brokenhead Standards. Reconstruct boulevard area, including boulevard, ditches and shoulder, in its original condition to match adjoining boulevard area.

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× 232.20	ELEVATION	232.20	♂	CURB STOP		⊙	PROPERTY LINE SOUTH/EAST								
× 232.20	DITCH/SWALE ELEVATION	232.20		PLUG		△	DITCH NORTH/WEST		B	SUBMITTED FOR 90% COORDINATION	10/07/20	CRT	TV	BC	
	PROPOSED GRADING SLOPE	-0.5%	◈	HYDRO POLE AND ANCHOR		▽	DITCH SOUTH/EAST		A	SUBMITTED FOR COORDINATION	03/07/20	CRT	TV	BC	
EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PROFILE	PROPOSED	NO.	REVISIONS	D/M/Y	BY	1st	2nd	

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20-0296 BEAUSEJOUR CO-OP CIVIL

RM OF BROKENHEAD

LOT GRADE DESIGN
WOOD GROUP PCL
PTS SE LOT 12 BLOCK 13 PLAN 7
RM OF BROKENHEAD, MB

C02

SHEET 2 OF 2

CITY DRAWING NUMBER

Jul 10, 2020 - 5:32pm
G:\WORK PROJECTS\B&D 2020\0200 - 0299\20-0296\1-ENG\CAD\20-0296 Beausejour Co-op Civil.dwg

Appendix F

Site Geotechnical Investigation Report

Geotechnical Investigation

Beausejour Co-op
Proposed Agro Site
SE¼-12-13-7 EPM
500 m North of Provincial Trunk Highways 44 and 12
WX1907601
19 June 2020

wood.
Environment & Infrastructure Solutions
440 Dovercourt Drive, Winnipeg Manitoba, Canada R3Y 1N4
Phone: (204) 488-2997
www.woodplc.com

Geotechnical Investigation
Proposed Agro Site
Wood Project Number - WX1907601

Prepared for:	Beausejour Consumers Co-op Ltd. 810 Park Ave., Beausejour, Manitoba R0E 0C0
Contact:	Kevin Van Den Bussche; Jason Bai, P. Eng.
Report Distribution:	
Beausejour Consumers Co-op:	Kevin Van Den Bussche
Wood:	
Report Classification:	Confidential

	Name	Job Title	Signature
Prepared by:	Robert Brown, P. Eng.	Geotechnical Engineer	
Reviewed by:	Brad Wiebe, M .Sc., P. Eng.	Sr. Associate Geotechnical Engineer	
Project Manager:	Robert Brown, P. Eng.	Geotechnical Engineer	
Other Technical Contributors			

Rev.	Date	Revision Notes
0	19 June 2020	Submitted final to client

Permit Stamp	Engineer Seal
	

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Third Party Disclaimer

Table of Contents

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Appendix A

Test Hole Logs
Explanation of Terms & Symbols

Appendix B

Granular Fill Gradation and Durability Specifications

1.0 Introduction

As authorized by Mr. Kevin Van Den Bussche of Beausejour Consumers Co-op Ltd., Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited (Wood), conducted a geotechnical investigation for a proposed new Agro Site near Beausejour, Manitoba.

The scope of work for the geotechnical investigation was provided in Wood's proposal WPG2020.122R1, dated 18 March 2020. The purpose of the investigation was to determine the subsurface soil and groundwater conditions at the Site in order to provide recommendations for the design and construction of applicable foundation options, frost protection of foundations, foundation concrete requirements, grade supported floor slabs, sloped excavations (assumed shallow), asphalt and gravel pavement structures (heavy and light duty), foundation and pavement drainage, and inspection and testing requirements. Where applicable, the report also provides comments on unusual geotechnical conditions which may result in potential design or construction difficulties.

Wood concurrently conducted a Phase I Environmental Site Investigation at this location, reported under separate cover, Wood file #19076.

2.0 Site and Project Description

2.1 Site Description

The Site is within the southeast quarter section of 12-13-7 EPM, and lies on the west side of Manitoba Provincial Trunk Highway (PTH) 12, approximately 500 m north of the intersection of PTH 12 with PTH 44. At the time of the investigation, the site was developed with a shed estimated to be 6 m high and having plan dimensions of approximately 18 x 28 m. The shed was surrounded by a gravel pad. A gated driveway was present to the southeast of the gravel pad. The remainder of the property consisted of an agricultural field and undeveloped land. Adjacent land use consisted of agricultural fields to the north, west and south, with Highway 12 and additional farmland to the east. According to the Manitoba Land Titles website, the property has a civic address of 73044 Road 42E.

Ground surface cover consisted of gravel and exposed soils, with sparse vegetation on the east side of the property. Geodetic ground surface elevations at the test holes, as measured in a topographic survey by Barnes & Duncan Surveying, Geomatics & Engineering, ranged from 239.337 to 239.664 m.

2.2 Geological Setting

Surficial geological deposits in the Beausejour region are described[1] as silty clay, with nearby exposed till described as calcareous silt diamicton, 1 to 75 m thick; low-relief, commonly streamlined deposits; subglacial deposits largely derived from carbonate rocks; thicker sequences consist of multiple units of varying texture; commonly scoured by icebergs; covered discontinuously by thin veneers (<1 m) of glaciolacustrine and glaciofluvial sediments.

[1] Geological Survey of Canada Map 2053A, Surficial geology, Beausejour, Manitoba, by Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey, Geoscientific Map MAP2003-5, scale 1:100,000, dated 2004 by A.K. Burt,

The surficial geology of the Beausejour area is further described[2] as Offshore Glaciolacustrine Sediments: clay, silt, minor sand; 1–20 m thick; very low relief massive and laminated deposits; deposited from suspension in offshore, deep water of glacial Lake Agassiz; commonly scoured and homogenized by icebergs.

2.3 Project Description

Based on a drawing emailed to Wood by Beausejour Co-op, the proposed development will consist of the following:

- an AWSA Warehouse (~447 m^2) converted from the existing warehouse;
- office building (~220 m^2);
- a 4,000 MT capacity dry fertilizer shed (~1,053 m^2, 27.1 x 38.4 m), with maximum factored slab loads of approximately 2300 psf (110 kPa) at the centre of the stockpile, tapering to less at the edges of the pile; and including a reclaim area 1.8 m below grade with a floor load of 300 psf (14 kPa);
- a bulk seed system consisting of 6 above ground storage bins, each 16 ft (4.9 m) in diameter, 50 ft (15.2 m) high, each with a capacity of 180 MT. The assumed empty mass of each bin is 6 MT; and the pressure applied to the clay by a concrete raft foundation below the bins is estimated to be approximately 80 kPa;
- conveyors, hoppers, scales, various concrete pads; and
- various parking lot and driveway areas (gravel and asphalt surfaced).

It is assumed that no changes requiring geotechnical recommendations will be made to the AWSA warehouse.

The structures will be without basements, however, based on information provided to Wood by Slawomir (Slav) Waplak of Hi Tech Installations Ltd. (Hi Tech), the fertilizer shed will include a reclaim area that will be recessed approximately 6 ft (1.8 m) below grade. The preferred foundation for the shed is understood to be a thickened edge slab, and the bins will preferably be supported on a rigid raft slab. The shed will have an adjacent overhead 50 MT weigh hopper supported on columns, further supported on a foundation consisting of a rigid 18-inch (455 mm) thick slab having plan dimensions of approximately 20 x 21 ft (6.1 x 6.4 m). Total loading conditions for the weigh hopper have not been provided.

A drawing provided to Wood by Hi Tech indicates that the preferred design for the thickened edge slab in the shed will have bearing surfaces with widths of 1.5 ft (0.5 m) (perimeter) and 2.0 ft (0.6 m) (interior), bearing at a depth of 2.0 ft (0.6 m) below final grade on 1 ft (0.6 m) of compacted gravel base, and with spacing between footings of 23.0 ft, centre-to-centre. Non-thickened portions of the slab will be constructed over 2 ft (0.6 m) of compacted gravel base. The preferred foundation for the bins is a single rigid raft slab of uniform thickness.

It is assumed that site grades will not be adjusted more than approximately 0.3 m.

[2] Matile, G.L.D. and Keller, G.R. 2004: Surficial geology of the Selkirk map sheet (NTS 62I), Manitoba; Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey, Surficial Geology Compilation Map Series, SG-62I, scale 1:250 000,

The proposed site layout is shown on Figure 1. Figure 2 shows a cross-section of the proposed thickened edge slab and weigh hopper slab.

3.0 Geotechnical Investigation

Prior to initiating drilling, Wood notified the various public utility providers (i.e. Manitoba Hydro, Bell MTS, etc.) of the intent to drill to clear public utilities. Wood also retained a private utility locator to sweep the work area for privately-owned utilities. All site operations were completed without incident.

On 4 and 5 May 2020, Wood supervised the drilling of twelve (12) test holes, TH20-01 to TH20-12, at the approximate locations shown on Figure 1. The test hole locations were selected by Wood in consultation with Beausejour Co-op and their contractor, Hi Tech Installations Ltd., as follows:

- TH20-01 – Office Building;
- TH20-02, TH20-03, TH20-12 – Fertilizer Shed;
- TH20-04, TH20-05 – Bulk Seed System; and
- TH20-06 to TH20-11 – Roads.

The road test holes were advanced to a termination depth of 3 m, and all other test holes were advanced to auger refusal, which occurred at depths ranging from 4.3 to 7.3 m from grade. All test holes were drilled using a track mounted Acker MP5 drill rig equipped with 125 mm diameter solid stem augers, operated by Maple Leaf Drilling Ltd. of Winnipeg, Manitoba.

During drilling, Wood field personnel visually classified the observed soils according to the Modified Unified Soil Classification System (MUSCS). Groundwater and drilling conditions were also recorded at the time of drilling. Disturbed grab samples were collected at selected depths from the auger cuttings, and relatively undisturbed Shelby Tube samples were obtained in cohesive soils at selected depths and locations. The relative consistency of cohesive overburden samples was evaluated using pocket penetrometer readings. The recorded pocket penetrometer readings are shown on the test hole logs.

The densities of silt till, silt and sand layers were evaluated by means of Standard Penetration Testing (SPT). The recorded SPT results are shown on the test hole logs as the SPT (N) value where the standard sampler was driven 450 mm (i.e. three full consecutive 150 mm sets) and is determined as the number of blows required to drive the SPT sampler the final 300 mm (i.e. two full consecutive 150 mm sets). In instances where full penetration of the standard sampler was not achieved, the number of blows per each complete 150 mm increment and each partial increment are shown on the logs, accompanied by the penetration (in mm) of the partial increment. In cases where sloughing occurred and prevented lowering the SPT sampler to the drilled depth, Dynamic Cone Penetrometer Tests (DCPT) were conducted. The cone was driven continuously through maximum 1.5 m depth intervals, and blow counts were recorded for every 300 mm increment, or partial increment, of penetration.

The test holes were left open for approximately ten minutes after completion of drilling to observe short-term groundwater seepage and sloughing conditions and were backfilled with auger cuttings and bentonite. Excess auger cuttings were piled over the test holes.

All geotechnical samples recovered during drilling were sealed against moisture loss, and following drilling, were transported to Wood's Winnipeg laboratory for testing. Laboratory testing was conducted

on selected soil samples and consisted of moisture content determinations, and unconfined compressive strengths completed in accordance with applicable ASTM Standards.

Detailed test hole logs summarizing the sampling, field testing, laboratory test results, and subsurface conditions encountered at the test hole location are presented in Appendix A. Summaries of the terms and symbols used on the test hole log and of the Modified Unified Soil Classification System are also presented in Appendix A.

4.0 Subsurface Conditions

4.1 Soil Profile

The soil profile encountered at the test holes consisted of the following, noted in descending order from grade level:

- Granular Fill or Organic Clay
- Clay
- Silt Till

Brief descriptions of each of the soil layers listed above are presented below. The test hole logs in Appendix A present detailed descriptions.

4.1.1 Granular Fill

Granular fill was present at the ground surface at TH20-04, TH20-05, TH20-08 and TH20-09 and was 150 to 455 mm thick. The granular fill was generally classified as gravel and sand, or gravel with some sand, and was poorly graded, fine grained, moist, inferred as compact, and brown to light brown. Sand fill was present at the ground surface at TH20-08 and was poorly graded, fine to medium grained, moist, inferred as compact and brown. All moistures tested in the gravel fill or sand fill were 7%.

4.1.2 Organic Clay

At the remaining test holes, organic clay was present at the ground surface ranging in thickness from 100 to 450 mm. The organic clay was silty, high plastic, moist, inferred as firm to stiff, dark brown, blocky, and contained trace rootlets.

4.1.3 Clay

Clay was encountered below the fill and organic clay layers described above, and extended to 2.1 to 2.9 m below grade. The clay was silty, high plastic, moist, very stiff to hard becoming firm to stiff with depth and brown, with occasional to abundant silt or silt till inclusions, and occasional sulphate inclusions. In TH20-05 and in TH20-10 from 0.5 to 1.1m, the clay was classified as silt and clay, or as silty clay, and was medium to high plastic. Moisture contents in the clay were 24 to 45%, with an outlier value of 13% in TH20-03 where abundant silt till inclusions were present. The results of Unconfined Compressive Strength (UCS) tests on the clay are provided in Table 4-1.

Table 4-1: Summary of Unconfined Compressive Strength Tests

Test Hole	Depth (m)	UCS (kPa)	Strain (%)		Dry Density (kg/m^3)	Moisture Content
			@ UCS	@ 50% of UCS		
TH20-01	1.5	72.9	5.7	0.7	1349	37.9
TH20-04	1.5	77.1	5.6	0.8	1245	44.4

Undrained shear strengths of the clay, as determined from the UCS tests in Table 4-1, were lower than Torvane and Pocket Penetrometer readings on the same samples; while commonly are somewhat higher due to silt inclusions in the clay. This discrepancy can be attributed to some degree to slickensides (i.e. weak, pre-existing shear surfaces) in the UCS specimens.

4.1.4 Silt Till

Silt till was encountered below the clay at every test hole and extended to the auger refusal depths or termination depths. The silt till contained minor soil types described as trace sand to and sand, trace clay to clayey, and trace to some gravel, and was moist to wet, loose to compact and light brown to grey. With increasing depth in the test holes advanced to auger refusal, i.e. TH20-01 to TH20-05 and TH20-12, the silt till became damp to moist and dense to very dense. Moisture contents in the silt till were 9 to 17%.

In TH20-12 only, a gravel layer and a silt layer were present within the till. The gravel layer extended from 4.0 to 4.3m from grade and was classified as gravel and silt, and was poorly graded, fine to medium grained, wet, inferred as compact to dense, and light brown. The silt layer, which was present at 4.6 to 6.4 m, was low to non-plastic, damp, compact and light grey, becoming dense to very dense below 6.1 m. The moisture content of the silt was 15%.

A natural sand layer was encountered in TH20-02 only, at 2.1 to 2.4 m from grade, was described as sand and silt to silty sand, and was poorly graded, fine grained, very moist to wet, inferred as loose to compact, and light brown.

SPT 'N' values in the till, gravel and silt ranged from 21, to 50 blows for 15 mm penetration.

A detailed description of the soil profile encountered at each test hole location is provided in the test hole logs, Figures A1 to A12.

4.2 Power Auger Refusal

Auger refusal was met in TH20-01 to TH20-05 and TH20-12 at 4.3 to 7.3 m from grade. All other test holes were terminated without encountering refusal.

4.3 Sloughing and Seepage Conditions

Seepage and sloughing conditions were noted during drilling, and the depths to slough and accumulated water levels within the test holes were measured approximately ten minutes after drilling. The recorded observations are provided in Table 4-2.

Table 4-2: Summary of Sloughing and Groundwater Observations

Test Hole ID	Drilled Depth (m)	During Drilling		Upon Completion	
		Sloughing Zone	Seepage Zone	Depth to Slough	Depth to Groundwater
TH20-01	4.3 (AR)	2.6 to 3.0 m (Till)	2.6 to 3.0 m (Till)	3.7 m	2.7 m
TH20-02	5.8 (AR)	2.1 to 3.4 m (Sand and Till)	2.1 to 3.4 m (Sand and Till)	5.5 m	5.5 m (trace)
TH20-03	4.6 (AR)	2.6 to 3.0 m (Till)	2.6 to 3.0 m (Till)	4.6 m	4.6 m (trace)
TH20-04	5.5 (AR)	2.4 to 3.0 m (Till)	2.4 to 3.0 m (Till)	5.5 m	4.6 m
TH20-05	5.0 (AR)	Below 4.0 m (Till)	2.7 to 2.9 m (Till)	4.0 m	3.4 m
TH20-06	3.0	None	None	None	None
TH20-07	3.0	2.9 m (Till)	None	2.9 m	None
TH20-08	3.0	None	None	None	None
TH20-09	3.0	Caving 0-0.5m (Gravel Fill)	None	2.7 m	None
TH20-10	3.0	None	None	None	None
TH20-11	3.0	None	None	None	None
TH20-12	7.3 (AR)	Caving 4.0-4.3m (Gravel)	2.7-3.0 m (Till)	7.1 m	5.8 m

AR = Auger Refusal

It should be noted that ground water levels can fluctuate annually, seasonally or as a result of construction activity.

5.0 Geotechnical Recommendations

5.1 General Evaluation

The soil profile encountered at the test holes consisted of thin layers of fill or organic clay, overlying clay that extended to depths ranging up to 2.9 m from grade, underlain by silt till that extended to either the termination depths or to auger refusal. Groundwater seepage occurred in the silt till in all of the test holes advanced to refusal.

As noted, the preferred foundation for the shed is a thickened edge slab, with a rigid raft slab for the seed bins. Both of these foundation types could also be considered for the office building. Shallow foundations supported on the clay are considered suitable provided the potential for movements is tolerable to the owner. Movements of shallow foundations supported on the clay are expected to occur as a result of long-term consolidation settlement under the applied foundation loads; volumetric shrinkage and/or swelling of the clay subgrade in response to post construction drying and/or wetting of the highly plastic clay; and seasonal heave and settlement in response to freezing and thawing ground conditions. Movements of a raft slab, or a thickened edge slab, are likely to be greater than with piled foundations. If the movements associated with shallow foundations must be minimized, then driven piles, cast-in-place concrete end-bearing piles or shallow spread footings bearing on the till should be considered.

Thickened edge slabs and rafts will require perimeter insulation and preferably, full-time heating to reduce the potential for frost heave effects. Adequate surface drainage away from the slabs will be important to reduce the effects of frost and swell/shrinkage.

Shallow footings, bearing on the compact to dense silt till at depths of 2 to 3 m below grade, are also considered suitable for support of the proposed shed and office building, however seepage is expected at the bearing depth and it may be necessary to excavate deeper than 3 m to reach the compact to dense till. It is understood that that shallow footings are not preferred by Hi Tech. Where recommendations for footings are required, this office should be contacted.

Piled foundations, consisting of driven piles and cast-in-place concrete end-bearing piles are considered suitable and where recommendations for piled foundations are required, this office should be contacted.

It is assumed that the recessed reclaim area in the shed will have rigid retaining walls, and that slab loads adjacent to the top of the retaining walls could be as high as 2300 psf (110 kPa). The walls should be checked for stability against shear failure within the retained soil, or below the wall. Any excavations must be undertaken in accordance with the Manitoba Workplace Safety & Health Act and Regulations.

Excavations for underground services have the potential to encounter groundwater from the till, and where practical, should be limited such that each day's excavation can be backfilled within the same day. Sumps and pumps may nevertheless be required to manage groundwater accumulations.

Grade-supported slabs and pavements at this site are expected to be susceptible to some moderate movements associated with volumetric swelling of the clay; and moisture-softening of the clay in areas of poor drainage, which could lead to rutting and potholes such as in traffic areas. The potential for movements can be reduced, but not eliminated, by reworking at least a portion of the upper, desiccated clay, using uniform moisture conditioning and uniform compaction, or by replacing a portion of the clay thickness with engineered granular fill. Adequate surface drainage is also important to reduce the potential for moisture changes to occur.

The following sections provide recommended Ultimate Limit State (ULS) and Serviceability Limit State (SLS) design values for concrete thickened edge slabs on clay, and raft slabs bearing on clay, in accordance with the current Manitoba and National Building Codes.

5.2 Grade Supported Floor Slabs

Figure 2 shows the proposed slab design. The design would require an excavation into the clay, approximately 0.3 m below surrounding grades, followed by placement of 0.3 m of compacted granular base. For the case of the design proposed, grade-supported slabs, raft foundations and thickened edge slab foundations will all be subject to similar preparation and construction procedures. On this basis, this section provides general recommendations, considerations and comments common to the design, preparation and construction of grade-supported flat, raft and thickened slabs.

5.2.1 General Discussion

Grade supported floor slabs constructed over swell-susceptible clays, such as those present at this site, are generally subject to long term volumetric changes that can result in movements which are typically in the order of 25 to 50 mm; however, can be as high as 150 mm or more under extreme circumstances. Construction of buildings and pavements generally tends to change natural evaporation routes, often leading to long-term increases in soil moisture content and consequently swelling, particularly within the

upper desiccated zone. Pre-existing moisture conditions, which can be influenced by site drainage and recent climatic events, have one of the greatest effects on the swell potential. Design, maintenance and post construction climate, however, will also significantly influence the actual performance.

The moisture contents in the native clay ranged between approximately 25 and 45% within the typical active soil zone (i.e. upper 3 m). Based on the variability of the test results across the site, the swell potential is estimated to vary between approximately normal to above average for this area of Manitoba. In this regard, total slab movements of 25 to 50 and as high as 50 to 100 mm or more could be anticipated across the areas of grade supported slabs over the long term, with differential movements likely to be in the order of 50% or more of the total movements. Greater movements can occur where the soil is allowed free access to water (i.e. poor drainage conditions, pipe breakage, etc.) and any heave movements which occur could create additional differential slab movements.

The estimated heave movements provided are based on moisture content data and Wood's experience with similar sites. Where an improved estimate of slab movements is required, additional investigation, lab testing and engineering should be undertaken.

Grade supported slabs are also subject to heave where there is a potential for the subgrade to become frozen. Frost-related slab performance risks are generally limited to exterior slabs and sidewalks. Frost heave is not a significant risk to interior slabs for heated structures where heat is beneficially lost to the foundation, except if the subgrade will be subjected to freezing conditions during construction. If the subgrade is allowed to freeze, some differential movements are expected to occur, potentially resulting in mid- to long-term movements of the slab up to (but not limited to) the heave amounts. Therefore, the subgrade should be protected from freezing. The potential for frost heave at a slab can be reduced by using insulation equivalent to 2.4 m of soil cover. The insulation should extend 2.4 m horizontally away from the edges of the slab. The potential for movements related to softening of the bearing surface can be reduced by providing adequate surface drainage. Wood can review or revise requirements for insulation on request once the final design details are known.

5.2.2 Modulus of Subgrade Reaction

The modulus of subgrade reaction is a conceptual relationship between soil pressure and deformation that is widely used in the structural analysis of concrete floor slabs. The modulus of subgrade reaction is a difficult parameter to accurately evaluate, as it cannot be measured via lab testing but must be back-calculated from full scale field tests.

Based on the field investigation completed at the site, the shallow subsurface soil conditions consisted of stiff natural clay. Construction of a grade supported main floor slab is expected to require a granular structure a minimum of 300 mm thick. For a grade supported slab constructed on a 300 mm thick gravel base structure and subgrade prepared as outlined above, an estimated subgrade reaction modulus of 30 MPa/m can be used on a preliminary basis. Where the total thickness of granular fill is reduced, the subgrade modulus will also be reduced accordingly. If additional subgrade stiffness is required, Wood can provide recommendations for additional gravel structure thickness on request.

5.2.3 Subgrade Preparation and Construction Recommendations

The following recommendations for subgrade preparation and construction of shallow grade supported slabs, thickened slabs and rafts are provided on the assumption that the risks outlined above regarding potential slab movements are acceptable to the owner. Where the performance risks and potential slab

movements discussed in Section 5.2.1 are not tolerable, or where maintenance and/or repair after their occurrence is not feasible, Wood recommends using a structural floor supported on footings or piles; and this office should be contacted for recommendations. The recommendations assume bearing on the 0.3 m of compacted granular base as shown in Figure 2, overlying undisturbed stiff native clay.

1. Excavate to the design subgrade elevation, which should be taken as the bottom elevation of the concrete slab minus the design thickness of base and any subbase, while further ensuring that all organic materials as well as any softened, weak, loose and/or disturbed or otherwise unsuitable soils are removed from the final subgrade surface. A minimum excavation depth of 0.3 m below surrounding grades is expected. Further remove any fill, if present. To create a uniform base condition and reduce the potential for total and differential settlements, excavation should proceed to subgrade design elevation, ensuring that the exposed soils consist of native, undisturbed firm to stiff clay.
2. Excavation should proceed with care using an excavator operating from the edge of the excavation to reduce the potential for disturbance. All finish cuts should be made using a smooth edged bucket. All loosened and disturbed soils should be removed from the final bearing surface by hand. Care should be taken to ensure that the bearing surface is not subject to frost, inundation, desiccation or heavy equipment, or disturbed in any way prior to casting the slab;
3. Conditions for spring construction may be wetter than those encountered at the time of drilling and as such, adequate drainage should be provided during construction.
4. Once the bearing surface has been suitably prepared, it should be evaluated by qualified geotechnical personnel to verify the suitability of the proposed subgrade or bearing soils, and to confirm that the soils are uniform and not affected by frost or disturbance. It should also be confirmed that the soils encountered are consistent with the conditions noted in the test hole logs presented this report.
5. If conditions are suitable, the subgrade should be proofrolled using a fully loaded tandem dump truck to identify soft, weak or compressible areas. Where trucks are not available and other equipment is used, such as a roller with a large drum, it should be understood that the roller drum could potentially bridge over weak zones and fail to detect such areas.
6. Any soft, weak or otherwise unsuitable areas identified at the subgrade or bearing elevation should be sub-excavated and replaced with a suitable lean mix concrete or well-compacted granular fill under the direction of the geotechnical engineer. Actual procedures, including the depth of sub-excavation required, should be determined by the geotechnical engineer at the time of construction according to the subgrade conditions encountered.
7. Preparation of the subgrade and bearing surface should be undertaken in non-freezing conditions. The clay at this site is considered susceptible to frost heave and moisture softening. The subgrade should be protected from frost, desiccation, inundation and excessive wheel loads at all times. The use of frozen soils for fill, placement or compaction of frozen soils, or placement or compaction of soils over frozen subgrade, should be avoided.
8. In general, fill materials required to raise grades to the underside of the proposed granular section should consist of additional 50 mm max. crushed rock or granular sub-base, placed in maximum 150 mm thick lifts and uniformly compacted to 98% of Standard Proctor Maximum Dry Density (SPMDD). Pre-approved clay fill could also be considered for raising grades, and if used should be uniformly moisture conditioned to 0 to 3% above Proctor optimum moisture content, and uniformly

compacted with a heavy sheepsfoot roller to a minimum of 95% of SPMDD.

9. Lean mix or mud slabs may be used to protect the subgrade or bearing surface from being disturbed, particularly during placing of the rebar cages.
10. Excavations and backfilling should follow the recommendations provided in Section 5.6. It is understood that the proposed granular base thickness beneath unthickened sections of the fertilizer shed slab will be 600 mm; this section is considered sufficient; however for slabs of uniform thickness, the granular structure should be a minimum of 300 mm thick All granular base should be uniformly compacted in maximum 150 mm thick lifts (when measured uncompacted) to a minimum of 98% and 100% of SPMDD for the sub-base and base, respectively.
11. Rafts, and all thickened and unthickened sections of slabs, should be steel reinforced and suitably designed by a structural engineer to act rigidly.
12. All granular materials should meet the gradation and quality requirements outlined in Appendix B

Additional construction recommendations applicable specifically to grade supported slabs are as follows:

- Due to the potential for frost heaving of exterior slabs, all sidewalks and apron slabs should be structurally separate from the structure and should not be dowelled into the grade beam or the interior slabs, except at doorway locations.
- Where it is proposed to dowel exterior slabs into structure components, or where frost related movement of the slab is undesirable, rigid insulation could be placed on the subgrade to reduce the depth of frost penetration beneath the slab. In this case, the placement of vertical insulation along the sides of grade beams should be avoided to allow beneficial heat loss from the building and lessen frost effects.
- A polyethylene vapour barrier may be utilized directly below the floor slab to limit moisture migration through the slab. It should be noted that curing problems (delays before final finishing), curling of the slab at the edges and shrinkage cracking might be encountered where the concrete slab is cast directly on the poly. Where the concrete will not require a finished floor covering, a vapour barrier is not necessarily required.

To reduce the effects of slab movements on the building structure, the following provisions are recommended:

- Design equipment and partition walls bearing on the slab with a void space to minimize the potential for structural damage if the slab heaves.
- Provide control joints at regular intervals in the slab to reduce random cracking.
- Construct the floor independent of structural elements by the use of isolation joints.

Construction activities, groundwater seepage, changes in groundwater elevations and precipitation during construction may expose the slab subgrade or bearing surfaces to water. Drainage should be provided as needed during construction to prevent inundation of the subgrade or bearing surface. A water pump should be maintained on site and used to immediately remove any water accumulations from the subgrade or bearing surface. Any softened or disturbed materials should be removed as required.

5.3 Shallow Foundations

5.3.1 Rigid Rafts of Uniform Thickness

Assuming some movements are acceptable, a rigid raft of uniform thickness, supported at shallow depth on the stiff to very stiff native clay, is considered suitable for support of the seed bins; the weigh hopper; and for the combined loads from dry fertilizer stockpiles inside the shed and the shed building envelop. Raising grades is not recommended, as this will correspondingly reduce the available height of stockpiles in the shed.

The distribution of loads by a raft to the foundation soil depends on the rigidity of the raft in relation to the stiffness of the underlying soil. In this regard, Wood recommends that rigid rafts be designed using both a limiting bearing pressure on the underside of the raft, and a subgrade reaction modulus for estimating flexure of the raft and reinforcement design. Differential movements of a grade supported slab are typically identified as out-of-plane movements occurring independently across the slab area, and can result in stresses in the supported building structure. Provided the raft behaves rigidly, however, out-of-plane movements will be negligible for practical purposes, and total and differential movements need only be considered relative to exterior features such as approaches and utility connections.

When founded on the gravel base structure outlined herein, a rigid raft foundation may be designed using a *factored ultimate* bearing pressure of 110 kPa. The factored geotechnical resistance at ultimate limit states provided above includes a geotechnical resistance factor of $\Phi = 0.5$, in accordance with the National Building Code of Canada (NBCC).

As noted in Section 5.2.2 on a preliminary basis the vertical modulus of subgrade reaction estimated as 30 MPa/m. It should be noted that the subgrade reaction modulus is not a fundamental soil property, and is not intended to be used to estimate raft settlement. It should also be strictly noted that the recommended design bearing pressures have been provided assuming an Ultimate Limit State defined by plastic soil deformation and geotechnical failure of the footing. In other words, no reduction has been applied to the bearing pressure value to maintain deformations with a zone of elastic or elastic-plastic deformation, nor to ensure a maximum level of tolerable deflection. Reduced bearing pressures may be required where the ultimate limit state (ULS) of the raft is to be defined by a specified deformation of foundation subgrade that could lead to the ULS state being induced in the superstructure.

With respect to serviceability and settlement, a rigid raft will be susceptible to both elastic settlement in the short term following construction, and long term consolidation settlement over the life of the structure.

Dry Fertilizer Shed, 27.1 x 38.4 m

The maximum applied unfactored bearing pressure under the dry fertilizer shed pad is expected to be 110 kPa at the base of the concrete pad. Under long term loading at the anticipated applied pressure, and assuming the applied pressure is uniformly distributed, maximum total long-term total settlements in the underlying clay are expected to be in the range of about 60 mm to 80 mm. Where lesser settlement is desirable, a portion of the clay can be excavated and replaced with gravel fill.

Seed Bins, 4.9 x 34 m

Under a uniform unfactored bearing pressure of 80 kPa applied to a 4.9 m wide rigid raft below the seed bins, maximum long-term total settlements of the raft are estimated to be in the range of 50 to 70 mm.

Weigh Hopper, 6.1 x 6.4 m

Under a uniform unfactored bearing pressure equal to 110 kPa applied to a 6.1 m wide raft below the weigh hopper, maximum long-term total settlements of the raft are estimated to be in the range of 60 to 90 mm.

It should be recognized that the estimated ranges of settlement provided above are calculated assuming the dry fertilizer shed, and all bins, would be full over the long term, which is considered unlikely and the estimated settlements are therefore conservative.

In order to facilitate excavation and construction of an even bearing surface, Wood recommends that the proposed raft foundations be underlain by a minimum gravel structure thickness of 300 mm, consisting of 100 mm of crushed gravel base course compacted to 100% of Standard Proctor Maximum Dry Density (SPMDD) at ±3 percent of optimum moisture content, underlain by 200 mm of crushed granular subbase compacted to 98% of SPMDD at ±3 percent of optimum moisture content. It is recommended that the gravel base course and gravel subbase materials meet the material and gradation requirements provided in Appendix B. Other gradations may be suitable but should be reviewed by the geotechnical engineer prior to use.

Additional recommendations for construction of the raft foundation are presented in Section 5.2.3 and 5.3.3

5.3.2 Thickened Edge Slabs

A thickened edge slab bearing on the stiff high plastic native clay is preferred by Hi Tech for support of the fertilizer shed and the office building, and is also considered suitable for the office building, subject to confirmation that the risks associated with potential consolidation settlement and shrinkage/swell are acceptable to the owner, and that the structure is permanently heated and/or adequate insulation is provided. The suitability of the bearing soils should be confirmed during construction, once the bearing surfaces are exposed.

A thickened edge slab consists of a grade-supported slab that is poured monolithically with stiffened footing sections (i.e. effectively shallow spread strip footings) that contribute support to distributed loads such as the contained fertilizer, as well as concentrated loading applied to the slab such as the structure envelope, column loads, etc. The un-thickened slab portions of the raft should be designed and constructed using an estimated subgrade reaction modulus of 30 MPa/m, and the recommendations for grade supported slabs outlined in Section 5.2. Section 5.2 should also be reviewed for discussion of risks associated with grade-supported slabs at this site. The recommended underslab granular structure below both thickened and unthickened portions of the slab is provided in Section5.2.3, item 10, i.e. a total of 300 mm. The proposed thickened edge slab design provided to Wood by Hi Tech includes a minimum bearing width of 1.5 ft (0.5 m). The applicable sections of NBCC, Manitoba Building Code and National Farm Building Codes should be consulted to ensure that this dimension satisfies applicable regulations.

The thickened edges and/or internal beams of thickened edge slabs bearing on 1 ft (0.3 m) of compacted gravel over native, undisturbed, medium to high plastic clay may be designed as spread footings using a *factored* ultimate bearing pressure of 125 kPa, assuming a bearing depth of at least 0.3 m below finished floor elevation. The recommended bearing pressure assumes a minimum width of 0.5 m for all perimeter stiffeners and 0.6 m for all internal stiffeners, and is subject to inspection and approval of all bearing surfaces, including un-stiffened areas, by the geotechnical engineer.

The *factored* ultimate bearing pressure for a larger rigid slab bearing on gravel over clay over an assumed width of 6.4 m, i.e. the column-to-column width shown on Hi Tech's gravel pad section, can be taken as 110 kPa.

As noted for rafts of uniform thickness, it should be recognized that the recommended design bearing pressure has been provided assuming an Ultimate Limit State defined by plastic soil deformation and geotechnical failure of the footing. In other words, no reduction has been applied to the bearing pressure value to maintain deformations with a zone of elastic or elastic-plastic deformation, nor to ensure a maximum level of tolerable deflection. Reduced bearing pressures may be required where the ultimate limit state (ULS) of the footing is to be defined by a specified deformation of foundation subgrade that could lead to the ULS state being induced in the superstructure.

With respect to serviceability and settlement, the bearing pressure at the Serviceability Limit State (SLS) can only be determined from settlement analyses which in turn can only be evaluated once the final foundation configuration, including both depth and footing size, is known. However, as a conservative estimate, the serviceability limit state may be assumed equivalent to the factored resistance, and in this regard, the bearing pressure at the serviceability limit state (i.e. 25 mm of movement) may be taken as 60 kPa. The long-term total settlement potential of bearing elements up to 0.6 m in width is estimated to be in the range of 15 to 30 mm for a sustained loading of 60 kPa. The estimated deflection is dependent on width, length, bearing depth, thickness of clay below the bearing surface, and applied loads. In this regard, under an applied uniform unfactored load of 110 kPa, long-term settlements in the range of 30 to 60 mm are estimated below the thickened portions of the slab. For un-thickened sections of slab with an assumed width of 7.0 m and with an applied unfactored pressure of 110 kPa, long-term settlements in the range of 30 to 90 mm are estimated.

For the serviceability limit assessment, load factors are not to be utilized for assessing acceptable bearing pressures. Where larger settlements are acceptable, a greater serviceability limit state can be utilized. Where smaller settlement tolerances apply, this office should be contacted. Wood can provide alternate SLS bearing pressure capacity recommendations for various embedment depths and thickened edge sizes on request. The consolidation potential beneath footings can be reduced by sub-excavating below the footing and replacing the highly plastic clay with well compacted gravel. Wood can provide a recommended gravel configuration, or revised bearing values, for specific footing sizes and serviceability tolerances upon request.

5.3.3 Construction of Rigid and Stiffened Raft Slabs

General recommendations for preparation and construction of slabs are provided in Section 5.2.3 and are applicable to stiffened raft slabs. Additional recommendations specific to stiffened slabs and rafts of uniform thickness are as follows:

1. Shallow foundations must not be founded on un-compacted fill, loosened or disturbed soil, or organic soils.
2. Regardless of bearing capacity considerations, it is recommended that all bearing elements have a minimum width of 0.6 m.

5.4 Lateral Earth Pressure on Permanent Below Grade Walls

Permanent below-grade walls with unequal fill on each side of the wall, such as the 6-ft deep reclaim area, should be designed to resist lateral earth pressures. The applicable earth pressure coefficient, and the

resulting magnitude and distribution of the lateral earth pressures on the walls, depends on such factors as the rigidity of the wall; the degree of compaction of the backfill against the structure; the backfill soil type; the slope angle at the structure/soil interface; and the subsurface drainage and groundwater conditions over the height of the structure.

5.4.1 Lateral Earth Pressure Coefficients

Table 5-1 provides recommended earth pressure coefficients for "at rest" earth pressure case, and total unit weights for various soil backfill types assuming horizontal grades and a vertical, unyielding wall. The earth pressure coefficients should be reviewed during detailed design for sloping grades and wall faces.

Table 5-1: At-Rest Earth Pressure Coefficients and Soil Unit Weights

Soil Type		"At Rest" Earth Pressure Coefficient	Total Soil Unit Weight	Friction Angle (deg) Between Soil and Concrete
Granular Fill	Moderately to Well Compacted (35°)	0.43	22	23
	Light to Moderately Compacted (30°)	0.50	21	20
Cohesive Fill	Moderately to Well Compacted (20°)	0.66	18	13
	Light to Moderately Compacted (15°)	0.74	17	10

Notes: 1) Moderately to Well Compacted = Compacted to 95% or more of Standard Proctor Maximum Dry Density (SPMDD).
2) Light to Moderately Compacted = Compacted to minimum 90% of SPMDD, but less than 95% SPMDD.

The "at rest" (K_o) earth pressure coefficient should be used in the case of unyielding walls. In the case of unyielding walls exposed to frost penetration, it is recommended that K_o = 1.0, be used to account for lateral frost pressures. However, where lateral frost pressures need to be considered in the design, the site-specific configurations of the walls or sub-structures should be reviewed by qualified geotechnical personnel to explore alternatives in reducing the frost pressures.

5.4.2 Apparent Earth Pressure Distribution

The apparent earth pressure distribution used on buried permanent below-grade walls should adopt the triangular distribution illustrated in Figure 3. Where backfill adjacent to the wall is moderately to well compacted (i.e. 95% of SPMMD or higher) and the wall is unyielding (i.e. the 'active' earth pressure condition cannot develop), the earth pressure distribution should be modified to include additional earth pressure induced by compaction as illustrated in Figure 4. The hydrostatic component should be included if sub-drainage is not provided and a perched groundwater level were to develop within the retained soil.

5.4.3 Surcharge Loads

In addition to earth pressures, lateral stresses generated by surcharge loads, such as heavy trucks, fertilizer loads, etc, also need to be evaluated in the design. For line or point surcharge loads, the lateral pressures should be determined using the relationships given in Figure 5. In the case of uniformly distributed surcharge loads, such as those acting on the surface of the retained soil, the induced lateral earth pressure

may be determined by multiplying the surcharge load by the appropriate earth pressure coefficient provided Table 5-1.

5.4.4 Load Factors

For the Limit States Design procedure for walls, the following Load Factors should be applied to loads calculated from the pressure distributions given above.

- For earth loads acting on walls, a Load Factor of 1.25 is recommended for sustained loads.
- For hydrostatic loads acting on walls, a Load Factor of 1.1 is recommended.
- For live surcharge loads acting on walls, the Load Factor of 1.5 should be used.

The above load factors should be applied to loads leading to instability of the walls.

5.5 Frost Design Considerations

5.5.1 Frost Penetration Depth

The upper stratigraphy encountered at the test holes is considered to be moderately to highly frost susceptible in the presence of water, and as such, frost effects should be considered for foundations or surface structures sensitive to movement. Based on historical temperature data for this area, a design seasonal frost penetration, assuming cohesive soils from ground surface, may be taken as 2.4 m below final grade in unheated areas that will not have regular snow or vegetative ground cover. The effects of frost penetration may potentially be reduced by using a bond breaker. Wood can provide recommended insulation details for specific development conditions upon request.

5.5.2 Frost Heave

To reduce the potential of frost heave pressures acting on the structure, a void-forming product should be installed beneath the underside of the pile caps and any other structural elements located within the depth of frost penetration. The recommended minimum thickness of the void form is 150 mm. Alternatively, a compressible material may be used in lieu of a void forming material, and the uplift pressure may be taken as the crushing strength of the compressible medium. It is recommended that a frost heave of 150 mm be assumed in determining the required thickness for the void-filler and the associated uplift pressures associated with the thickness used.

The finished grade adjacent to foundation elements should be capped with well compacted clay and sloped away so that the surface runoff is not allowed to infiltrate and collect in the void space or in the compressible medium. Where either the void or compressible medium is allowed to become filled or saturated with water, resulting frost heave pressures and movements may be significant and therefore this condition should be avoided.

5.5.3 Shallow Foundations

In the case of shallow foundations, including thickened edge slabs and raft slabs, insulation equivalent to the depth of frost penetration outlined in Section 5.5.1 should be placed in unheated areas along the perimeter of heated or structures. For the proposed rigid raft and thickened edge slab foundations, rigid high-density extruded polystyrene insulation (such as Dow Styrofoam) is recommended. Where there is a potential that the insulation material would be in direct contact with light hydrocarbons, a hydrocarbon-resistant product should be used.

5.6 Temporary Excavations and Backfill

5.6.1 Site Preparation

Site preparation should include removal of the existing granular fill, and stripping should be completed to design subgrades, further removing any unsuitable materials that may be encountered (e.g. compressible organics, silt, etc.).

The site should be graded and prepared to the extent possible and practicable during the early stages of construction so as to provide for positive drainage of surface runoff away from the work areas, and from structures to enhance the long term performance of foundations, slabs and pavements.

Typical features that should be included in the grading and drainage design plans are:

- Raising site grades above surrounding areas;
- Removing weak soils and deleterious materials such as topsoil, vegetation, etc.;
- Using competent fills; and
- Provide adequate finished cross slopes, crowns, ditches and swales, directed overland to perimeter ditches, catch basins or overland off site.

For general grading purposes and excavation backfill, common fill is considered suitable provided placement meets the recommendations herein. Common fill should generally consist of native, high plastic clay. Imported gravel, meeting applicable Manitoba Infrastructure specifications for base (Granular Class A or Class A limestone) or sub-base (Granular Class C or Class C limestone), may also be considered. Wood recommends against placement or compaction of fill in winter. Placement of frozen fill, or placement of fill over frozen subgrade, should be avoided.

5.6.2 Temporary Sloped Excavations

Generally, conventional trench excavations with cut slopes are considered to be appropriate for the soil conditions encountered at the test hole locations, however, seepage may occur in the silt till, with risks for sloughing and seepage into the excavations if the till layer is saturated at the time of construction, or if the slopes are not properly protected from surface water. Risks associated with sloped excavations should consider the proximity of the excavation to surrounding property lines and adjacent structures or underground utilities, and the potential impacts to the project should a temporary slope fail or need to be stabilized during construction.

Regulations set forth by Manitoba Workplace Health & Safety must be followed for all excavations. Excavation works should be undertaken by an experienced contractor, and workers should not be allowed into open excavations without proper protection and appropriate confined space training. As a minimum requirement, the side walls of short-term temporary excavations extending to a maximum excavation depth of 3.0 m below grade should typically be cut no steeper than 1H:1V where entrance into the excavation is required. Flatter side slopes (i.e. 2.5H:1V or flatter) or benching in silt till, if present within excavation depths, may be required if the till is saturated at the time of construction, or if the duration of excavation is exceedingly long. 'Short term' is generally defined as excavations in clay with a duration of approximately one month or less; however, the specific duration is dependent on the soil and groundwater conditions encountered. Therefore, it is important that all excavations be reviewed by Wood periodically throughout the duration of construction to confirm that they are behaving as anticipated. The

specific excavation configuration should be evaluated by the geotechnical engineer at the time of construction based on stability analysis once the details and duration of the excavation are known.

Construction planning should be directed at minimizing the length of time an excavation is left open. All excavations should be monitored on an ongoing basis and inspected regularly by the geotechnical engineer of record for signs of instability. If sloughing of the sidewalls is observed, the cut slope angle should be flattened until a stable angle of repose for the soil has been attained. Alternatively, if sloughing of the upper soils somewhere within the excavation depth is an issue, a benched excavation could be maintained at the interface of the unstable and stable soils to allow a collection area for sloughing of the upper soils. In the case of a combination of sloped sidewalls and a vertical trench (i.e. Y excavation), the vertical faces shall not exceed 1 m in height. If space is insufficient to allow for a sloped excavation, Wood should be contacted to provide geotechnical design values for shored excavations. Where signs of instability (i.e. tension cracks, sloughing soils, toe bulging, etc.) are detected, these conditions should be brought to the immediate attention of Wood so that appropriate solutions to the problem areas can be determined.

Surface drainage should be directed away from the crest of the excavations. All temporary surcharge loads, including stockpiles of materials and excavated soil, should be kept back from the excavated faces a distance equal to at least the depth of the excavation. Wheel loads should be kept back at least 1 m from the crest of the excavation.

Excavation dewatering during construction is likely to be required for footings and utility trenches at this site, given that seepage was observed from the silt at all of the deep test holes. Greater seepage amounts are possible than those encountered at the test holes. It is anticipated that dewatering can be accomplished through sloping excavations to localized sumps with water pumped and discharged to a location sufficiently far away from the excavation.

5.6.3 Shored Excavations

Shored excavations may be required where the locations of the proposed structures within the Site do not allow sufficient space for sloped excavations. Shoring design is typically undertaken by the prime contractor. In this regard, Wood's proposed scope of work for this geotechnical investigation did not include providing lateral earth pressure distributions and geotechnical design parameters required for shoring design. Notwithstanding, Wood can provide such recommendations upon request using the geotechnical findings outlined in this report, subject to approval of additional scope.

5.6.4 Backfill

Backfill material and quality requirements for excavations should be assessed during design from the standpoint of performance requirements, such as bedding and support requirements for underground utilities, drainage requirements along the building perimeter, and long term settlement limits of fill required to mitigate risks and impacts to grade supported structures (i.e. pavements) and/or surface grading and drainage. For this project, it was anticipated backfill requirements will be mostly limited to backfill along perimeter grade beams and within utility trench installations.

Excavations at the perimeter of the structure (grade beams, etc.) should be backfilled with moderately to well compacted fill compacted to between 95 percent and 100 percent of Standard Proctor Maximum Dry Density (SPMDD). Backfill material selection and compaction specifications should consider the following:

1. All backfill should be free of excessive organic content and of any deleterious material such as roots, litter, silt pockets, etc.
2. The moisture content of highly plastic clay at the site ranged between about 24 and 45 percent in the upper 3 m of the soil profile. The optimum moisture content for highly plastic clay backfill typically falls in range of 25 to 35 percent, and thus clay excavated from above the silt till layer is expected to require moisture conditioning to enable compaction.
3. Silt or silt till encountered should not be used as fill material. Primary issues with using silt or silt till as fill material include frost susceptibility and high sensitivity to rutting, shoving, and loss of stability due to changes in moisture level during placement and compaction.
4. In comparison to gravel fill, the clay overburden at the site is virtually impermeable, and in this regard, the use of gravel fill below final grade creates a "bathtub" effect. As a minimum, where gravel backfill will be used, a permeable geotextile separator should be used; however ideally, sub-drainage should be provided.
5. The upper 0.3 m of all excavations subject to overland flow should be backfilled with a moderately to well compacted clay cap to reduce the potential for surface water infiltration into the underlying backfill.
6. To mitigate potential settlement, trench backfill should be compacted to a minimum 95 percent of SPMDD within landscaped areas and to a minimum of 98 percent of SPMMD within the upper 1 m of areas requiring subgrade support, at soil moisture contents at or slightly above Optimum Moisture Content to achieve the desired compaction target. More stringent backfill criteria may be required for pipe support, and the pipe manufacturer's specifications should be referenced in this regard.
7. For clay fill compacted to a minimum of 95 percent of the Standard Proctor maximum dry density, the self-weight settlement is expected to be in the order of 1.5 percent of the fill thickness. For clay fill compacted to a minimum of 98 percent of the Standard Proctor maximum dry density, the settlement is expected to be in the order of 1 percent of the fill thickness.
8. For granular fill materials compacted to 98 percent or more of SPMDD, settlement due to self-weight is expected to be in the range of 0.5 to 1 percent of the fill thickness, with most of the settlement occurring within the first freeze-thaw cycle.

5.7 Asphalt Pavement and Granular Traffic Surface

5.7.1 General Discussion

The construction and performance of asphalt and concrete pavements at this site will generally have similar concerns as those presented in Section 5.2 for grade supported slabs; however, there is generally more flexibility in pavement design to tolerate some movements.

Assuming heavy traffic will be limited to areas designed to support the applicable loads, the greatest risk to pavement performance at this Site is considered to be the presence of relatively desiccated shallow clay. The clay poses some risk for frost heave to occur, and for soft subgrade conditions to be encountered. Subgrade inspection should be conducted, and the requirement for subgrade improvement should be reviewed by the geotechnical engineer at the time of construction.

5.7.2 Subgrade Preparation

Recommendations for subgrade preparation in pavement areas may be taken as outlined in Section 5.2.3, with subgrade design elevation taken as the top of pavement minus the total pavement structure selected

from Section 5.7.3. Additional measures recommended to improve long term pavement performance are as follows:

- Maximize drainage slopes.
- Minimize drainage path lengths.
- Maintain finished grades as high as possible.
- Provide regular maintenance of the asphalt surface (crack sealing) to prevent water infiltration and subsequent softening of the subgrade.

5.7.3 Pavement Sections

The following asphalt pavement sections are intended as minimum sections for the design of pavement structures. The recommended pavement sections provided below are based on the use of the area by cars with some light truck traffic (i.e. 1-Ton trucks or lighter). Asphalt pavement recommendations for heavy truck traffic areas have also been provided based on these areas being used by fully loaded highway-legal tractor trailers at frequency of less than 5 trucks per day (i.e. buses and delivery and/or garbage trucks). The asphalt pavement sections should be reviewed during detailed design for actual design traffic loading.

Pavement sections have been established based on an assumed effective subgrade resilient modulus (M_r) of 20 MPa, or an approximately equivalent California Bearing Ratio of 2.0%. The above subgrade resilient modulus represents a relatively low level of subgrade support as is expected during spring thaw when the clay subgrade may be in a weakened condition. If softened areas are present in the subgrade during construction, it may be necessary to incorporate additional gravel to establish a stable subgrade. Recommendations for additional gravel thickness should be made in the field based on observations made during site grading.

Table 5-2: Asphalt Pavement Design Sections

Material	Recommended Minimum Thickness (mm)	
	Passenger Vehicles	Truck Traffic
Dense Hot Mix Asphalt – Type 1A	65	80
20 mm minus Crushed Limestone Base Course	150	150
50 mm minus Crushed Limestone Sub-base	150	250
Total Structure Depth	365	480

The proposed pavement sections are also based on the assumption of a properly compacted pavement structure constructed on a stable subgrade prepared in accordance with subgrade preparation recommendations outlined in Section 5.2.3. Outlined below are additional construction recommendations pertaining to asphalt pavement sections:

- The granular subbase should be placed in maximum 200 mm thick lifts (or reduced lift thicknesses as governed by the compactive abilities of the compaction equipment) and uniformly compacted to a minimum of 98% of SPMDD to the bottom of the base course design elevation.

- The granular base course should be placed in maximum 200 mm thick lifts (or reduced lift thicknesses as governed by the compactive abilities of the compaction equipment) and uniformly compacted to a minimum 100% of SPMDD to the bottom of the asphalt design elevation.
- Qualified and knowledgeable geotechnical personnel should monitor the quality and placement of gravel and the compaction of the gravel should be monitored using field density testing at regular frequencies. The density of each lift should be tested to confirm that adequate compaction has been achieved before placing the next lift.
- Asphalt should be compacted to a minimum 98% of a 50 blow Marshall Density.
- All granular and asphalt materials should meet Manitoba Infrastructure Specifications. Base course and sub-base materials should reflect Manitoba Infrastructure Specifications.

Concrete pavement sections should be provided for any areas where heavy static wheel loads such as B-trains will bear, and areas where trailer dollies will bear on the pavement. Asphalt pavement used in such areas is at risk of rutting.

With respect to maintenance, all pavements, no matter the pavement type, require routine annual maintenance and upkeep which are essential to maintaining the pavement investment at a specified level of service, and to mitigate the rate of deterioration of the pavement. The annual maintenance is required to repair normal 'wear and tear' and environmental damages, and may include, but not be limited to, crack sealing or seal coating, patching, routing, or dowel joint repairs. Un-maintained pavements are more susceptible to developing serious cracks or structural defects requiring earlier replacement than properly maintained pavements. By mitigating the deterioration of the pavement structure, particularly at depth, a properly maintained pavement could provide for an increased number of pavement rehabilitation alternatives when the design life of the pavement has been achieved.

Pavement maintenance should include limiting heavy vehicle traffic to heavy duty pavement areas. Overland drainage paths should be constructed and maintained to allow the free flow of surface water away from the structure and pavements, such as through regular cleanouts in catch basins.

5.7.4 Granular Traffic Surface

Design recommendations for the granular traffic structure are provided in Table 5-3 assuming subgrade preparation is undertaken according to the recommendations in Section 5.2.3, and those following Table 5-3:

Table 5-3: Gravel Traffic Surface Design Sections

Material	Light Duty	Heavy Duty	Compaction Required
20 mm minus Base Course (MIT "A"-Base)	280mm	310 mm	100% of Standard Proctor
38 mm minus Subbase Course ("C" - Base)	150 mm	250 mm	98% of Standard Proctor
Total Structure Depth	430 mm	560 mm	NA

Subgrade preparation follow the recommendations provided in Section 5.2.3.

Granular traffic surfaces should undergo a regular program of maintenance including re-grading and replenishment.

5.8 Drainage

5.8.1 Exterior and Surface Drainage

Drainage adjacent to buildings, structures and slabs should promote runoff away from the structure. Drainage from the structures should be discharged well away from the building and leaders, splashguards and positive drainage slopes should be provided where necessary to prevent erosion and ponding of water. Site grading should provide positive drainage away from structures at a minimum gradient of 4% for landscaped areas within 3 m of the perimeter of the structure or slab; and at a minimum gradient of 2% for all pavement areas and landscaped areas outside of 3 m of the structure or slab perimeter, to improve long-term drainage and to reduce the potential for moisture percolation to the foundation elements.

Excavations at the perimeter of the structure (exterior portions of reclamation area excavation, or perimeter thickened edges or raft excavations, etc.) should be backfilled with well-compacted fill, and topped with a clay cap a minimum of 0.3 m thick to reduce the potential for surface water infiltration into the slab subgrade or subsurface granular backfill. In landscaped areas, the clay cap should extend over and beyond granular backfills, to reduce infiltration through backfills and below slabs or grade beams. As a recommended minimum, the clay cap in landscaped areas along the perimeter of the foundation should extend a minimum of 3.0 m from the foundation edges. Pavements, concrete aprons or slabs abutting structural components should be sealed with an asphaltic tack coat or flexible seal to minimize surface water infiltration below the main floor.

5.9 Foundation Concrete

Where concrete elements outlined in this report and all other concrete in contact with the local soil will be subjected in service to weathering, sulphate attack, a corrosive environment, or saturated conditions, the concrete should be designed, specified, and constructed in accordance with concrete exposure classifications outlined in the latest edition of CSA standard A23.1, Concrete Materials and Methods of Concrete Construction. In addition, all concrete must be supplied in accordance with current Manitoba and National Building Code requirements.

Data gathered through previous work in the Lake Agassiz area shows that water soluble sulphate concentrations in the soil are typically in the range of 0.2% to 2.0%. As such, the degree of sulphate exposure at the site may be considered as 'severe' in accordance with current CSA standards, and the use of sulphate resistance cement (Type HS or HSb) is recommended for concrete in contact with the local soil. Furthermore, air entrainment should be incorporated into any concrete elements that are exposed to freeze-thaw to enhance its durability.

It should be recognized that there may be structural and other considerations, which may necessitate additional requirements for subsurface concrete mix design.

5.10 Construction Monitoring and Testing

In accordance with Section 4.2.2.3 Field Review of the NBCC, all engineering design recommendations presented in this report assume that an adequate level of testing and monitoring will be provided during construction by either the designer or other suitably qualified personnel. Furthermore, it is assumed that all construction will be carried out by a suitably qualified contractor experienced in foundation and earthworks construction. An adequate level of testing and monitoring is considered to be:

- for earthworks:
  - full-time monitoring of fill quality and subgrade conditions and compaction testing.
- for shallow foundations:
  - design review and regular monitoring during construction.
- for concrete construction:
  - testing of plastic and hardened concrete in accordance with the latest editions of CSA A23.1 and A23.2; and
  - review of concrete supplier's mix designs for conformance with prescribed and/or performance concrete specifications.

On the basis of the above, and given Wood's familiarity with the subsurface conditions at this site as the Geotechnical Engineer of Record, Wood requests the opportunity to review the design drawings, and the installation of the foundations, to confirm that the geotechnical recommendations have been correctly interpreted. Wood would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents. Wood can provide design modifications as required at the time of construction should subsurface conditions be found to vary from those described herein.

6.0 Closure

The findings and recommendations presented in this report were based on the geotechnical investigation performed and described herein. If conditions other than those noted in this report are encountered during subsequent phases of the project, or if the assumptions stated herein are not in keeping with the design, this office should be notified immediately in order that the recommendations can be reviewed and adjusted, if necessary. Recommendations presented herein may not be valid if an adequate level of testing and monitoring is not provided during construction, or if relevant building code requirements are not met.

The geotechnical investigation conducted and described in this report was for the sole purpose of identifying geotechnical conditions at the project Site. No environmental issues were considered in developing the geotechnical recommendations provided in this report, however this does not indicate that no such issues exist. If the owner or other parties have any concern regarding the presence of environmental issues, then an appropriate level environmental assessment should be conducted.

Soil and groundwater conditions, by their nature, can be highly variable across a site. The placement of fill and prior construction activities on a site can contribute to the variability especially in near surface soil conditions. A contingency should always be included in any construction budget to allow for the possibility of variation in soil conditions, which may result in modification of the design and construction procedures.

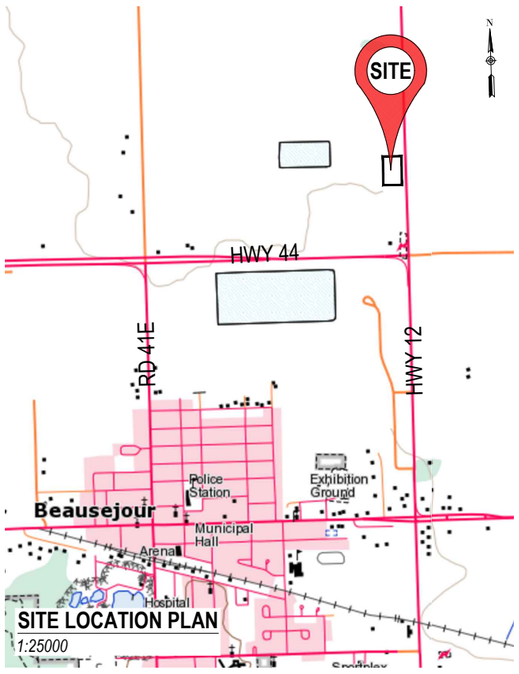
This report was prepared exclusively for Beausejour Consumers Co-op, and their agents, for specific application to the project described in the report. The data and recommendations provided herein should not be used for any other purpose, or by any other parties, without the review and written advice from Wood. Any use that a third party makes of this report, or any reliance or decisions made based on this report, are the responsibility of those parties. Wood accepts no responsibility for damages suffered by a third party as a result of decisions made or actions based on this report.

This report was prepared in accordance with generally accepted professional engineering principles and practices. No other warranty, expressed or implied, is made.

Respectfully Submitted,

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Ltd.

Figures



NOTES: SITE FEATURES AND LOCATIONS ARE APPROXIMATE ONLY. IMAGES FROM AUTODESK IMAGERY AND TOPO MAPS.

LEGEND:

TEST HOLE

REVISION	BY	DATE
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CLIENT:

BEAUSEJOUR CONSUMERS CO-OP LTD.

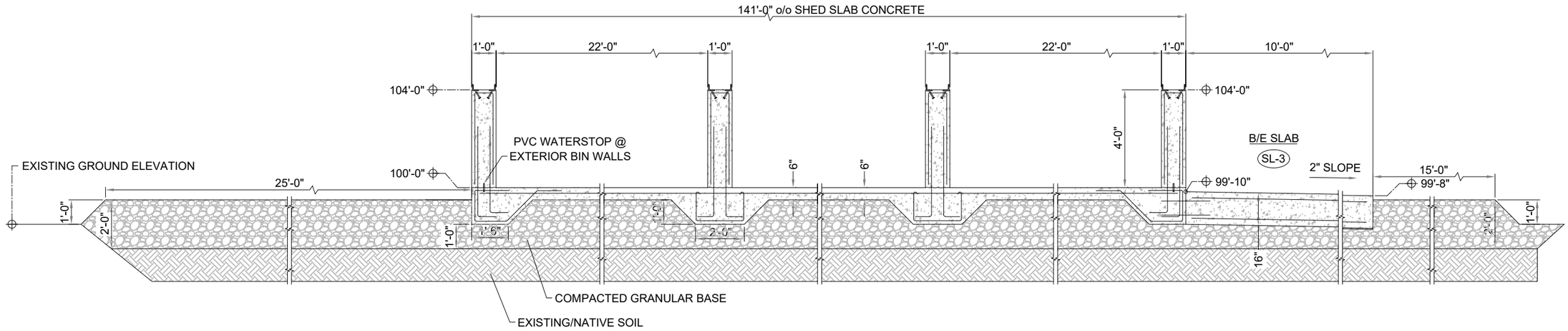
wood.
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

DWN BY:	MD
CHK'D BY:	RB
DATUM:	---
PROJECTION:	---
SCALE:	AS SHOWN

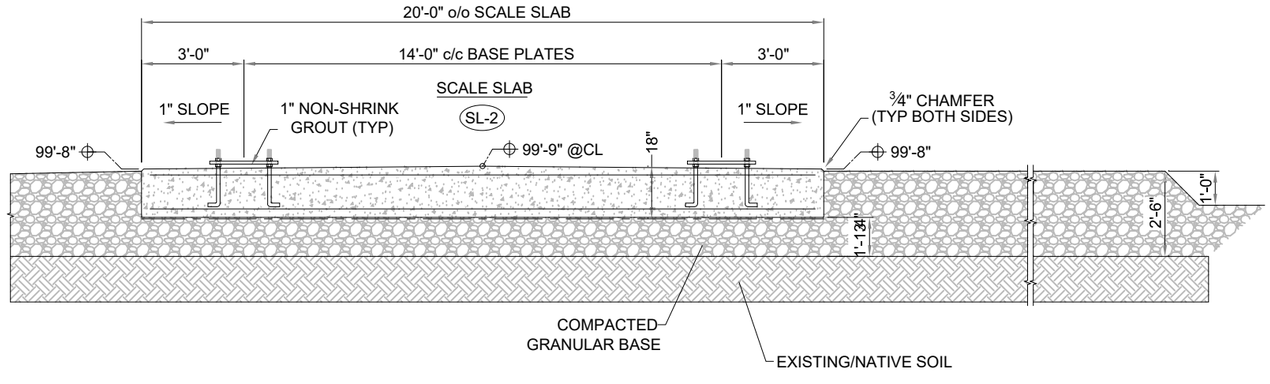
GEOTECHNICAL INVESTIGATION
BEAUSEJOUR CO-OP AGRO SITE
400 MT CAPACITY FERTILIZER SHED
BEAUSEJOUR, MANITOBA

SITE AND TEST HOLE LOCATION PLAN

DATE:	MAY 2020
PROJECT NO:	WX1907601
REV. NO.:	A
FIGURE NO:	FIGURE 1



PROPOSED GRAVEL PAD CROSS-SECTION
MARCH 12, 2020 REV: A



0 1.5 3 Meters

NOTE:
- Drawing Provided by Hi Tech Industries Ltd.

REVISION	BY	DATE
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CLIENT:
BEAUSEJOUR CONSUMERS CO-OP LTD.

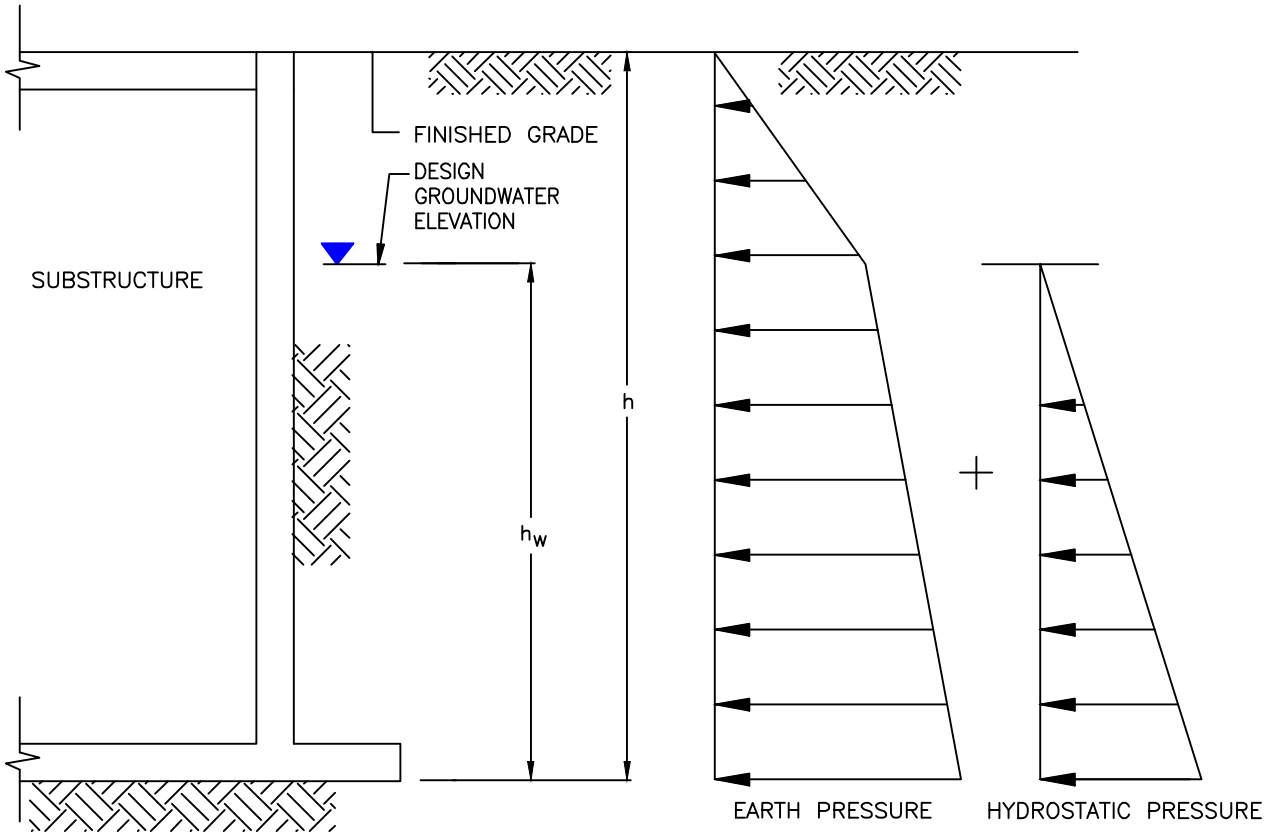
wood.
440 DOVERCOURT DRIVE
WINNIPEG, MANITOBA R3Y 1N4
PHONE: 204.488.2997 FAX:204.489.8261

DWN BY: MD
CHK'D BY: RB
DATUM: ---
PROJECTION: ---
SCALE: AS SHOWN

GEOTECHNICAL INVESTIGATION
BEAUSEJOUR CO-OP AGRO SITE
400 MT CAPACITY FERTILIZER SHED
BEAUSEJOUR, MANITOBA

PROPOSED GRAVEL PAD SECTION

DATE: MAY 2020
PROJECT NO: WX1907601
REV. NO.: A
FIGURE NO: FIGURE 2



RECOMMENDED PRESSURE DISTRIBUTION

$$P_h = K\gamma(h-h_w) + K\gamma' h_w + \gamma_w h_w$$

WHERE: P_h = LATERAL EARTH PRESSURE (kPa)

γ = UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

γ' = BUOYANT UNIT WEIGHT OF SOIL (SEE TEXT OF REPORT)

γ_w = UNIT WEIGHT OF WATER (USE γ_w=9.8 kN/m^3)

h = HEIGHT OF WALL FROM FINISHED GRADE TO BASE OF WALL (m)

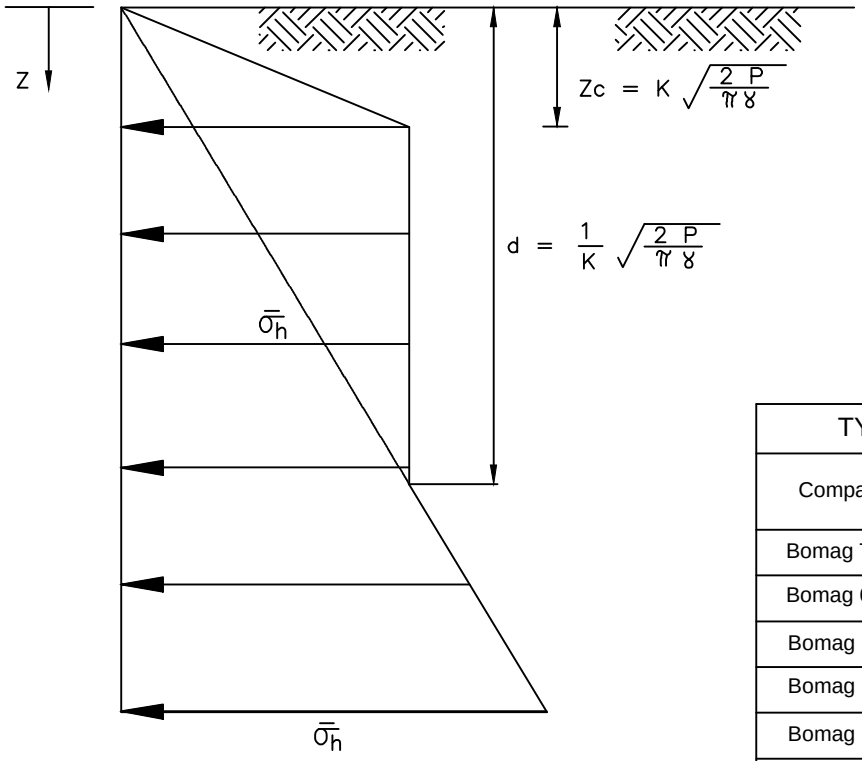
h_w = HEIGHT OF GROUNDWATER TABLE ABOVE BASE OF WALL (m)

K = LATERAL EARTH PRESSURE COEFFICIENT (K_a OR K_o – SEE REPORT TEXT)

NOTES:

1. SEE TEXT OF REPORT FOR UNIT WEIGHTS AND LATERAL EARTH PRESSURE COEFFICIENTS.
2. A HYDROSTATIC COMPONENT NEED ONLY BE INCLUDED WHERE A PERCHED GROUND WATER TABLE WERE TO OCCUR WITHIN THE LEVEL OF SUB–STRUCTURE IN COMBINATION WITH NO SUB–DRAINAGE.

BEAUSEJOUR CO-OP	DWN BY: MD CHK'D BY: RB DATUM: - PROJECTION: - SCALE: NOT TO SCALE	GEOTECHNICAL INVESTIGATION PROPOSED AGRO SITE SE-12-13-7 EPM, BEAUSEJOUR, MB	DATE: MAY 2020 PROJECT No.: WX1907601 REV. No.: A
wood.		LATERAL EARTH PRESSURE DISTRIBUTION FOR LIGHTLY COMPACTED BACKFILL	FIGURE No.: FIGURE 3



EARTH PRESSURE DISTRIBUTION

FOR $Zc \leq Z \leq d$

$$\bar{\sigma}_h = \sqrt{\frac{2P\gamma}{\pi}}$$

FOR $Z > d$

$$\bar{\sigma}_h = K \cdot \gamma \cdot Z$$

TYPICAL COMPACTOR LOADS (P)			
Compactor	LOAD (P) kN/m	Compactor	LOAD (P) kN/m
Bomag TSE	31	Bomag BW122PD	36
Bomag 60S	32	Bomag 142PDB	47
Bomag 65S	22	Bomag 172PDB	93
Bomag 75S	33	Dynapac LR100	42
Bomag 90S	39	Dynapac 2100V	93
Bomag 75AD	20	Dynapac CA121D	53
Bomag 100AD	20	Dynapac CA121PD	54
Bomag 120AD	34	Dynapac CA151	80
Bomag 130AD	36	Dynapac CA151D	80
Bomag BW122D	30	Dynapac CA151PD	96

P (ROLLER LOAD) = $\frac{\text{DEAD WT. OF ROLLER + CENTRIFUGAL FORCE}}{\text{WIDTH OF ROLLER}}$

TYPICAL VALUES GIVEN IN TABLE

EARTH PRESSURE COEFFICIENTS

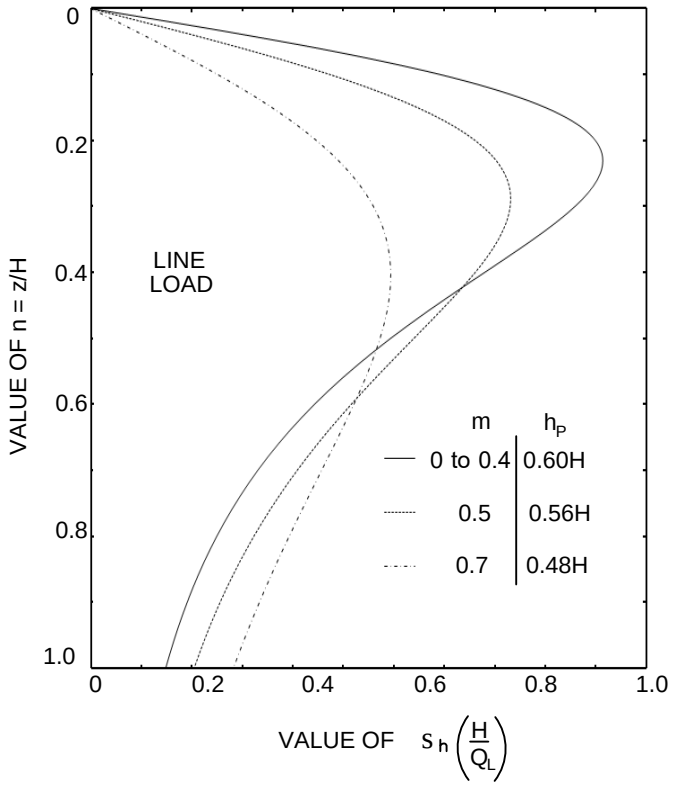
$\bar{\sigma}_h$ = HORIZONTAL EARTH PRESSURE AT DEPTH Z

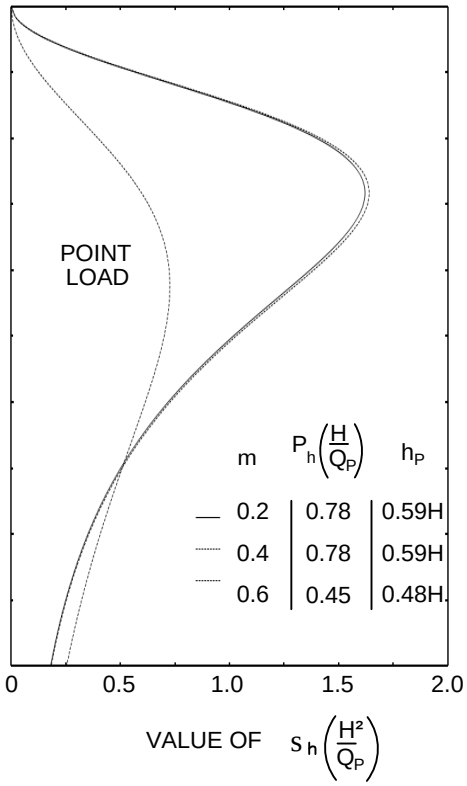
K = K_o ("AT REST") OR K_a (ACTIVE CASE)
(SEE TEXT OF REPORT)

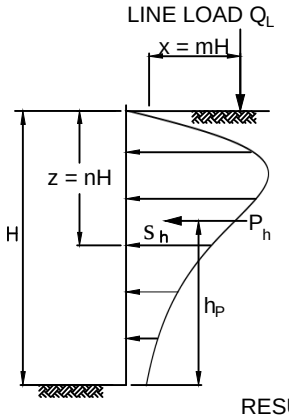
γ = SOIL UNIT WEIGHT
(SEE TEXT OF REPORT)

REFERENCE: INGOLD (1980), INTERNATIONAL CONFERENCE ON COMPACTION

BEAUSEJOUR CO-OP	DWN BY: MD	GEOTECHNICAL INVESTIGATION PROPOSED AGRO SITE SE-12-13-7 EPM, BEAUSEJOUR, MB	DATE: MAY 2020
	CHK'D BY: RB		PROJECT No.: WX1907601
wood.	DATUM: -		REV. No.: A
	PROJECTION: -	LATERAL EARTH PRESSURES INDUCED BY COMPACTION	FIGURE No.: FIGURE 4
	SCALE: NOT TO SCALE		







FOR $m \leq 0.4$:

$$s_h\left(\frac{H}{Q_L}\right) = \frac{0.20n}{(0.16 + n^2)^2}$$

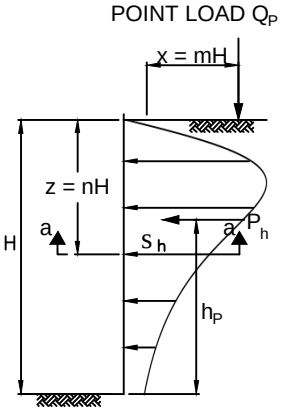
$$P_h = 0.55\ Q_L$$

FOR $m > 0.4$:

$$s_h\left(\frac{H}{Q_L}\right) = \frac{1.28m^2n}{(m^2 + n^2)^2}$$

RESULTANT $P_h = \frac{0.64\ Q_L}{(m^2 + 1)}$

PRESSURES FROM LINE LOAD
(BOUSSINESQ EQUATION MODIFIED BY EXPERIMENT)



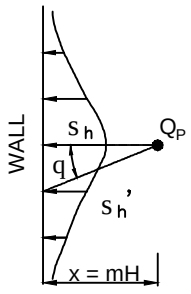
FOR $m \leq 0.4$:

$$s_h\left(\frac{H^2}{Q_P}\right) = \frac{0.28n^2}{(0.16 + n^2)^3}$$

FOR $m > 0.4$:

$$s_h\left(\frac{H^2}{Q_P}\right) = \frac{1.77m^2n^2}{(m^2 + n^2)^3}$$

$$s_h' = s_h \cos^2(1.1q)$$



SECTION a-a
PRESSURES FROM POINT LOAD
(BOUSSINESQ EQUATION
MODIFIED BY EXPERIMENT)

BEAUSEJOUR CO-OP	DWN BY: MD	GEOTECHNICAL INVESTIGATION PROPOSED AGRO SITE SE-12-13-7 EPM, BEAUSEJOUR, MB	DATE: MAY 2020
	CHK'D BY: RB		PROJECT No.: WX1907601
	DATUM: -		REV. No.: A
wood.	PROJECTION: -	LATERAL PRESSURES DUE TO SURCHARGE POINT AND LINE LOADS	FIGURE No.: FIGURE 5
	SCALE: NOT TO SCALE		

Appendix A

Test Hole Logs

Explanation of Terms & Symbols

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-01**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Office Building	DRILL METHOD: 125mm SSA	ELEVATION: 239.55 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, blocky, trace rootlets		1			239
			CLAY - silty, high plastic, moist, stiff to very stiff, brown, frequent silt till inclusions - from 0.5 to 1.1m, and silt, medium to high plastic		2			
1		CH			3			238
			- below 1.6m, stiff		4			
2					5			237
			SILT (TILL) - some sand, trace gravel, very moist to wet, compact (inferred), light brown - below 2.7m, very dense (inferred)		6			
3		ML	- below 3.0m, gravelly, damp to moist, very dense		7	50/40	SPT@3.0m: 40mm penetration for 50 blows Auger refusal at 3.1m, moved test hole 1m west	236
4			AUGER REFUSAL AT 4.3m BELOW EXISTING GROUND SURFACE.		9			235
			NOTES: - Sloughing and seepage encountered in till at 2.6 to 3.0m below grade during drilling. - Test hole remained open to 3.7m and water level was measured at 2.7m below grade on completion of drilling. - Test hole backfilled wint bentonite and auger cuttings.					234
5								233
6								232
7								231
8								
9								

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 4.3 m
REVIEWED BY: BW	COMPLETION DATE: 5 May 2020
Figure No. A1	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-02**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Fertilizer Shed	DRILL METHOD: 125mm SSA	ELEVATION: 239.45 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Drill Cuttings | Grout | Slough | Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, stiff (inferred), dark brown, trace rootlets		1			239
1		CH	CLAY - silty, high plastic, moist, stiff, brown, frequent silt till inclusions, frequent sulphate inclusions		2			238
2					3			
					4		Unconfined Compressive Test - Sample 4 @ 1.5m: Max Stress = 72.9 kPa Bulk Density = 1861 kg/m³ Dry Density = 1349 kg/m³	237
		SM	SAND - and silt to silty, poorly graded, find grained, very moist to wet, loose to compact (inferred), light brown		5			
3			SILT (TILL) - some sand, trace gravel, very moist, compact (inferred), light brown		6			
					7	7-8-50 /140	- hard drilling below 3.4m	236
4		ML	- below 3.4m, moist, very dense					
					8			235
5								234
					9			
6			AUGER REFUSAL AT 5.8m BELOW EXISTING GROUND SURFACE. NOTES: - Seepage and sloughing encountered in sand from 2.1 to 3.4m below grade during drilling. - Test hole remained open to 5.5m with trace water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					233
7								
								232
8								
								231
9								

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LOGGED BY: RB	COMPLETION DEPTH: 5.8 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A2	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-03**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Fertilizer Shed	DRILL METHOD: 125mm SSA	ELEVATION: 239.35 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Drill Cuttings | Grout | Slough | Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, trace rootlets		1			239
			CLAY - silty, high plastic, moist, hard, brown, occasional silt and sulphate inclusions					
			- below 0.6m, very stiff		2			
1		CH	- from 1.2 to 2.3m, abundant silt laminations		3			238
			- below 1.5m, frequent to abundant silt inclusions					
			- below 1.7m, stiff		4			
2					5			237
			SILT (TILL) - trace clay, some sand to sandy, moist to very moist, compact (inferred), light grey					
3					6			
			- below 3.0m, moist, compact		7	21		236
		ML						
4			- below 4.0m, damp to moist, dense to very dense					
					8			235
			- below 4.6m, very dense		9	50 /75	SPT@4.6m: 75mm penetration for 50 blows - hard drilling below 4.6m	
5			AUGER REFUSAL AT 4.6m BELOW EXISTING GROUND SURFACE.					234
			NOTES: - Seepage and sloughing encountered in till from 2.6 to 3.0m below grade during drilling. - Test hole remained open to 4.6m with trace water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					
6								233
7								
								232
8								
								231
9								

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LOGGED BY: RB	COMPLETION DEPTH: 4.6 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A3	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-04**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Bulk Seed Bins	DRILL METHOD: 125mm SSA	ELEVATION: 239.38 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		GP	GRAVEL (FILL) - 150mm thick, some sand, poorly graded, fine grained, moist, compact (inferred), brown		1			239
			CLAY - silty, high plastic, moist, very stiff, brown, occasional silt till inclusions					
1			- below 0.6m, stiff		2			
		CH			3			238
2					4		Unconfined Compressive Test - Sample 4 @ 1.5m: Max Stress = 77.1 kPa Bulk Density = 1797 kg/m^3 Dry Density = 1245 kg/m^3	
					5			237
			SILT (TILL) - some sand, some gravel, trace clay, low plastic, very moist, loose (inferred), grey					
3					6			
			- below 3.0m, moist, compact		7	26	Sample #7 @ 3.0m: rock in tip of SPT spoon	236
4		ML	- below 4.0m, damp, dense to very dense (inferred)				- hard drilling below 4.0m	
					8			235
			- below 4.6m, very dense		9	50/50	SPT @ 4.6m: 50mm penetration for 50 blows - very hard drilling below 4.6m	
5					10			234
			AUGER REFUSAL AT 5.5m BELOW EXISTING GROUND SURFACE.					
6			NOTES: - Sloughing and seepage encountered in till from 2.4 to 3.0m below grade during drilling. - Test hole remained open to 5.5m and water level was 4.6m below grade on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					233
7								232
8								
								231
9								

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LOGGED BY: RB	COMPLETION DEPTH: 5.5 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A4	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-05**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Bulk Seed Bins	DRILL METHOD: 125mm SSA	ELEVATION: 239.49 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		GP	GRAVEL (FILL) - 365mm thick, and sand, trace silt, poorly graded, fine grained, moist, compact (inferred), light brown		1			239
1		CI-CH	CLAY - and silt to silty, medium to high plastic, moist, stiff, brown, occasional silt till stringers		2 3	15		238
2					4 5 6			237
3		ML	SILT (TILL) - some sand to sandy, some gravel, trace clay, low plastic, moist, compact (inferred), light brown - from 2.7 to 2.9m, very moist - below 3.0m, moist, compact		7 8	26		236
4			- below 4.0m, damp to moist, dense (inferred) - below 4.1m, damp, very dense (inferred)				- very hard drilling below 4.1m	235
5			- below 4.6m, very dense AUGER REFUSAL AT 5.0m BELOW EXISTING GROUND SURFACE. NOTES: - Sloughing encountered below 4.0m from grade during drilling. - Seepage encountered from 2.7 to 2.9m below grade during drilling. - Test hole remained open to 4.0m and water level was measured at 3.4m from grade on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.		9		- sloughed to 4.0m on 4.6m trip, Dynamic Cone Penetrometer Test used below 4.6m DCPT @ 4.6 to 4.9m: 48 blows DCPT @ 4.9 to 5.0m: 50 blows for 100mm penetration	234
6								233
7								232
8								231
9								

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 5 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A5	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-06**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.34 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, trace rootlets		1			239
			CLAY - silty, high plastic, moist, very stiff, brown, occasional silt inclusions		2			
1		CH	- below 1.12m, stiff		3			238
2					4			237
		ML	SILT (TILL) - trace to some sand, trace gravel, trace clay, low plastic, moist to very moist, compact (inferred), light grey		5			
3			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE.					236
			NOTES: - No sloughing or seepage encountered during drilling. - Test hole remained open to 3.0m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					
4								235
5								234
6								233
7								232
8								231
9								

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A6	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-07**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.43 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, firm to stiff (inferred), dark brown, blocky, trace rootlets		1			239
1		CH	CLAY - silty, high plastic, moist, firm to stiff, brown, occasional silt stringers - from 0.9 to 1.5m, and silt, medium to high plastic, firm		2 3 4			238 237
2								
3		ML-CI	SILT (TILL) - some clay, trace to some sand, low to medium plastic, moist to very moist, compact (inferred), grey		5			236
4			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE. NOTES: - Sloughing occurred below 2.9m from grade during drilling. - No seepage encountered during drilling. - Test hole remained open to 2.9m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					235
5								234
6								233
7								232
8								231
9								

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 5 May 2020
Figure No. A7	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-08**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.5 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		SP	SAND (FILL) - 305mm thick, poorly graded. fine to medium grained, moist, compact (inferred), brown		1			239
			CLAY - silty, high plastic, moist, hard, brown, occasional to frequent silt inclusions, occasional sulphate inclusions		2			
1								
		CH	- below 1.1m, stiff		3			238
2					4			
								237
3		ML	SILT (TILL) - and sand, trace gravel, trace clay, low plastic, moist to very moist, compact (inferred), brown		5			
			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE.					236
4			NOTES: - No sloughing or seepage encountered during drilling. - Test hole remained open to 3.0m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					235
5								234
6								233
7								232
8								231
9								

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A8	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-09**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.66 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Drill Cuttings | Grout | Slough | Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		GP	GRAVEL (FILL) - 455mm thick, sandy, trace to some silt, poorly graded, fine grained, moist, compact (inferred), light brown		1			
			CLAY - silty, high plastic, moist, very stiff, brown, occasional silt till inclusions		2			239
1								
					3			
		CH						238
2			- below 2.1m, stiff		4			
								237
3		ML-CI	SILT (TILL) - clayey, some sand, trace gravel, low to medium plastic, moist to very moist, compact (inferred), grey		5			
			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE.					
			NOTES: - Caving occurred from gravel at 0 to 0.5m below grade during drilling - No seepage encountered during drilling. - Test hole remained open to 2.7m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					236
4								
								235
5								
								234
6								
								233
7								
								232
8								
								231
9								

wood.

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 5 May 2020
Figure No. A9	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-10**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.42 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Drill Cuttings | Grout | Slough | Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, blocky		1			239
		CH	CLAY - silty, high plastic, moist, stiff, brown, occasional silt till inclusions - from 0.5 to 1.1m, and silt, medium plastic, firm		2			
1		CI-CH	- below 1.1m, and silt to silty, medium to high plastic, damp to moist, stiff, frequent silt and sulphate inclusions		3			238
2		CH			4			237
3		ML-CI	SILT (TILL) - some clay, some sand, trace gravel, low to medium plastic, moist to very moist, compact (inferred), grey		5			236
			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE. NOTES: - No sloughing or seepage encountered during drilling. - Test hole remained open to 3.0m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					235
4								234
5								233
6								232
7								231
8								
9								

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A10	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-11**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Truck Lanes	DRILL METHOD: 125mm SSA	ELEVATION: 239.34 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, blocky, trace rootlets		1			239
			CLAY - silty, high plastic, moist, stiff, brown, occasional silt till inclusions, occasional sulphate inclusions		2			
1		CH			3			238
2					4			237
		ML-CI	SILT (TILL) - sandy, some gravel, low to non plastic, very moist, compact (inferred), light brown		5			
3			TEST HOLE TERMINATED AT 3.0m BELOW EXISTING GROUND SURFACE.					236
			NOTES: - No sloughing or seepage encountered during drilling. - Test hole remained open to 3.0m with no water accumulation on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					
4								235
5								234
6								233
7								232
8								231
9								

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LOGGED BY: RB	COMPLETION DEPTH: 3 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A11	Sheet 1 of 1

PROJECT: Beausejour Co-op Agro Site	DRILLER: Maple Leaf Drilling Ltd.	TEST HOLE ID: **TH20-12**
CLIENT: Beausejour Consumer Co-operatives Ltd.	DRILL RIG: Track Mounted Acker MP5	PROJECT No: WX1907601
LOCATION: Fertilizer Shed	DRILL METHOD: 125mm SSA	ELEVATION: 239.38 m

SAMPLE TYPE: Shelby Tube; No Recovery; SPT (N); Grab Sample; Split-Pen; Core

BACKFILL TYPE: Bentonite; Pea Gravel; Drill Cuttings; Grout; Slough; Sand

▲ UNCONFINED COMPRESSION (kPa) ▲ 100 200 300 400

☒ POCKET PENETROMETER (kPa) ☒ 100 200 300 400

PLASTIC M.C. LIQUID 20 40 60 80

DEPTH (m)	SOIL SYMBOL	MUSCS	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	COMMENTS	ELEVATION (m)
0		OH	ORGANIC CLAY - silty, high plastic, moist, very stiff (inferred), dark brown, trace rootlets		1			239
			CLAY - silty, high plastic, moist, very stiff, brown, frequent silt till inclusions, frequent sulphate inclusions		2			
1		CH	- below 1.4m, stiff		3			238
2					4			237
3		ML	SILT (TILL) - trace to some sand, trave gravel, trace clay, low plastic, very moist, compact (inferred), light brown		5			
			- below 3.0m, moist, compact					
			- below 3.2m, damp, very dense		6	14-50 /90	- hard drilling from 3.2 to 4.6m	236
			- below 3.7m, trace sand, no clay, low to non plastic					
4		GM	GRAVEL - and silt, poorly graded, fine to medium grained, wet, compact to dense (inferred), light brown					
		ML	SILT (TILL) - trace sand, trave gravel, low to non plastic, very moist, very dense (inferred), light brown		7			235
			SILT - low to non plastic, damp to moist, compact, light grey		8	26		
5		ML						234
6			- below 6.1m, dense		9			
					10	35-28-50 /90	- hard drilling below 6.1m	233
			SILT (TILL) - some gravel, trace to some sand, low to non plastic, damp, very dense, light grey					
7		ML			11			
			AUGER REFUSAL AT 7.3m BELOW EXISTING GROUND SURFACE.					232
8			NOTES: - Caving encountered from gravel at 4.0 to 4.3m below grade during drilling. - Seepage occurred from 2.7 to 3.0m below grade during drilling. - Test hole remained open to 7.1m and water level was measured at 5.8m below grade on completion of drilling. - Test hole backfilled with bentonite and auger cuttings.					231
9								

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LOGGED BY: RB	COMPLETION DEPTH: 7.3 m
REVIEWED BY: BW	COMPLETION DATE: 4 May 2020
Figure No. A12	Sheet 1 of 1

WX1907601 BEAUSEJOUR COOP AGRO.GPJ 20/06/19 02:02 PM (WPG - GEOTECH LOG 1)

EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these pages.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation test	*ST	Swelling test
D_R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis	w	Natural Moisture Content (ASTM D2216)
	and hydrometer test	w_l	Liquid limit (ASTM D 423)
N	Standard Penetration Test (CSA A119.1-60)	w_p	Plastic Limit (ASTM D 424)
N_d	Dynamic cone penetration test	E_f	Unit strain at failure
NP	Non plastic soil	γ	Unit weight of soil or rock
pp	Pocket penetrometer strength	γ_d	Dry unit weight of soil or rock
*q	Triaxial compression test	ρ	Density of soil or rock
q_u	Unconfined compressive strength	ρ_d	Dry Density of soil or rock
*SB	Shearbox test	C_u	Undrained shear strength
SO_4	Concentration of water-soluble sulphate	→	Seepage
		▼	Observed water level

* The results of these tests are usually reported separately

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the Unified Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual[2].

Relative Density and Consistency:

Cohesionless Soils

Relative Density	SPT (N) Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Cohesive Soils

Consistency	Undrained Shear Strength c_u (kPa)	Approximate SPT (N) Value
Very Soft	0-12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Standard Penetration Resistance ("N" value)
The number of blows by a 63.6kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" drill rods for a distance of 300 mm after an initial penetration of 150 mm.

[1] "Unified Soil Classification System", Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army. Vol. 1 March 1953.

[2] "Canadian Foundation Engineering Manual", 3rd Edition, Canadian Geotechnical Society, 1992.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISIONS			SYMBOLS: USCS	SYMBOLS: GRAPH	SYMBOLS: COLOUR	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75um)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >4; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u=D_{60}/D_{10}$ >6; $C_c=(D_{30})^2/(D_{10}xD_{60})$ = 1 to 3
			SP		RED	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR PI LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND PI MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75um)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L > 50%	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SAND OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L > 50%	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	W_L < 50%	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L > 50%	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGHLY ORGANIC SOILS			PT		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SPECIAL SYMBOLS

LIMESTONE		OILSAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

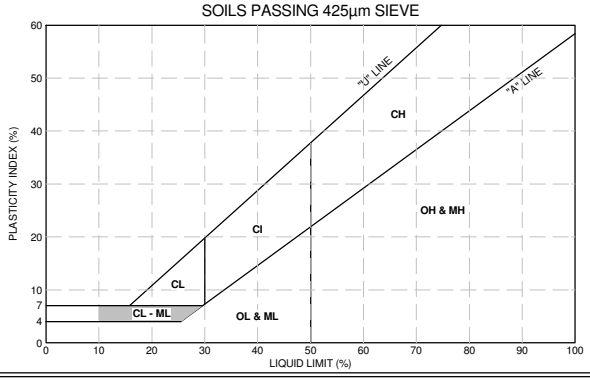
SOIL COMPONENTS

FRACTION	U.S. STANDARD METRIC SIEVE SIZE		DEFINING RANGES OF PERCENT BY WEIGHT OF MINOR COMPONENTS	
GRAVEL	PASSING	RETAINED	PERCENT	DESCRIPTOR
COARSE	76mm	19mm		
FINE	19mm	4.75mm	35 - 50	AND
SAND				
COARSE	4.75mm	2.00mm	30 - 35	Y / EY
MEDIUM	2.00mm	425µm	10 - 20	SOME
FINE	425µm	75µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)	75µm		1 - 10	TRACE

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED:	NOT ROUNDED:
COBBLES 76mm to 200mm BOULDERS > 200mm	ROCK FRAGMENTS ? 76mm ROCKS > 0.76 CUBIC METRE IN VOLUME

PLASTICITY CHART FOR SOILS PASSING 425µm SIEVE



NOTES:

1. ALL SIEVE SIZES MENTIONED ARE U.S. STANDARD ASTM E.11.
2. COARSE GRAINED SOILS WITH TRACE TO SOME FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH TRACE TO SOME CLAY.
3. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

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Appendix B

Granular Fill Gradation and Durability Specifications

Table B-1: Requirements for Granular Base Course

Gradation		Aggregate Quality Requirements
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should have a minimum California Bearing Ratio (CBR) of 60 percent. The material passing the 0.425 mm sieve size should have a liquid limit of less than 25 and a plasticity index less than 6. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 35%. The aggregate should consist of sound, durable particles of crushed rock, stone, gravel, sand and fine soil. It should not contain thin elongated particles, sods, topsoil, roots or plants. At least 35% of the material retained on the 4.75 mm sieve should consist of crushed particles, which are not shale or ironstone. A maximum of 12% of the material retained by weight on the 4.75 mm sieve may consist of shale and/or ironstone.
19 mm	100%	
16 mm	80 – 100%	
4.75 mm	40 – 70%	
2 mm	25 – 55%	
0.425 mm	15 – 30%	
0.075 mm	8 – 15%	

Table B-2: Requirements for Crushed Stone Base Course

Gradation		**Aggregate Quality Requirements**
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should be crushed and have a minimum California Bearing Ratio (CBR) of 60 percent. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 35%. The aggregate should consist of sound, durable crushed stone. It should not contain thin elongated particles, sods, topsoil, roots or plants. 100% of the material retained on the 4.75 mm sieve should consist of crushed stone.
19 mm	100%	
4.75 mm	35 – 70%	
0.425 mm	15 – 30%	
0.075 mm	6 – 17%	

Table B-3: Requirements for Granular Sub-Base

Gradation		Aggregate Quality Requirements
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should have a minimum California Bearing Ratio (CBR) of 30 percent. The material passing the 0.425 mm sieve size should have a liquid limit of less than 25 and a plasticity index less than 6. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 40%. The aggregate should consist of sound, durable particles of crushed rock, stone, gravel, sand and fine soil. It should not contain thin elongated particles, sods, topsoil, roots or plants. At least 15% of the material retained on the 4.75 mm sieve should consist of crushed particles, which are not shale or ironstone. A maximum of 20% of the material retained by weight on the 4.75 mm sieve may consist of shale and/or ironstone.
38 mm	100%	
25 mm	85 – 100%	
4.75 mm	25 – 80%	
0.425 mm	15 – 40%	
0.075 mm	8 – 18%	

Table B-4: Requirements for Crushed Stone Sub-Base Course

Gradation		Aggregate Quality Requirements
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should be crushed and have a minimum California Bearing Ratio (CBR) of 60 percent. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 40%. The aggregate should consist of sound, durable crushed stone. It should not contain thin elongated particles, sods, topsoil, roots or plants. 100% of the material retained on the 4.75 mm sieve should consist of crushed stone.
50 mm	100%	
4.75 mm	25 - 80%	
0.075 mm	5 - 18%	

Table B-5: Requirements for 100 mm Crushed Rock Bridging Material

Gradation		Aggregate Quality Requirements
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should be crushed and have a minimum California Bearing Ratio (CBR) of 60 percent. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 40%. The aggregate should consist of sound, durable crushed stone. It should not contain thin elongated particles, sods, topsoil, roots or plants. 100% of the material retained on the 4.75 mm sieve should consist of crushed stone.
100 mm	97 - 100%	
25 mm	30 - 50%	
0.080 mm	8% max.	

Table B-6: Requirements for 150 mm Crushed Rock Bridging Material

Gradation		Aggregate Quality Requirements
Sieve Size	**Percent Passing (by dry mass)**	The aggregate should be crushed and have a minimum California Bearing Ratio (CBR) of 60 percent. The coarse fraction of the aggregate should have a maximum Los Angeles abrasion loss of 40%. The aggregate should consist of sound, durable crushed stone. It should not contain thin elongated particles, sods, topsoil, roots or plants. 100% of the material retained on the 4.75 mm sieve should consist of crushed stone.
200 mm	100%	
150 mm	90 - 100%	
100 mm	65 - 85%	
25 mm	0 - 4%	