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**Proposal for an Environment Act Licence to Construct a New Domestic
Wastewater Lagoon for Westview Colony at S¹/₂ NW 22-14-21W in the
Rural Municipality of Oakview**

**Submitted to:
Director
Environment Approvals Branch
Manitoba Sustainable Development
Suite 160, 123 Main Street
R3C 1A5**

**Proponent:
Westview Colony
Represented by
South-Man Engineering
15-1599 Dugald Rd.
Winnipeg, MB
R2J 0H3**



April 15, 2018



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Table of Contents

| | | |
|-----------|---|-----------|
| 1 | EXECUTIVE SUMMARY | 4 |
| 2 | INTRODUCTION | 5 |
| 3 | LAND OWNERSHIP AND MUNICIPAL LAND-USE DESIGNATION | 5 |
| 4 | SITE CONDITIONS | 6 |
| 4.1 | LOCATION | 6 |
| 4.2 | GROUNDWATER AND SURFACE WATER RESOURCES | 8 |
| 4.3 | SOIL CONDITIONS | 9 |
| 5 | DESIGN CRITERIA FOR THE PROPOSED WASTEWATER LAGOON | 9 |
| 5.1 | HYDRAULIC LOADING | 10 |
| 5.1.1 | <i>Domestic.....</i> | <i>10</i> |
| 5.1.2 | <i>Slaughter house.....</i> | <i>10</i> |
| 5.1.3 | <i>Truck Wash Bay.....</i> | <i>11</i> |
| 5.1.4 | <i>Total Hydraulic Loading.....</i> | <i>11</i> |
| 5.2 | ORGANIC LOADING | 11 |
| 5.2.1 | <i>Domestic.....</i> | <i>11</i> |
| 5.2.2 | <i>Slaughter house.....</i> | <i>12</i> |
| 5.2.3 | <i>Truck Wash Bay.....</i> | <i>12</i> |
| 5.2.4 | <i>Total Organic Loading</i> | <i>12</i> |
| 5.3 | GENERAL DESIGN PARAMETERS | 13 |
| 6 | DESIGN CAPACITY | 14 |
| 6.1 | PRIMARY CELL..... | 14 |
| 6.2 | SECONDARY CELL..... | 14 |
| 7 | EFFLUENT DISCHARGE..... | 15 |
| 7.1 | METHOD OF DISCHARGE..... | 15 |
| 7.2 | DISCHARGE PROCEDURE | 17 |
| 8 | ENVIRONMENTAL IMPACT | 18 |
| 8.1 | ODOR PRODUCTION..... | 18 |
| 8.2 | IMPACT OF DISCHARGE TO WATERWAYS | 18 |
| 8.3 | IMPACT ON GROUNDWATER..... | 22 |
| 8.4 | IMPACTS ON WILDLIFE, FORESTRY AND HERITAGE RESOURCES | 22 |
| 8.5 | GASOLINE AND ASSOCIATED PRODUCT STORAGE | 22 |
| 8.6 | SOCIO-ECONOMIC IMPLICATION..... | 22 |
| 9 | MAINTENANCE AND INSPECTION | 23 |
| 9.1 | GENERAL MAINTENANCE | 23 |
| 9.2 | MONITORING REQUIREMENTS..... | 23 |
| 10 | CONSTRUCTION SCHEDULE | 23 |

| | | |
|-----------|--|-----------|
| 11 | FUNDING..... | 23 |
| 12 | REFERENCES | 24 |
| 13 | APPENDIX A – CERTIFICATE OF TITLE | 25 |
| 14 | APPENDIX B – LOCATION OF THE PROPOSED DEVELOPMENT | 28 |
| 15 | APPENDIX C – GEO-TECHNICAL INFORMATION | 30 |
| 16 | APPENDIX D – CORRESPONDENCES | 51 |
| 17 | APPENDIX E – DESIGN DRAWINGS..... | 60 |

1 Executive Summary

Westview Colony is the proposed daughter colony of Delta Colony situated near Austin, MB. As customary for Hutterite Brethren Colonies, Delta Colony has currently grown to a size and population which warrants the establishment of a new daughter colony, Westview Colony. It is anticipated that over time that this colony will grow to approximately 150 people, at which point the Colony will again undertake plans to establish another separate daughter colony. The proposed wastewater treatment lagoon is expected to service the domestic wastewater needs of this colony in addition to the operation of a seasonal livestock meat slaughter and packing facility, which will also contribute to the wastewater treatment volume and organic load.

As typical for Colonies, Westview Colony owns vast stretches of land and holds agricultural land adjacent to the existing facility, where construction of a new wastewater treatment lagoon is logical. A geotechnical investigation revealed that the soil at the location of the proposed development is suited for the construction of a wastewater treatment lagoon utilizing a recompacted clay liner constructed using the in-situ clay.

Owing to its location, the proposed site is ideal to mitigate any nuisance concerns to neighbours. No impacts to wildlife or fish are anticipated as a result of the proposed development. The new wastewater treatment lagoon will provide the opportunity for Westview Colony to fulfill their obligations with respect to environmental performance and protection.

Following issuance of an Environment Act Licence for construction and operation of the proposed wastewater treatment facility, Westview Colony will take steps to ensure that a certified operator will be available to operate the new wastewater treatment facility.

The treated wastewater from the secondary cell will be discharged into a roadside ditch to the west of the development site (123W) prior to entering into a first order drain approximately 1.13 km south of the development site which eventually meets Broughton's Creek approximately 17 km further south of the development site. It is our understanding that the implementation of the proposed wastewater treatment lagoon will be considered a Class 2 Development under Manitoba's *Environment Act*.

2 Introduction

A review of Manitoba Conservation records on existing Environment Act Licences suggests that there are presently no licensed domestic wastewater treatment facilities nor previous applications pertaining to the development of a wastewater treatment facility at the proposed location situated at NW 22-14-21W. Under *The Environment Act, Classes of Development Regulation MR164/88*, all wastewater facilities fall under Class 2 developments, and can only be erected in compliance with the environment act licensing process as prescribed by the *Licensing Procedures Regulation MR163/88*, and be operated under the licence requirements defined by Manitoba Conservation. Westview Colony, through their association with Delta Colony are aware of the wastewater treatment process, and have facilitated the preparation and submission of a proposal under the aforementioned legislation in order to fulfill the regulatory requirements and ensure protection of the environment.

Traditionally, Hutterite Colonies range in size from 120 to 150 persons before an additional colony is developed. Therefore, it is proposed that the wastewater facility will be sized to accommodate up to 150 persons in the future. The Colony also proposes to operate, on a seasonal basis, a small livestock slaughterhouse and packing facility providing for the Colony's own meat and poultry consumption. Liquid waste from this facility will be routed to the proposed wastewater treatment facility, while segregated and screened solids from the slaughterhouse are treated separately by composting.

South-Man Engineering has been retained to provide the design services for the proposed wastewater treatment lagoon. The following information has been compiled to address the information requested by the *Licensing Procedures Regulation MR163/88*.

3 Land Ownership and Municipal Land-Use Designation

Westview Colony owns the proposed site. A copy of the Certificate of Title for the land is included in Appendix A. The proposed wastewater stabilization pond is situated on NW 22-14-21W while the residential infrastructure will be situated on SW 22-14-21W in the Rural Municipality of Oakview (Figure 1).

The land where the proposed development is to take place, and the immediate surrounding land, are currently used for agricultural production within the Rural Policy Area of the RM of Oakview and is used primarily for the production of cereals, oilseeds, forages and pasture. The RM of Oakview Zoning Bylaws consider wastewater lagoons as Conditional Uses. The

development plan states that Rural Policy Areas should be preserved for a full range of agricultural activities on prime agricultural land where there are no significant limitations on the ability of the land base to sustain such operations, or where there are no restrictions of the development of high quality aggregate resources. The development plan further states that to support the ongoing viability of agricultural operations all lands in the Rural Policy Area should be maintained in large parcel sizes.

There have been no previous studies or activities relating to this potential site development. As the surrounding property is primarily agricultural land, there is little expectation that any significant residential development will occur in the area.

4 Site Conditions

4.1 Location

The wastewater treatment lagoon is located within the Little Saskatchewan River Watershed, approximately 1.76 km from the nearest neighboring rural residence south east of the proposed development site. The nearest urban residential development is Cardale located approximately 4.83 km northwest of the proposed project site, Figure 1. Information obtained from satellite images of the site indicates that there are approximately 8 rural residences within a 3 km radius of the site and no wastewater treatment lagoons within this radius. However, there is one manure storage lagoon, owned by the same colony, located approximately 760 m southwest of the proposed development site.

Access to the proposed development site is attainable via PR 355 which runs approximately 3.70 km north of the development site and intersects municipal road 123W, one of the border lines of the property. The site is also accessible from PTH 250 via municipal road 80N which intersects with municipal road 123W 2 miles to the west.

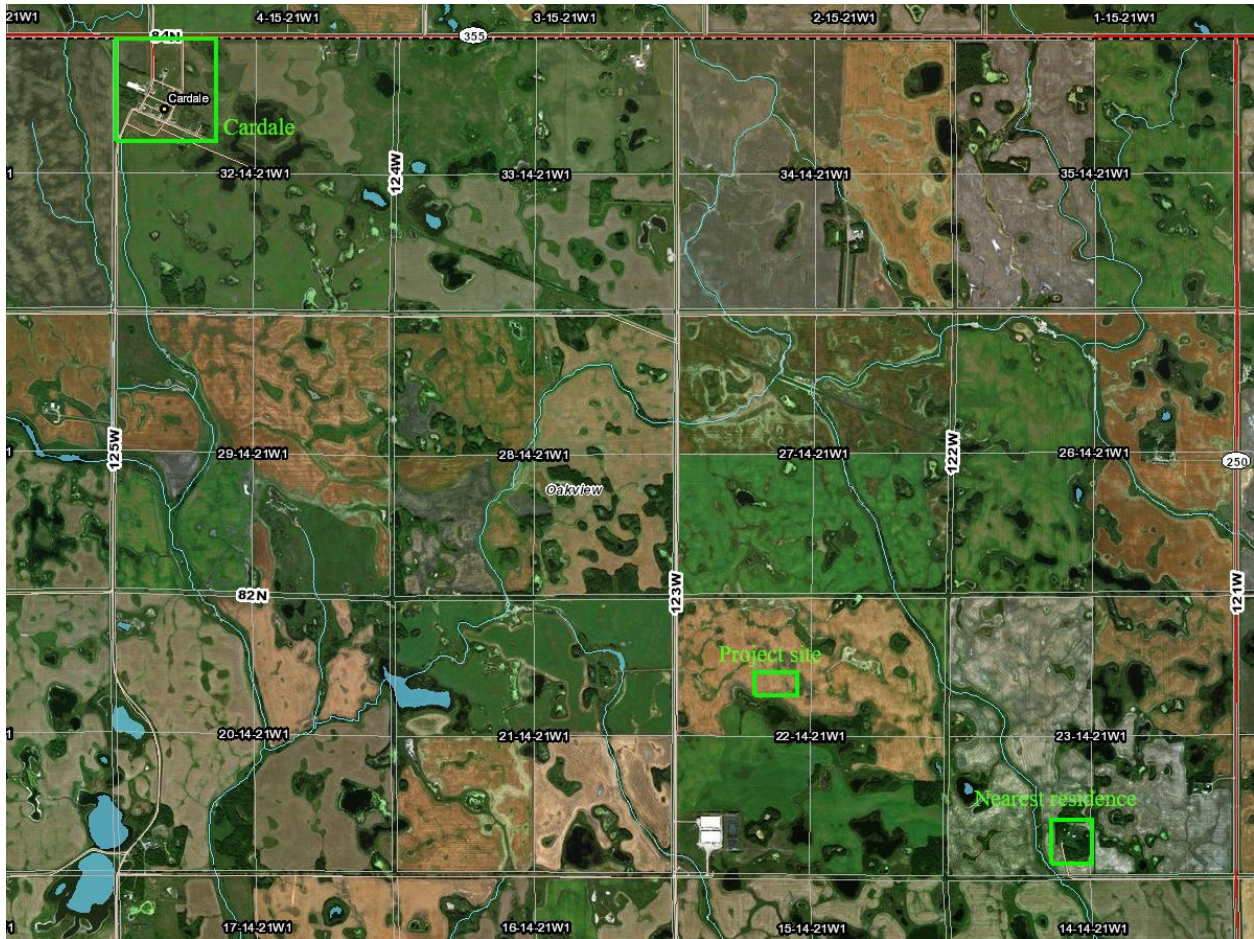


Figure 1. Location of the proposed wastewater lagoon.

The location where the lagoon is to be situated is such that prevailing winds from the northwest, west-northwest and south will not affect a significant number of people in the area (Figure 2). The nearest residence to the southeast is approximately 1.76 km away meeting the minimum setback requirements set by Manitoba Sustainable Development. It is anticipated that this separation distance will significantly mitigate any odour concerns caused as a result of the winds from the west-northwest direction. The release of odorous hydrogen sulphide gas (H_2S) from the wastewater treatment system usually occurs during the spring season for a short period of time while the ice thaws and the system returns to an aerobic non-odorous condition typically coinciding with the melting of ice cover.

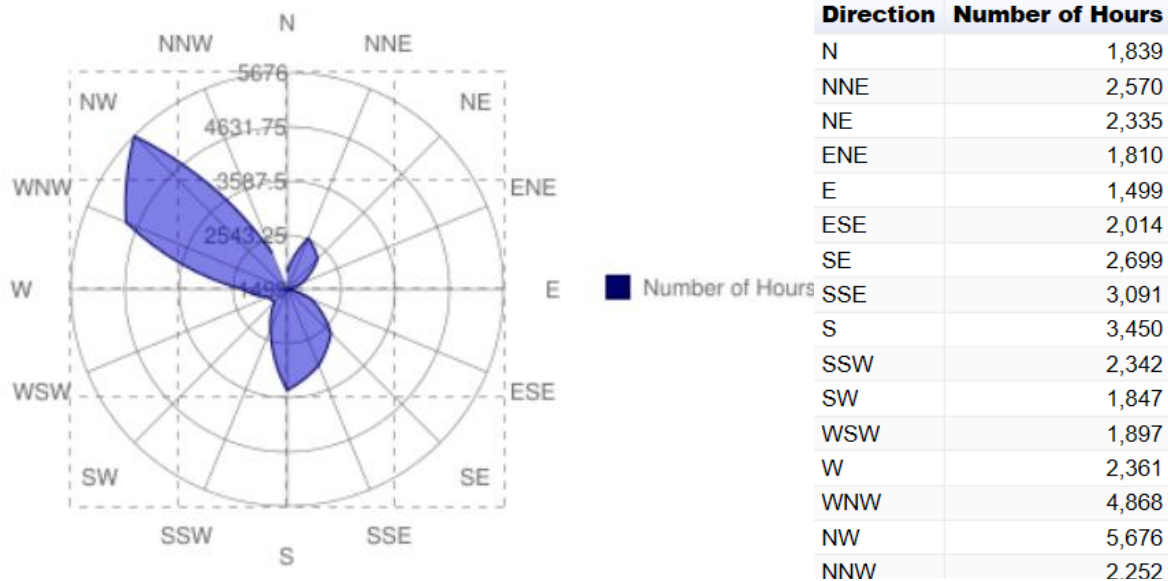


Figure 2. Wind direction distribution at Shoal Lake station
https://shoallake.weatherstats.ca/charts/wind_direction-quarterly.html

4.2 Groundwater and Surface Water Resources

A review of well logs recorded by Manitoba Water Stewardship (GW Drill Logs) indicates that there are no well records in NW 22-14-21W. However, there are a total of three wells that have been drilled in the neighbouring quarter sections (two well records in SW 22-14-21W and one well record in NE 21-14-21W). Review of these well logs revealed that the water table in the area is generally in the range of 3.35 m to 8.54 m below the surface. The soil formation in the NE 21-14-21W quarter section is generally characterized by the presence of gravely brown till surface deposits in the top 6 m underlain by stony grey/brown/shale tills. The top 30 cm soil layers in the NW 22-14-21W quarter section are mainly dominated by black top soils underlain by yellow/brown/grey clay till.

In consultation with Tamara Butterfield of Manitoba Sustainable Development, it is confirmed that there are no known licensed users of surface water along the proposed discharge path up to Lake Wahtopana (Appendix D). Due to a tortuous path followed by the effluent discharge and the length of discharge path, it is anticipated that the effluent reaching Broughton’s Creek will be equivalent to the water quality of the creek under normal non-discharge conditions. Therefore, the effluent discharge is not anticipated to have any impacts on the Rivers town pump site which is located downstream of where the flow would enter Lake Wahtopana. Moreover, activities on the surface in this region are generally not considered a significant threat to groundwater quality, thereby resulting in a low pollution hazard potential.

A review of topography in the area indicates that natural drainage patterns from the proposed site are to the south away from the closest residences southeast of the proposed site. In consultation with Manitoba Infrastructure, it has been determined that there are no records of flood damage in the proposed development site (Appendix D). However, to prevent isolated surface accumulations from causing property damage it is recommended that any structure built be slightly elevated and graded to enhance drainage. Structures such as the wastewater treatment lagoon will be constructed with inherent flood protection by way of berms which will extend at least 1.22 meters above surrounding grade. Any natural drainage impeded by the proposed facility will be re-established by constructing drainage swales with a minimum 0.1% slope to ensure ponding does not occur adjacent to the structure.

4.3 Soil Conditions

A geo-technical investigation was conducted by South-Man Engineering on December 4, 2017 in order to assess the soil characteristics to facilitate construction of the proposed wastewater lagoon. Three test holes were drilled in the vicinity of the proposed lagoon site and representative samples were collected for laboratory analysis. Details of the soil test results are included in Appendix C.

Based on the particle size analysis determined on the soil samples, the soil is classified as medium to high plastic, silty to silty clay-loam. Results of the Atterberg Limits test indicates that the soil's Liquid Limit and Plasticity Index are in the ranges of 33%–50% and 20%–31%, respectively. Construction of the wastewater treatment lagoon will utilize in-situ clay as lining material as this type of soil has proven to exhibit sufficiently low hydraulic conductivity to be able to avoid excessive percolation or seepage of liquid.

5 Design Criteria for the Proposed Wastewater Lagoon

The domestic wastewater treatment lagoon will service the wastewater from the residential and community facilities proposed at Westview Colony's premises, as well as the wastewater from a small-scale livestock slaughter and packing facility. For the purpose of estimating the maximum required facility dimensions, calculations account for a maximum population of 150 persons at the Colony. In addition, the wastewater from the livestock slaughter and packing facility were accounted for; wastewater production for this facility is based on an average consumption of approximately 96.3 kg of meat or poultry products per capita annually (FAO,

2009). The Colony will also operate a truck wash bay which will contribute wash water to the wastewater collection system.

5.1 Hydraulic Loading

5.1.1 Domestic

Hydraulic loading refers to the volume of raw sewage that will flow to the treatment lagoon per day. This volume is impacted by the number of residents the system is servicing, the amount of water use by each resident and the amount of water infiltration into the infrastructure.

Based on historical data, and industry adopted production rates for this type of application, an estimated 250 liters per day is used as the “per capita” daily water consumption/wastewater generation. Given a projected maximum population of 150 people at the Colony, the total flow is projected to be 37,500 liters per day (**37.5 m³/day**). The contribution from groundwater infiltration into the sewer system is considered negligible due to the absence of high water table.

5.1.2 Slaughter house

In addition to domestic wastewater production, there will also be contribution from the proposed slaughterhouse to be used strictly for butchering and packaging meat products for the Colony’s own consumption. Based on FAO publication (FAO, 2009), per capita consumption of meat in Canada in 2005 was 96.3 kg/person/year. For beef meat, Iowa State University Extension and Outreach determined the percentage yields from live weight killed to dressed weight (dressing percentage) and from dressed weight to packaged meat weight (carcass cutting percentage) as 61% and 67%, respectively (Thiboumery and Jepsen, 2009). Therefore, average live weight animal killed for consumption per person per year in Canada is calculated as 236 kg LWK/person/year. For Westview Colony, the total live weight of livestock that would be processed annually for consumption by 150 people would be 35,400 kg. Based on discussions with members of the Colony all blood-letting will take place outside of the facility and the paunches will be disposed of by means of composting.

Based on the low range of wastewater production from simple commercial slaughter houses and low-processing packing houses it is estimated that 760 litres of wastewater will be produced per 455 kg of live weight killed. On an annual basis this represents a total hydraulic load of 59,130 litres (59.13 m³). Although it is likely that slaughtering will not occur on a daily

basis, for the purpose of determining the daily hydraulic loading the annual production has been divided evenly into each day. The resulting daily hydraulic loading from the slaughter house is 162 litres/day (**0.162 m³/day**). Preparation and submission of an Environment Act Proposal for the slaughterhouse will be completed in the future prior to the development of the building when more details are known on the construction and location.

5.1.3 Truck Wash Bay

The truck wash bay is operated on average 2 hours per day, considering heavier uses in the summer, and less use in the winter months. The main purpose is for washing domestic vehicles and livestock trucks. The Colony intends to ship livestock twice a week, therefore there are only two trucks being thoroughly washed and disinfected each week. These trucks are washed and have the manure removed prior to returning home from their destination thereby eliminating any introduction of livestock manure. The other uses for the wash bay will include washing of other farm equipment and domestic vehicles. Nichols (2012) reports amounts as much as 2.4 m³/truck of wash water production for livestock haul trucks, using pressure spray washers. Westview Colony will use a high-pressure washer as the main cleaning tool; the rated flow for the high-pressure washer is 13 L/min (Rich Silverman, n.d.). The use of this high-pressure washer over a continuous operation for 2 hours would result in **1.56 m³/day** of wastewater on average throughout the year.

5.1.4 Total Hydraulic Loading

The total combined hydraulic loading for the domestic wastewater, the livestock slaughter facility and the truck wash bay is:

$$\textit{Total daily hydraulic load} = 37.5 + 0.162 + 1.56 = 39.22 \textit{ m}^3/\textit{day}$$

5.2 Organic Loading

5.2.1 Domestic

Based on accepted practice the daily BOD₅ (5-day Biochemical Oxygen Demand) production has been estimated to be 0.077 kg per person. The total daily BOD₅ contribution to the stabilization pond will be **11.55 kg** based on a population of 150 people.

5.2.2 Slaughter house

The average daily BOD₅ contribution from the slaughter house is estimated to be **1.26 kg** based on 13 kg BOD₅ per tonne of live weight killed.

$$\frac{13 \text{ kg/tonne} \times 35.4 \text{ tonne/yr}}{365 \text{ days/yr}} = 1.26 \text{ kg BOD}_5 / d$$

Traditionally the BOD₅ of wastewater from a red meat slaughter house is estimated at 26 kg/tonne of live weight killed, with blood being the single largest contributor. As the blood will not be disposed of through the sewer and the paunch will be disposed of through composting, these contributors have been subtracted resulting in an estimated 13 kg/tonne of live weight killed.

5.2.3 Truck Wash Bay

The BOD₅ from the truck wash water comes primarily from washing domestic vehicles, highway trucks and farm equipment. Tekere et al. (2012) reports an average BOD₅ generation of 257 mg/L from car wash bays. Therefore, based on the estimated daily hydraulic loading of 1.56 m³/day from the truck wash bay, the resulting daily BOD₅ production will be **0.40 kg**.

$$BOD_5 = \left(\frac{257 \text{ mg BOD}_5/L \times 10^3 \text{ L/m}^3}{10^6 \text{ mg/kg}} \right) \times 1.56 \text{ m}^3/d = 0.40 \text{ kg BOD}_5/d$$

5.2.4 Total Organic Loading

Consequently, the average daily design value for the wastewater treatment lagoon is the sum of the BOD₅ from the residential sources, the livestock processing facility and the truck wash bay. This equates to a combined BOD₅ loading of **13.21 kg/day**:

$$\text{Combined organic (BOD}_5\text{) loading} = 11.55 + 1.26 + 0.40 = 13.21 \text{ kg BOD}_5/d$$

5.3 General Design Parameters

The maximum design liquid depth in the storage is 1.15 meters. A one meter freeboard is provided to protect against catastrophic levels of precipitation and to shelter the liquid surface to minimize the effects of wave action. Moreover, a 0.35 m depth is set aside as reserve storage to hold the wastewater flow in the primary cell without surpassing the freeboard level when the transfer pipe connecting the primary cell to secondary cell is closed to facilitate effluent discharge. The interior slopes of the embankments will be constructed at 4:1 and the exterior slopes will be constructed at 5:1 in order to facilitate proper maintenance and grooming. The embankment top width will be 3.05 metres to permit access of maintenance equipment.

Due to the low hydraulic conductivity afforded by the high quality, high plastic clays encountered in the proposed development site, it is recommended that the lagoon be constructed with a 1.0 m thick recompacted clay layer utilizing in-situ soil material. The recompacted clay layer is proposed as a means of ensuring that any potential preferential flow paths are eliminated, thereby minimizing seepage losses. With the exception of topsoil which is to be utilized for landscaping only, any deleterious soil containing high percentages of silt or sand shall only be used in constructing the outer embankments.

The first phase of construction will consist of removing all topsoil and organic matter from the entire foot print of the proposed cells, including beneath the embankments. This material is to be stockpiled for future use in landscaping and final dressing of the embankments in order to promote the growth of grass. In addition to the removal of the topsoil, a 0.3 m deep key is to be constructed beneath the embankments to provide additional lateral support. Prior to starting placement of clay material to construct the embankments the material in the key is to be scarified and compacted to at least 95% of maximum dry density (MDD).

During construction of the embankments, the material is to be placed in maximum 150 mm thick lifts and compacted using a sheepsfoot packer to achieve a minimum of 95% of MDD. To achieve the desired compaction rate, the moisture content of the clay material should be within plus or minus two percent of the optimum moisture content as determined from the Standard Proctor moisture versus density relationship curve. The amount of compaction effort required to achieve the minimum 95% will be dependant on the moisture content of the material. In general, a minimum of 5 to 10 passes over each lift will be required. Discing or wetting of the fill material may be necessary to attain the optimum moisture content.

Construction of the bottom of the storage will consist of removing the in-situ material to 1.0 m below the design elevation of the facility and recompacting the material in 0.15 m lifts to achieve a minimum compaction density of 95% of maximum dry density. The purpose of this design element is to eliminate any potential fissures and preferential flow paths within the clay which in turn will ensure an effective hydraulic conductivity of 1.0×10^{-7} cm/s is attained for a full metre thickness over the entire interior surface of the structure.

For safety reasons it is recommended that fencing and warning signs be installed around the facility to discourage the entry of livestock, wildlife and trespassers. Gates sufficient to permit the entry of mowing and maintenance equipment shall be provided and be locked when access is not required.

6 Design Capacity

6.1 Primary Cell

The size of the primary treatment cell has been determined based on the liquid surface area at 0.575 m above the cell floor. The surface area at 0.575 m height is 3,337 m² (0.3337 ha). Based on the BOD₅ contribution of 13.21 kg per day anticipated at the maximum design capacity, the primary cell BOD₅ loading will be 39.59 kg/ha/day. A conservative BOD₅ loading has been used to minimize the potential for odour production during spring thaw and to limit the potential for offensive odour production throughout the year. Given the geometry of the proposed cells the larger size minimizes the potential for short circuiting of effluent between the cells. Construction drawings for the lagoon are included in Appendix E.

6.2 Secondary Cell

Given the soil conditions encountered on site and the design criteria to be implemented, it is reasonable to assume that seepage losses from the storage will be negligible. Based on resources from the University of Manitoba, annual precipitation for this area is approximately 540 mm while annual evaporation values from open water bodies are as high as 700 mm (Figure 3). Therefore, it is assumed that evaporation will at a minimum meet or exceed precipitation levels, thereby eliminating the need to provide additional storage capacity to facilitate excess precipitation.

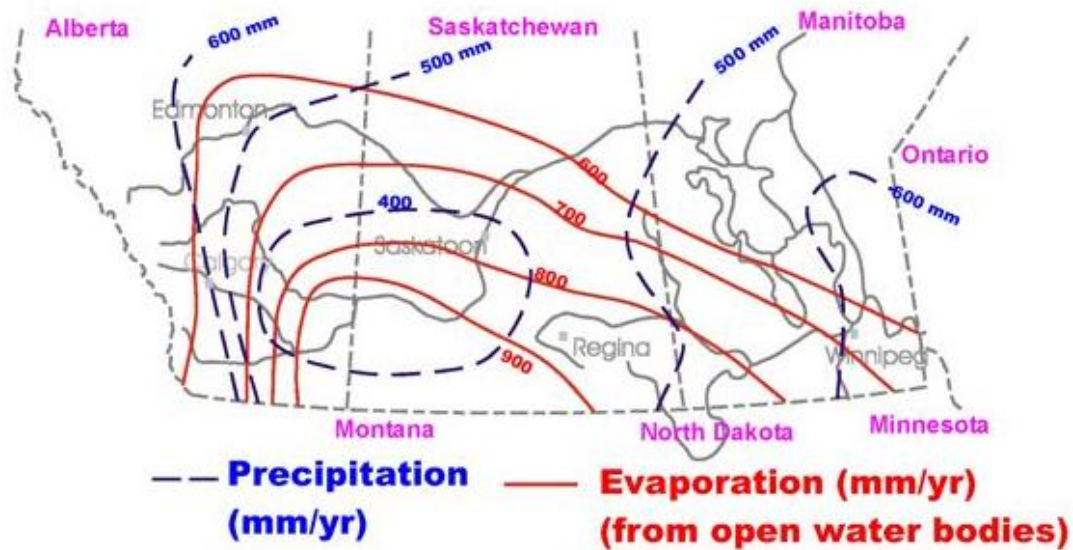


Figure 3. Annual precipitation and evaporation in Manitoba.

(Source: <http://home.cc.umanitoba.ca/~mlast/lakelevel/page3/page3.html>)

Operation of the lagoon is based on twice per year discharge, thereby requiring that the total storage capacity of the wastewater lagoon be equivalent to the estimated hydraulic flow, multiplied by the retention time. To eliminate the need for discharging treated effluent more than twice per year, or discharging in the period between November 1st and June 15th of the following year, the secondary cell is sized to accommodate a minimum of 196 days of retention time, not taking into consideration any contribution in allowable storage capacity of the primary cell. Therefore, the storage capacity of the secondary cell is 7,672 m³, excluding 0.3 m of dead storage below the discharge pipe. The footprint of the storage is such that the design storage capacity is achieved at a maximum liquid depth of 1.15 m. In addition, a 1.0 m freeboard is provided to accommodate a significant rainfall event and to shelter the liquid surface from wind thereby reducing wave action while 0.35 m depth is reserved to accommodate flow during the period when the primary cell is isolated from the system. The retention capacity of the secondary cell alone is 196 days, and when combined with 50% of the capacity of the primary cell will achieve a total retention time of 245 days at the design population.

7 Effluent Discharge

7.1 Method of Discharge

It is proposed that treated effluent from the wastewater lagoon will be discharged, via a constructed field drain, into a roadside ditch west of the facility. As the lagoon will be

constructed partially above grade, it is proposed to accomplish the cleanout by means of gravity. Once discharged into the roadside ditch, the effluent will flow south until it joins a first order natural drain crossing the road approximately 1 km south of the project site. This drain will then convey the effluent to the southeast until it joins Broughton's Creek and ultimately Lake Wahtopana approximately 17 km and 23 km, respectively, downstream of the development site. Installation of rip rap at the discharge of the effluent pipe and at the point of entry into the roadside ditch will be required to prevent erosion of the embankments and disturbance of particulate matter in the water stream.

Trickle discharge will be implemented in order to limit the release of liquids into the ditch as a means of trying to minimize the amount of liquids and particulates that actually enter into the creek. Over its entire length between the proposed construction site and Broughton's Creek, the treated effluent flows through vegetated drains which are permanently grassed. This provides the unique opportunity to recapture any nutrients within the treated effluent as well as any sediment within the water stream. Trickle discharge will allow the opportunity for maximum infiltration to occur and under low flow conditions will provide additional opportunity for further treatment to occur. Under normal conditions where soil conditions are not saturated or following an intense rainfall event, it is not anticipated that any effluent discharge will reach Broughton's Creek. In the event that discharge does reach Broughton's Creek, it is anticipated that due to the length of the discharge path that the effluent reaching the Broughton's Creek will be equivalent to the water quality of the creek under normal non-discharge conditions.

For the purpose of trickle discharge it is proposed to restrict the release of liquids to 0.006 m³/sec. This can be accomplished by restricting the valve opening to approximately 10% of its maximum opening area. Discharge duration is computed iteratively as the total wastewater generated during the maximum residence period (230 days) (November 1 to June 15 of the next year) less the amount generated when the valve in the connecting pipe between the primary and secondary cells is closed (21 days plus discharge duration) divided by the trickle discharge (0.006 m³/sec). At this rate, it would be anticipated to take approximately 15 days to complete an entire discharge.

Discharges should not be undertaken or contribute to localize flooding as the result of excessive or intense rainfalls. In the event that significant rainfall is experienced during the discharge period, discharge shall be halted until such time that runoff accumulation in the drainage system has subsided.

7.2 Discharge Procedure

In order to facilitate emptying the secondary cell, it must first be proven that the treated effluent meets the minimum effluent standards. Consideration must be given to the time required for the final treatment in the cell and the time required to perform the necessary testing in order to meet a specific discharge period, as may be specified in the License. Realistically, the final treatment and testing phase may take in excess of four weeks.

Following is the general discharge procedure to be implemented:

- 1) Close the valve in the connecting piping between the primary and secondary cells a minimum of two weeks before collecting the effluent samples for laboratory analysis. This valve is to remain closed until discharge of the secondary cell is complete.
- 2) Collect samples from the secondary cell and submit for analysis. Laboratory results can usually be expected in approximately two weeks.
- 3) If the results of the laboratory analysis meet the minimum effluent quality requirements, discharge of the secondary cell can proceed. If the results are not favorable, additional treatment will be required. In the event that the BOD₅ level exceeds the limit, additional time will be required to allow the contents of the secondary cell to further stabilize. Alternately, mechanical aeration can be provided to speed up the treatment process. If the coliform MPN exceeds the limit, dry chlorine may be spread over the surface of the secondary cell at a rate of 100 kg/ha. Re-testing to verify that the minimum standards are met will be required. Discharge the secondary cell when all requirements are met.
- 4) With discharge of the secondary cell complete, the discharge valve is closed and the valve between the primary and secondary cells is opened to allow the liquid levels of the two cells to equalize. This valve will remain open until the next discharge procedure is initiated. Sizing of the secondary cell is such that two discharges will be required per year at the maximum design population of 150 persons.
- 5) If additional discharges are required due to unforeseen scheduling issues, repeat the entire procedure.

8 Environmental Impact

8.1 Odor Production

Sizing of the primary cell has been based on an organic loading rate of 39.59 kg BOD₅/ha/day. This level, which is significantly less than the maximum allowable 56 kg BOD₅/ha/day as prescribed in the Province of Manitoba's document "Design Objectives for Standard Sewage Lagoons" will ensure that the facility operates odour-free for the majority of the year.

Potential does exist for odour to be present during the spring thaw when gases such as hydrogen sulfide, which have been trapped under the ice, are released. Production of these gases are the result of anaerobic decomposition of organic compounds which occurs when the ice cover prevents the introduction of oxygen into the wastewater. The duration of these odours is not anticipated to last any longer than two to three weeks depending on the time it takes for the ice cover to completely melt. With the removal of the ice cover the lagoon will quickly return to an aerobic state and odour production will return to a minimal level.

The large separation distance between the lagoon and the nearest residence not associated with the lagoon (1.76 km) will serve to further reduce any potential impacts of odour production. Wind data available for the area indicates that the prevailing wind directions are from the northwest, west-northwest and south. The large separation distance to the neighbouring residence in the direction of prevailing winds is such that little to no effect is anticipated.

In summary, odor reduction has been taken into consideration in the design of the treatment lagoon and separation distances from neighbouring residences are significantly greater than the required minimums. For these reasons, it is not anticipated that odour will have any significant environmental impacts.

8.2 Impact of Discharge to Waterways

The treated effluent from the secondary cell of the lagoon will be discharged twice per year during the period prescribed in the Environment Act Licence. In order to discharge treated domestic effluent into a waterway, specific treatment levels must be achieved before any release is permitted. Laboratory analysis of the treated effluent will be used to verify that the minimum requirements as specified in the Environmental Act Licence are met. Discharge will

not be permitted unless the minimum requirements are met. Table 2, summarizes published information for the minimum accepted standards of specific constituents.

Table 2: Minimum Standards for Effluent Quality

| CONSTITUENT | TREATED WASTERWATER |
|---|----------------------------|
| BOD ₅ (mg/L) | Less than 30 |
| NH ₃ (mg/L) | Less than 15 |
| Total Coliform (MPN/100mL) | Less than 1500 |
| Fecal Coliform (MPN/100mL) | Less than 200 |
| Total Suspended Sediments (mg/L) (excluding growing algae) | Less than 30 |
| Total Phosphorus (mg/L) | 1 |
| Total Nitrogen (mg/L) | 30 |

Stream flow statistics are not available for Broughton’s Creek. The first order natural drain into which the effluent is discharged, after traversing a one-kilometer roadside ditch, exhibits a tortuous path over 16 km before it reaches Broughton’s Creek. As the natural drain crosses a sizeable marshy area (approximately 3.4 ha in surface area), it is very likely that the entire discharge will be retained within the bed of this intermittent drain. The effluent will also benefit from additional treatment in the marshy area crossed by this drain. Under trickle discharge conditions, no flow would be anticipated to reach the Broughton’s Creek when flow rates in the natural drain are minimal as most of the treated effluent would be absorbed into the soil or utilized by the vegetation within the drain.

Moderate levels of SAR in treated wastewater are not anticipated to affect the quality of water significantly in waterways. The cumulative effect of numerous sources within the watershed region should be considered in coordinating the discharge periods in order to lessen the impact on water quality. In the event that discharge is necessary during a period of low flow in the waterway, it is anticipated that any precipitated salts will be re-suspended and diluted by the next significant rainfall and corresponding flow event.

The implementation of trickle discharge, except under extremely wet surface soil conditions, will in most situations prevent or minimize any significant amount of treated effluent from reaching Broughton’s Creek, thereby further minimizing the threat to the downstream environment. During periods of increased flows, dilution of any residual constituents from the treated effluent will be afforded.

The minimum standards for effluent quality, requires that the maximum phosphorus level in the treated effluent be less than 1.0 mg/L. The colony has been made aware of this requirement and have committed to reducing the use of phosphate-based soaps in order to achieve this goal. Testing of the treated effluent for phosphorus levels prior to discharge is suggested as a means of monitoring levels. When levels exceed the allowable levels at the facility, monitoring will also be performed at the ditch along Rd 123W to ensure the regulatory levels are achieved. In the event that levels exceed the allowable minimum, alum may be applied to the lagoon as a means of reducing the phosphorus level in the discharge effluent stream.

Periodic removal of vegetative growth within the discharge route is also recommended as a means of removing the nutrient stores within the plant material in order to minimize the long-term potential for nutrient movement into waterways. Removal of this material, however, should be done in a manner that does not disturb the soil surface in order to avoid the potential for introducing sediment into the water stream. Removed material can be utilized as animal feed if of a desirable plant species or alternately recycled as organic material and applied to surrounding cropland as a source of fertilizer.

Agricultural waterways are generally classified into five fish habitat types (A, B, C, D or E) based on gross measurements of fish habitat complexity and the fish species presence (Milani, 2013). Type E habitat typically has insufficient flow duration for fish to complete one or more of their life processes (spawning, rearing, feeding, over wintering or migration) and provides indirect fish habitat. Type A habitat includes all fish species with sport or commercial, domestic, or sport fishery value such as Northern Pike, Walleye or White Sucker, and species at risk whereas all other fish species are classified as Type C habitat.

It has been determined that type E and C fish habitat exists in the drain proposed for discharge (Figure 4). However, type A fish habitats are found further downstream once this drain runs into Broughton's Creek approximately 17 km downstream of the proposed development site. As this habitat represents potential spawning grounds, discharge of treated wastewater during the spawning period is not recommended. It is generally accepted that discharge after June 15th will mitigate any negative effects on fish spawning.

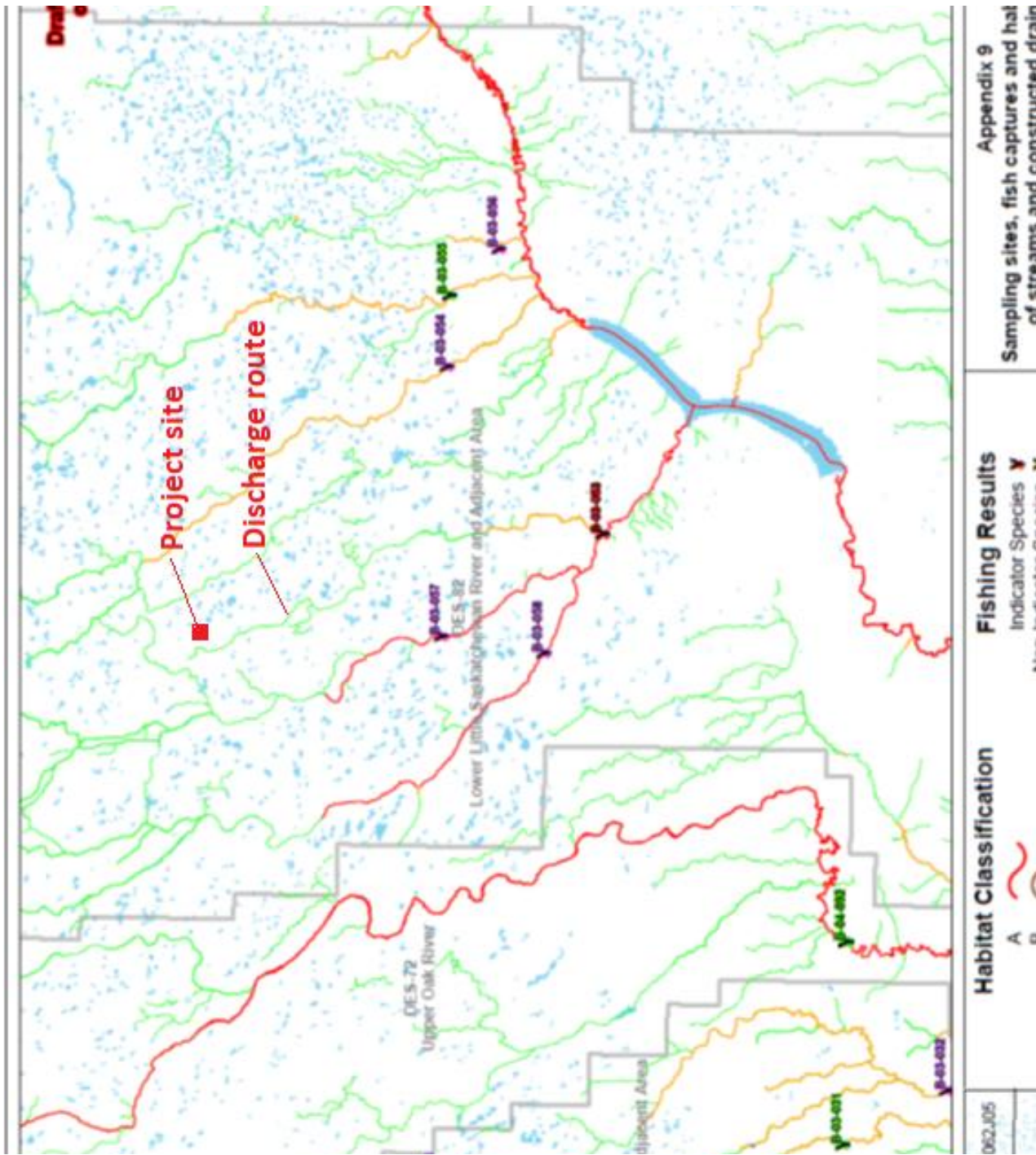


Figure 4. Fish habitat classification along the proposed discharge route

8.3 Impact on Groundwater

Soil types and construction methods utilized in constructing the lagoon will limit potential seepage losses to a minimum. The clay overburden and the 1m thick recompacted clay layer within the proposed lagoon will adequately protect the sub-surface groundwater resources beneath the facility. Based on our past experience, the clay soil identified at the proposed site is anticipated to be able to achieve a hydraulic conductivity of less than 1×10^{-7} cm/s when remolded to form the 1m thick layer. For this reason, the impact on groundwater is considered negligible.

8.4 Impacts on Wildlife, Forestry and Heritage Resources

Currently the land at the proposed construction site is utilized for agricultural purposes for growing annual crops. This area currently does not represent a significant source of wildlife or forestry habitat, or heritage resource. Consequently, it is not anticipated that the proposed lagoon will have an impact on them.

In consultation with Chris Friesen, Biodiversity Information Manager with the Manitoba Conservation Data Centre, it was determined that there are no rare species identified within the proposed development area at this time (Appendix D).

In consultation with Perry Blomquist, Archeological Services Officer, Historic Resources Branch of Manitoba Sport, Culture and Heritage, it was determined that the potential to impact significant heritage resources in the proposed project site has been deemed low (Appendix D).

8.5 Gasoline and Associated Product Storage

No storage of gasoline or associated petroleum products are expected on site due to the proposed development. Refueling and storage of petroleum products will be done within the developed yard site far from the proposed lagoon, and is to maintain a minimum 100 m setback from any waterway.

8.6 Socio-economic Implication

As no significant environmental impacts are anticipated, no socio-economic implications are likely. Construction of the proposed facility will in fact generate economic opportunities for local contractors, having a beneficial impact.

9 Maintenance and Inspection

9.1 General Maintenance

Several aspects require regular attention throughout the year, particularly during the growing season. Regular mowing of the grass on the embankments is required to minimize and discourage habitation by burrowing rodents which may impair the water holding capacity. Manual or mechanical removal of aquatic vegetation from the bottom and interior slopes of the embankments is required to prevent over population by these species. Significant populations of aquatic plants remove considerable amounts of oxygen from the wastewater which would otherwise be used in the breakdown of organic compounds. These populations will also prevent sunlight from penetrating the surface of the wastewater further reducing the efficiency of the natural treatment process.

9.2 Monitoring Requirements

Operation of the lagoon is relatively self-sufficient, however regular inspections are required to ensure operation and water flows are occurring as designed.

During moderate temperatures when the lagoon surface is free of ice, it should be noted whether the wastewater introduced into the primary cell is dispersed evenly or whether it is short-circuiting to the cross-over into the secondary cell. Odour levels are to be assessed and if excessive, the cause of the odours determined and rectified. General condition of the embankments and any rip-rap should also be assessed for damage from wind and wave action and repaired as necessary.

Winter monitoring is limited to checking for frozen piping and verifying that the cross-over piping between the cells is not frozen. This can be accomplished by comparing that the water levels in the cells are the same.

10 Construction Schedule

It is proposed that construction would begin as soon as the Environment Act Licence has been granted and weather conditions are favorable. For practical purposes, construction would occur between May 1st and October 31st to avoid contending with frozen soil and freezing conditions.

11 Funding

Construction of the domestic lagoon will be funded primarily by Westview Colony. However, a grant may be requested from the Canada/Manitoba Infrastructure program to potentially recover some of these costs.

12 References

FAO (2009). The state of food and agriculture. *Rome, Italy.*

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Tekere M., T Sibanda, and K. W. Maphangwa (2016). An assessment of the physicochemical properties and toxicity potential of carwash effluents from professional carwash outlets in Gauteng Province, South Africa. *Environ Sci Pollut Res Int.* 2016 Jun;23(12):11876-84. doi: 10.1007/s11356-016-6370-5.

Thiboumery, Arion and Jepsen, Kristine (2009). Beef and Pork Whole Animal Meat Buying Guide. Iowa State University, Extension and Outreach.

13 Appendix A – Certificate of Title

DATE: 2014/08/26
TIME: 22:58

MANITOBA STATUS OF TITLE

TITLE NO: 2738912/5

PAGE: 1

| | | | |
|-----------------------|------------|----------------|------------------------------|
| STATUS OF TITLE..... | ACCEPTED | PRODUCED FOR.. | DUBOFF, EDWARDS, HAIGHT |
| ORIGINATING OFFICE... | NEEPAWA | ADDRESS..... | 1900 - 155 CARLTON STREET |
| REGISTERING OFFICE... | NEEPAWA | | WINNIPEG MB R3C 3H8 |
| REGISTRATION DATE.... | 2014/08/21 | LTO BOX NO.... | 71 |
| COMPLETION DATE..... | 2014/08/26 | CLIENT FILE... | 130076-1401 |
| | | PRODUCED BY... | SYSTEM for Series: 1108913/5 |

WESTVIEW HOLDING CO. LTD

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

THE SLY 1320 FEET PERP OF THE NW 1/4 OF SECTION 22-14-21 WPM SUBJECT TO SPECIAL RESERVATIONS AS TO MINES MINERALS AND OTHER MATTERS AS PARTICULARLY DEFINED IN THE ORIGINAL GRANT FROM THE CROWN

ACTIVE TITLE CHANGE(S):

| | | | |
|----------------|----------|--|-------------------|
| 1039164/5 | ACCEPTED | MORTGAGE | REG'D: 2004/07/06 |
| FROM/BY: | | W. J. M. VERBRUGGEN & W. M. G. M. VERBRUGGEN | |
| TO: | | FARM CREDIT CANADA | |
| CONSIDERATION: | | \$500,000.00 | NOTES: |

| | | |
|---------------------------------|---|-------------|
| ADDRESS(ES) FOR SERVICE: | | |
| EFFECT | NAME AND ADDRESS | POSTAL CODE |
| ACTIVE | WESTVIEW HOLDING CO. LTD. 1900-155 CARLTON STREET WINNIPEG MB | R3C 3H8 |

| | | | |
|-----------------------------------|---------------------------------------|------------|----------------|
| ORIGINATING INSTRUMENT(S): | | | |
| REGISTRATION NUMBER | TYPE | REG. DATE | CONSIDERATION |
| 1108913/5 | T | 2014/08/21 | \$1,200,000.00 |
| PRESENTED BY: | DUBOFF, EDWARDS, HAIGHT | | |
| FROM: | W.M.G.M.VERBRUGGEN & W.J.M.VERBRUGGEN | | |
| TO: | WESTVIEW HOLDING CO. LTD. | | |
| | | | SWORN VALUE |
| | | | \$1,200,000.00 |

FROM TITLE NUMBER(S):

1979613/6 PART

| | | | | |
|--------------------|-------------------------|---------|----------|-------|
| LAND INDEX: | | | | |
| LOT | QUARTER | SECTION | TOWNSHIP | RANGE |
| | NW | 22 | 14 | 21W |
| NOTE: | SLY 1320 FT PERP EX RES | | | |

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM ON 2014/08/26 OF TITLE NUMBER 2738912/5

DATE: 2014/08/26
TIME: 22:58

MANITOBA
STATUS OF TITLE

TITLE NO: 2738912/5
PAGE: 2

STATUS OF TITLE..... ACCEPTED
ORIGINATING OFFICE... NEEPAWA
REGISTERING OFFICE... NEEPAWA
REGISTRATION DATE.... 2014/08/21
COMPLETION DATE..... 2014/08/26

PRODUCED FOR.. DUBOFF, EDWARDS, HAIGHT
ADDRESS..... 1900 - 155 CARLTON STREET
WINNIPEG MB R3C 3H8

LTO BOX NO.... 71
CLIENT FILE... 130076-1401
PRODUCED BY... SYSTEM for Series: 1108913/5

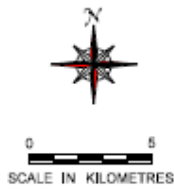
ACCEPTED THIS 21ST DAY OF AUGUST, 2014
BY E.SIMS FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF NEEPAWA.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2014/08/26 OF TITLE NUMBER 2738912/5.

***** END OF STATUS OF TITLE 2738912/5 *****




14 Appendix B – Location of the proposed development

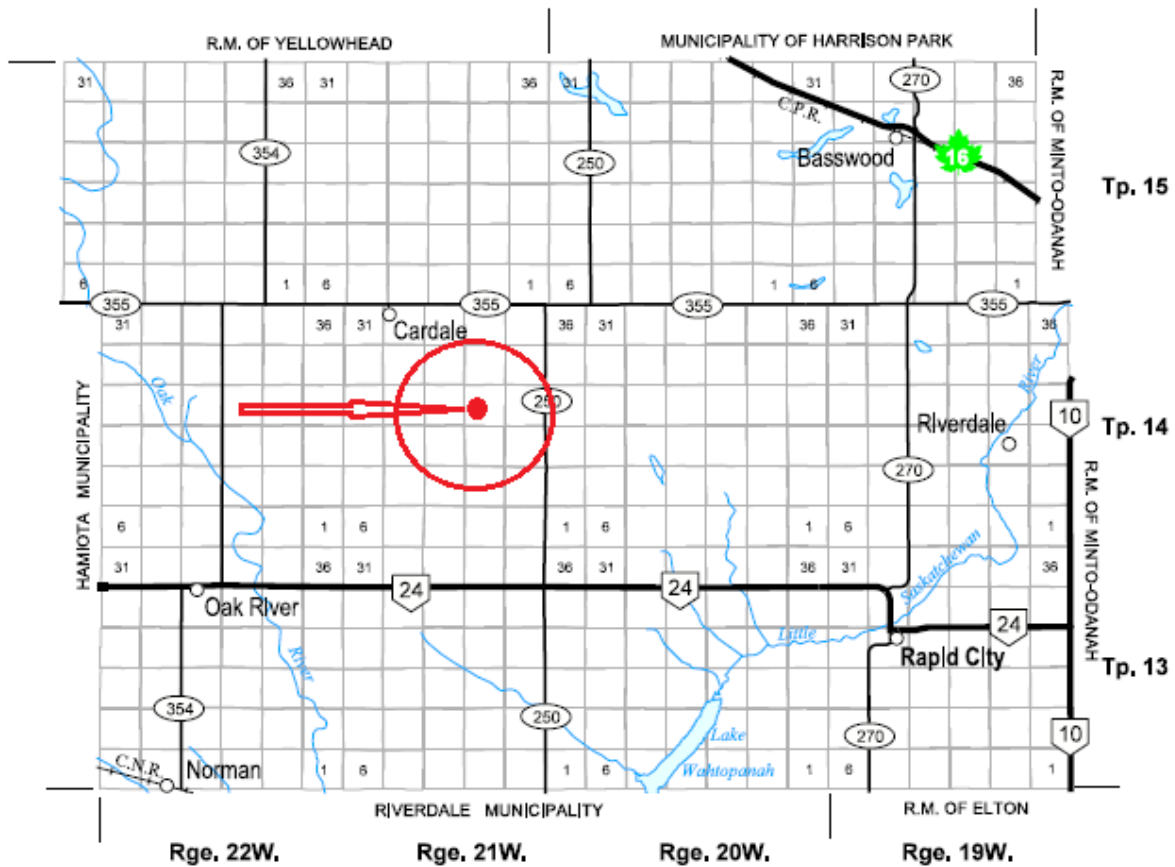
R.M. OF OAKVIEW



PROVINCE OF MANITOBA
 INFRASTRUCTURE
 HIGHWAY PLANNING AND DESIGN BRANCH
 GEOGRAPHIC & RECORDS MANAGEMENT SECTION
 WINNIPEG
 JANUARY 1, 2015

LEGEND

- TRANS-CANADA HIGHWAY 
- PROVINCIAL TRUNK HIGHWAYS 
- PROVINCIAL ROADS 
- ACCESS ROADS
- RAILWAYS



Formerly RMs of BLANSHARD and SASKATCHEWAN

SHEET 1 OF 1

15 Appendix C – Geo-Technical Information

Well log data in the vicinity of section NW 22-14-21W

LOCATION: NE21-14-21W

Well_PID: 71654
 Owner: M HEARN
 Driller: M & M Drilling Rivers Ltd.
 Well Name:
 Well Use: PRODUCTION
 Water Use: Domestic
 UTMX: 408319.211
 UTM Y: 5562493.01
 Accuracy XY: UNKNOWN
 UTMZ:
 Accuracy Z:
 Date Completed: 1991 Apr 05

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|---------------------|
| 0 | 22.0 | GRAVELLY BROWN TILL |
| 22.0 | 31.0 | STONY GREY TILL |
| 31.0 | 89.9 | STONY BROWN TILL |
| 89.9 | 146.9 | STONY SHALY TILL |
| 146.9 | 167.9 | SHALE |
| 167.9 | 169.9 | GOOD FRACTURES |
| 169.9 | 239.8 | MEDIUM FRACTURES |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia. (in) | Outside Dia. (in) | Slot Size (in) | Type | Material |
|---------------|-------------|----------------|---------------------|----------------------|-------------------|---------|----------|
| 0 | 209.9 | casing | 4.00 | | | INSERT | PVC |
| 209.9 | 239.8 | perforations | 4.00 | | | SAW CUT | PVC |

Top of Casing: 2.0 ft. below ground

PUMPING TEST

Date: 1991 Apr 05
 Pumping Rate: 10.0 Imp. gallons/minute
 Water level before pumping: 11.0 ft. below ground
 Pumping level at end of test: 32.0 ft. below ground
 Test duration: 12 hours, minutes
 Water temperature: ?? degrees F

REMARKS

EC=4200, HARD=24, FE-0.5

LOCATION: NE21-14-21W

Well_PID: 27310
Owner: M HEARN
Driller: ZAVISLAK, JOHN
Well Name:
Well Use: PRODUCTION
Water Use: Domestic, Livestock
UTMX: 408319.211
UTMY: 5562493.01
Accuracy XY: UNKNOWN
UTMZ:
Accuracy Z:
Date Completed: 1976 Jul 27

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|--------------------------------------|
| 0 | 12.0 | YELLOW CLAY& STONES |
| 12.0 | 24.0 | BLUE CLAY& STONES INTO GRAVEL, WATER |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia. (in) | Outside Dia. (in) | Slot Size (in) | Type | Material |
|---------------|-------------|----------------|---------------------|----------------------|-------------------|------------|----------|
| 0 | 24.0 | casing | | 30.00 | | CORRUGATED | |

GALVANIZED

Top of Casing: ft. below ground

No pump test data for this well.

LOCATION: SE22-14-21W

Well_PID: 122002
Owner: DUTCH PIG BARN
Driller: M & M Drilling Rivers Ltd.
Well Name: WELL #1
Well Use: PRODUCTION
Water Use: Domestic, Livestock
UTMX: 409950.393
UTMY: 5561647.5
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 1999 Oct 01

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|------------------|
| 0 | 4.0 | BACKFILL |
| 4.0 | 22.0 | STONY BROWN TILL |
| 22.0 | 125.0 | GREY STONY TILL |
| 125.0 | 150.0 | ODANAH SHALE |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia.(in) | Outside Dia.(in) | Slot Size(in) | Type | Material |
|---------------|-------------|----------------|--------------------|---------------------|------------------|---------|----------|
| 0 | 130.0 | CASING | 5.00 | | | | PVC |
| 130.0 | 150.0 | PERFORATIONS | 5.00 | | | SAW CUT | PVC |

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2002 Oct 05
Pumping Rate: 30.0 Imp. gallons/minute
Water level before pumping: 3.0 ft. below ground
Pumping level at end of test: 65.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

FE=1.75, HARD=33, TDS=3200. BACKFILLED GROUTED CLORINATED. 50'
APART FROM WELL #2.

LOCATION: SE22-14-21W

Well_PID: 122005
Owner: DUTCH PIG BARN
Driller: M & M Drilling Rivers Ltd.
Well Name: WELL #2
Well Use: PRODUCTION
Water Use: Domestic, Livestock
UTMX: 409950.393
UTMY: 5561647.5
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 1999 Oct 01

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|------------------|
| 0 | 4.0 | BACKFILL |
| 4.0 | 22.0 | STONY BROWN TILL |
| 22.0 | 125.0 | GREY STONY TILL |
| 125.0 | 150.0 | ODANAH SHALE |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia.(in) | Outside Dia.(in) | Slot Size(in) | Type | Material |
|---------------|-------------|----------------|--------------------|---------------------|------------------|---------|----------|
| 0 | 130.0 | CASING | 5.00 | | | | PVC |
| 130.0 | 150.0 | PERFORATIONS | 5.00 | | | SAW CUT | PVC |

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2002 Oct 05
Pumping Rate: 30.0 Imp. gallons/minute
Water level before pumping: 3.0 ft. below ground
Pumping level at end of test: 65.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

FE=1.75, HARD=33, TDS=3200. LOCATED 50' FROM WELL #1. BACKFILLED,
GROUTED, CLORINATED.

LOCATION: SW22-14-21W

Well_PID: 154430
Owner: DUTCH BARN
Driller: M & M Drilling Rivers Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Industrial
UTMX: 408788
UTMY: 5561476
Accuracy XY: 1 EXACT [<5M] [GPS]
UTMZ: 558
Accuracy Z: 4 FAIR - Shuttle at Centroid
Date Completed: 2009 Aug 11

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|-------------------------------|
| 0 | 1.0 | TOPSOIL |
| 1.0 | 21.0 | BROWN TILL |
| 21.0 | 57.0 | GREY TILL |
| 57.0 | 70.0 | GREY CLAY |
| 70.0 | 75.0 | SAND AND GRAVEL |
| 75.0 | 127.0 | GREY TILL AND STONES |
| 127.0 | 200.0 | LAYERS OF HARD AND SOFT SHALE |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia.(in) | Outside Dia.(in) | Slot Size(in) | Type | Material |
|---------------|-------------|----------------|--------------------|---------------------|------------------|----------|----------|
| 0 | 130.0 | CASING | 5.00 | | | INSERT | PVC |
| 130.0 | 190.0 | PERFORATIONS | 5.00 | | | SL. PIPE | PVC |
| 100.0 | 190.0 | GRAVEL PACK | | | | PEA SIZE | GRAVEL |
| 95.0 | 100.0 | CASING GROUT | | | | | |

BENTONITE

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2009 Aug 11
Pumping Rate: 40.0 Imp. gallons/minute
Water level before pumping: 28.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 2 hours, minutes
Water temperature: ?? degrees F

LOCATION: SW22-14-21W

Well_PID: 139679
Owner: DUTCH BARN
Driller: Ransom Drilling Ltd.
Well Name:
Well Use: TEST WELL
Water Use:
UTMX: 409135.841
UTMY: 5561663.84
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2006 Oct 02

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|---------------------------------------|
| 0 | 1.0 | GRAVEL |
| 1.0 | 10.0 | YELLOW CLAY |
| 10.0 | 66.0 | BLUE CLAY TILL |
| 66.0 | 70.0 | SAND, GRAVEL AND SHALE |
| 70.0 | 73.0 | BLUE CLAY |
| 73.0 | 77.0 | SAND AND GRAVEL |
| 77.0 | 125.0 | BLUE CLAY TILL |
| 125.0 | 160.0 | SOFT BLUE SHALE |
| 160.0 | 240.0 | SOFT BLUE SHALE WITH SOME HARD LAYERS |

No construction data for this well.

Top of Casing: 0.0

No pump test data for this well.

REMARKS

CARDALE, TEST HOLE IS AT THE WEST CORNER OF PIG BARN. HOLE ABANDONED WITH HOLE PLUG.

LOCATION: SW22-14-21W

Well_PID: 139678
Owner: DUTCH BARN
Driller: Ransom Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Livestock
UTMX: 409135.841
UTMY: 5561663.84
Accuracy XY:
UTMZ:
Accuracy Z:
Date Completed: 2006 Oct 04

WELL LOG

| From (ft.) | To (ft.) | Log |
|---------------|-------------|-------------------------------------|
| 0 | 1.0 | BLACK SOIL |
| 1.0 | 8.0 | YELLOW CLAY |
| 8.0 | 52.0 | BLUE CLAY TILL |
| 52.0 | 55.0 | SAND AND GRAVEL |
| 55.0 | 61.0 | BLUE CLAY TILL |
| 61.0 | 65.0 | SAND AND GRAVEL |
| 65.0 | 128.0 | BLUE CLAY TILL |
| 128.0 | 165.0 | HARD BLUE SHALE WITH SOME LIMESTONE |

WELL CONSTRUCTION

| From (ft.) | To (ft.) | Casing Type | Inside Dia.(in) | Outside Dia.(in) | Slot Size(in) | Type | Material |
|---------------|-------------|----------------|--------------------|---------------------|------------------|---------|----------|
| 0 | 141.0 | CASING | 5.00 | | | INSERT | PVC |
| 141.0 | 161.0 | PERFORATIONS | | | 0.020 | SAW CUT | PVC |
| 120.0 | 130.0 | CASING GROUT | | | | | |

BENTONITE

Top of Casing: 1.0 ft. above ground

PUMPING TEST

Date: 2006 Oct 04
Pumping Rate: 30.0 Imp. gallons/minute
Water level before pumping: 20.9 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, minutes
Water temperature: ?? degrees F

REMARKS

CARDALE, WELL IS ON THE SOUTH SIDE OF NORTH ACCESS ROAD. A RUBBER SHALE PACKER IS ON CASING AT 130 FEET, NO WASHDOWN.



15-1599 Dugald Road
Winnipeg, MB R2J 0H3

Phone: 204.668.9652
Fax: 204.668.9204
E-mail: sme@southmaneng.com

TEST HOLE LOGS

For: Westview Colony
Operation: Domestic Wastewater Lagoon
Location: NW 22-14-21W
RM: Oakview
City/Town, Prov.: Cardale, Mb

Test Hole Logs by: Peter Grieger, P. Eng. & Desalegn Edossa
Drilling Performed by: Paddock Drilling Ltd
Date: November 4, 2017

Test hole # 1

0-8" Topsoil
8"-5' Grey, med plastic clay, thin sand lenses
5'-10' Grey clay, med/high plastic, with slight gravel and pebbles, slight oxidation at 6'
10'-15' Grey plastic clay with slight gravel and pebbles, medium/high plastic, slight oxidation
15'-20' Dark grey till with pebbles, slight shale pieces and gravel, medium/high plastic, stiff
20'-25' Dark grey medium/high plastic clay till, with slight shale and gravel, stiff
25'-30' Brown, low plastic silty/sandy clay till with gravel, slight oxidation and inclusion of pebbles

Test hole # 2

0-8" Topsoil
8"-5' Brown silty clay till with visible salt and slight oxidation
5'-10' Grey brown clay till with slight gravel and oxidation, stiff
10'-15' Dark brown clay till up to 13', slight silt inclusion at 14', slight gravel and oxidation
15'-20' Dark clay till with high plasticity, slight gravel and pebble inclusions, slight oxidation
20'-25' Grey, high plastic clay till with slight gravel and pebbles, coarse sand layer with water at 24'
25'-27.5' Coarse sand, gravel with slight clay, hole sloughed at 27.5', no water

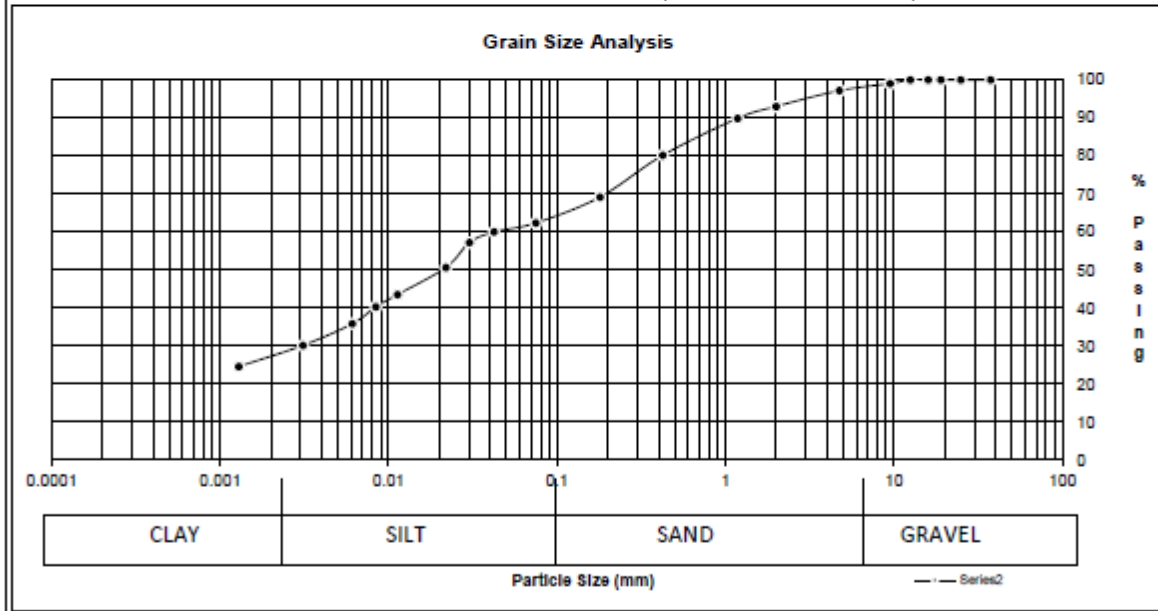
Test hole # 3

0-8" Topsoil
8"-5' Brown silty clay with slight oxidation
5'-10' Grey/brown silty clay with slight gravel, pebbles, and oxidation, stiff
10'-15' Grey/brown clay till with gravel, pebbles and oxidation, stiff
15'-20' Stone encountered at about 19', grey/brown sandy clay, thin sand layer, slight oxide flecks
20'-25' Grey/brown, medium/high plastic clay with slight gravel and sand inclusions
25'-30' Grey/brown sandy clay with medium/high plasticity, slight gravel

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT: Southman Engineering PROJECT NO. 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
|--|-----------|----------------|-----------|----------------|-----------|---------------------|---------|
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| Material Identification B.H./T.H. No. TH 1 @ 5' Sample No. 1 Sample Source Specific Gravity of Material: 2.65 | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| | | | | 12.50 | 100.0 | 0.0423 | 60.0 |
| | | | | 9.50 | 99.1 | 0.0303 | 57.2 |
| | | | | 4.75 | 97.2 | 0.0220 | 50.7 |
| | | | | 2.00 | 93.0 | 0.0113 | 43.6 |
| | | | | 1.18 | 89.9 | 0.0084 | 40.3 |
| 0.425 | 80.2 | 0.0061 | 35.9 | | | | |
| 0.180 | 69.2 | 0.0031 | 30.2 | | | | |
| 0.075 | 62.4 | 0.0013 | 24.6 | | | | |



| SOIL DESCRIPTION | % Composition | | D10 | |
|------------------|---------------|------|--------|---------|
| | SILT LOAM | 16.6 | Gravel | D30 |
| 21.0 | | Sand | D60 | 0.04230 |
| 37.8 | | Silt | Cu | #DIV/0! |
| 24.6 | | Clay | Cc | #DIV/0! |

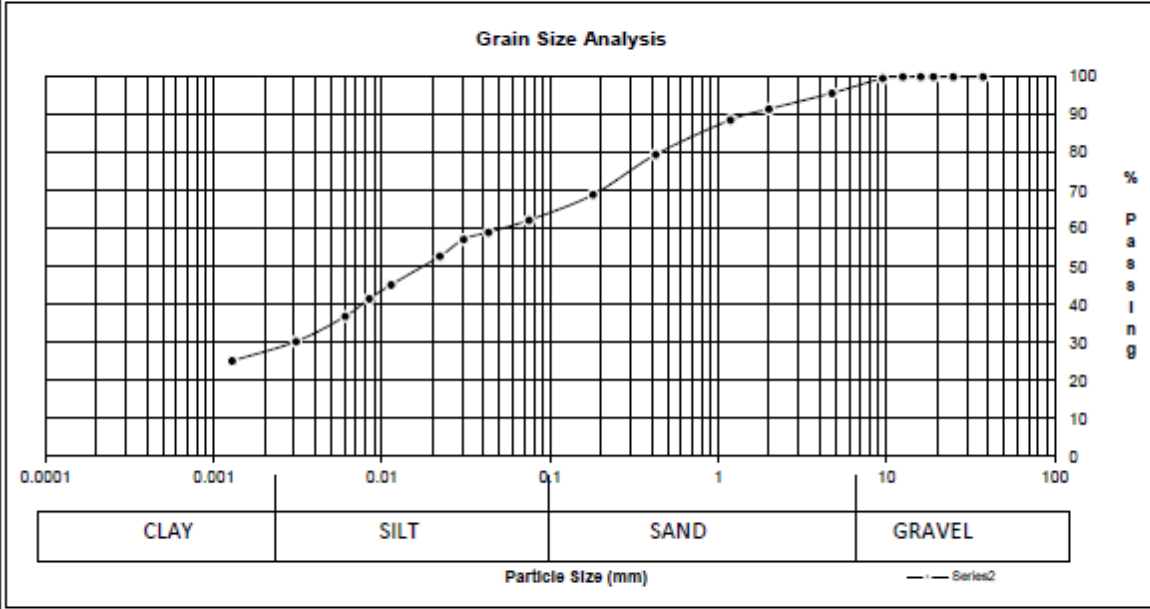
Remarks: Test Method: ASTM D422, D2216, D4318
Technician: GM/VL

Reviewed by: Hermie Manalo

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT: South-Man Engineering PROJECT NO. 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
|--------------------------------|-----------|----------------|-----------|----------------|-----------|---------------------|---------|
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| Material Identification | | | | 12.50 | 100.0 | 0.0430 | 59.1 |
| B.H./T.H. No. | TH 2 @ 5' | | | 9.50 | 99.6 | 0.0306 | 57.3 |
| Sample No. | 2 | | | 4.75 | 95.7 | 0.0221 | 52.8 |
| Sample Source | | | | 2.00 | 91.5 | 0.0114 | 45.3 |
| Specific Gravity of Material: | 2.65 | | | 1.18 | 88.7 | 0.0084 | 41.6 |
| | | | | 0.425 | 79.6 | 0.0061 | 36.9 |
| | | | | 0.180 | 69.0 | 0.0031 | 30.3 |
| | | | | 0.075 | 62.3 | 0.0013 | 25.2 |



| SOIL DESCRIPTION | % Composition | | D10 | 0.00309 |
|------------------|---------------|------|-----|---------|
| | | 18.8 | | |
| SILT LOAM | 21.1 | Sand | D60 | #DIV/0! |
| | 37.1 | Silt | Cu | #DIV/0! |
| | 25.2 | Clay | Cc | #DIV/0! |

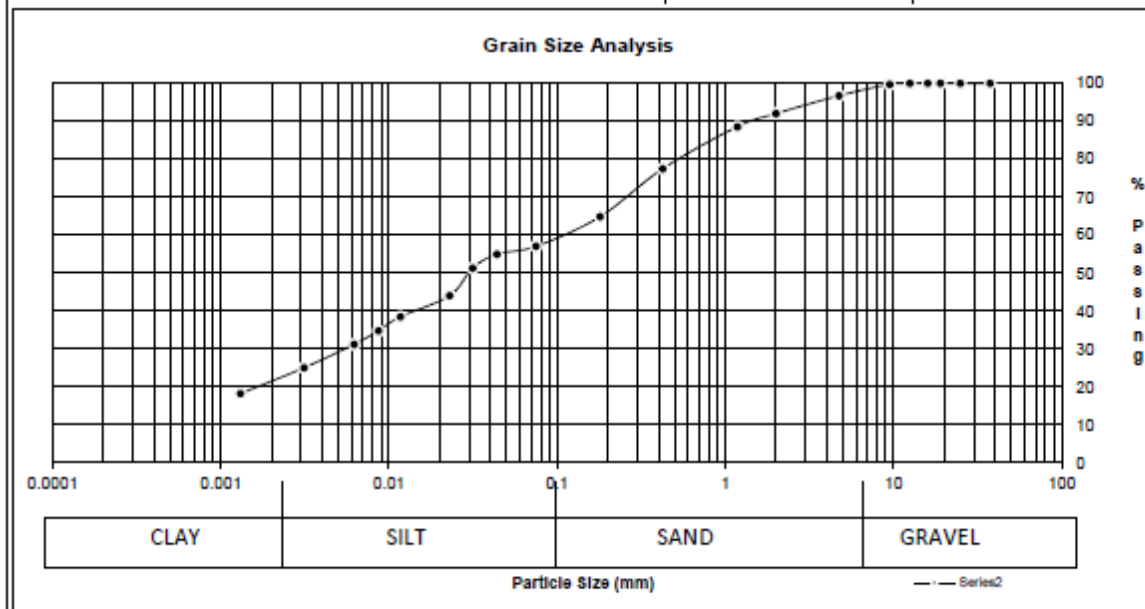
Remarks: Test Method: ASTM D422, D2216, D4318
Technician: GM/VL

Reviewed by: Hermie Manalo

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

| | | |
|------------|---|----------------------|
| CLIENT: | South-Man Engineering 1599 Dugald Road Winnipeg, MB R2J 0H3 | PROJECT NO. 101-1715 |
| ATTENTION: | Peter Grieger | |
| PROJECT: | Westview | |

| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
|--------------------------------|------------|----------------|-----------|----------------|-----------|---------------------|---------|
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| Material Identification | | | | 12.50 | 100.0 | 0.0439 | 55.0 |
| B.H./T.H. No. | TH 2 @ 25' | | | 9.50 | 99.8 | 0.0315 | 51.3 |
| Sample No. | 3 | | | 4.75 | 96.8 | 0.0229 | 44.1 |
| Sample Source | | | | 2.00 | 92.0 | 0.0117 | 38.5 |
| Specific Gravity of Material: | 2.65 | | | 1.18 | 88.6 | 0.0087 | 34.9 |
| | | | | 0.425 | 77.5 | 0.0062 | 31.3 |
| | | | | 0.180 | 64.9 | 0.0031 | 25.1 |
| | | | | 0.075 | 57.1 | 0.0013 | 18.3 |



| SOIL DESCRIPTION | % Composition | D10 | |
|------------------|---------------|--------|---------|
| SILT LOAM | 18.8 | Gravel | D10 |
| | 26.3 | Sand | D30 |
| | 38.8 | Silt | D60 |
| | 18.3 | Clay | Cu |
| | | | #DIV/0! |
| | | | Cc |
| | | | #DIV/0! |

Remarks: Test Method: ASTM D422, D2216, D4318

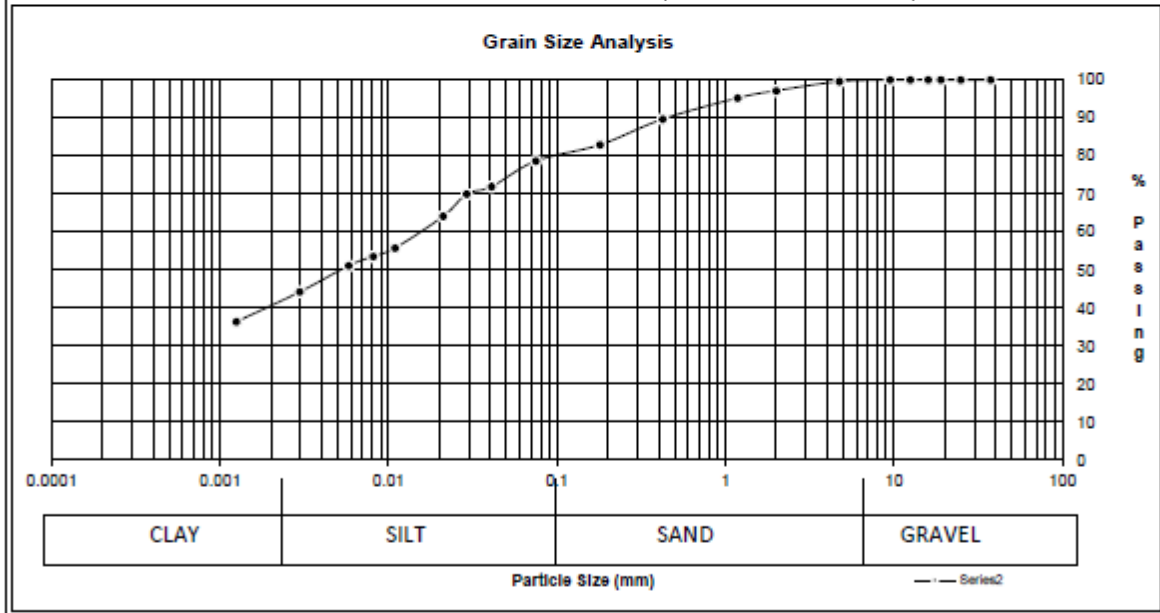
Technician: GM/VL

Reviewed by: Hermie Manalo

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

| | | | |
|------------|---|-------------|----------|
| CLIENT: | South-Man Engineering 1599 Dugald Road Winnipeg, MB R2J 0H3 | PROJECT NO. | 101-1715 |
| ATTENTION: | Peter Grieger | | |
| PROJECT: | Westview | | |

| | | | | | | | |
|--------------------------------|-----------|----------------|-----------|----------------|-----------|---------------------|---------|
| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| Material Identification | | | | 12.50 | 100.0 | 0.0409 | 71.9 |
| B.H./T.H. No. | TH 3 @ 2' | | | 9.50 | 100.0 | 0.0291 | 70.0 |
| Sample No. | 4 | | | 4.75 | 99.6 | 0.0211 | 64.2 |
| Sample Source | | | | 2.00 | 97.2 | 0.0109 | 55.8 |
| Specific Gravity of Material: | 2.65 | | | 1.18 | 95.2 | 0.0081 | 53.6 |
| | | | | 0.425 | 89.7 | 0.0058 | 51.2 |
| | | | | 0.180 | 83.0 | 0.0030 | 44.3 |
| | | | | 0.075 | 78.7 | 0.0012 | 36.4 |



| | | | |
|------------------|---------------|-----|---------|
| SOIL DESCRIPTION | % Composition | D10 | |
| SILTY CLAY LOAM | 18.8 Gravel | D30 | |
| | 4.7 Sand | D60 | 0.01095 |
| | 42.3 Silt | Cu | #DIV/0! |
| | 36.4 Clay | Cc | #DIV/0! |

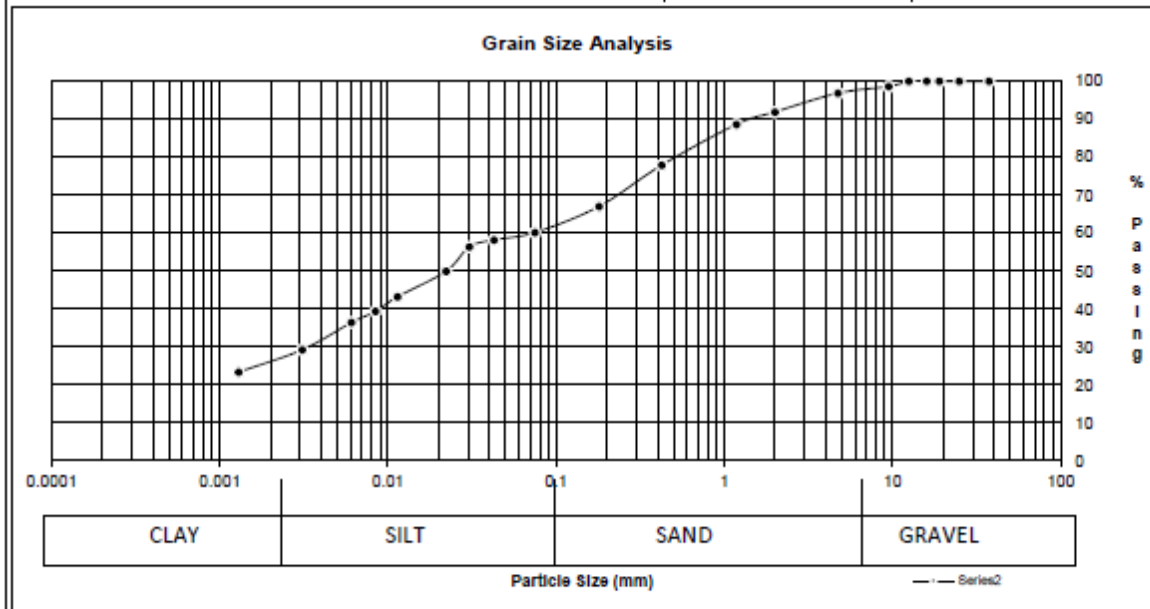
Remarks: Test Method: ASTM D422, D2216, D4318
Technician: GM/VL

Reviewed by: Hermie Manalo

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT: South-Man Engineering PROJECT NO. 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
|--------------------------------|------------|----------------|-----------|----------------|-----------|---------------------|---------|
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| | | | | 12.50 | 100.0 | 0.0428 | 58.2 |
| Material Identification | | | | 9.50 | 98.6 | 0.0305 | 56.4 |
| B.H./T.H. No. | TH 3 @ 10' | | | 4.75 | 96.9 | 0.0221 | 50.0 |
| Sample No. | 5 | | | 2.00 | 91.9 | 0.0114 | 43.3 |
| Sample Source | | | | 1.18 | 88.7 | 0.0084 | 39.4 |
| Specific Gravity of Material: | 2.65 | | | 0.425 | 77.9 | 0.0061 | 36.5 |
| | | | | 0.180 | 67.1 | 0.0031 | 29.3 |
| | | | | 0.075 | 60.2 | 0.0013 | 23.4 |



| SOIL DESCRIPTION | % Composition | | D10 | D30 | D60 | Cu | Cc |
|------------------|---------------|------|-----|---------|-----|----|----|
| | SILT LOAM | 18.8 | | | | | |
| 23.2 | | Sand | | 0.07500 | | | |
| 36.8 | | Silt | | #DIV/0! | | | |
| 23.4 | | Clay | | #DIV/0! | | | |

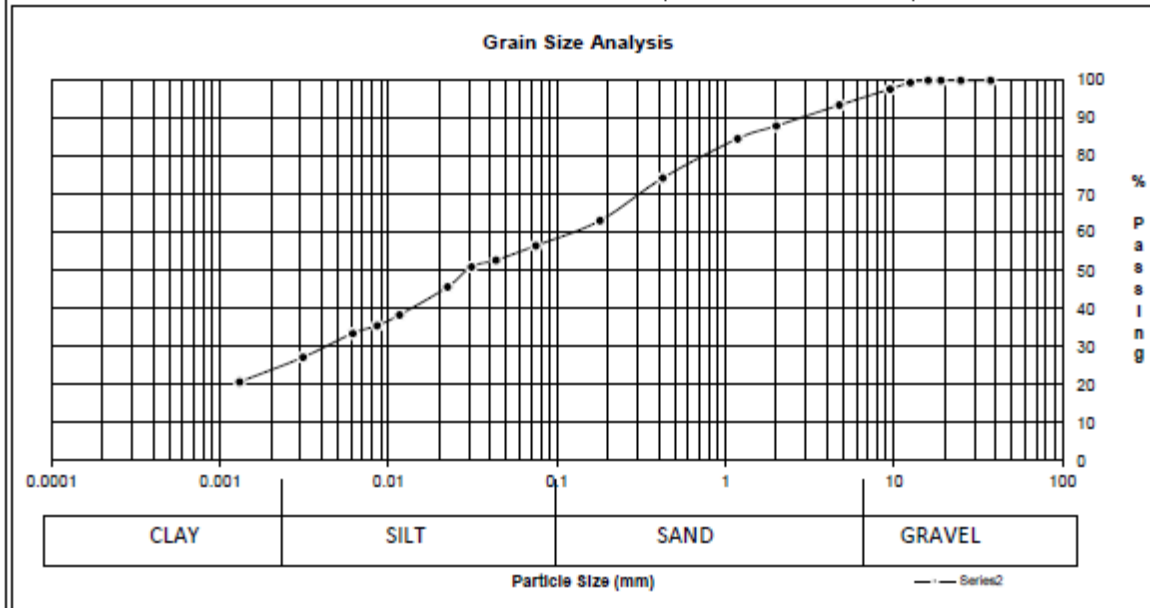
Remarks: Test Method: ASTM D422, D2216, D4318
Technician: GM/VL

Reviewed by: Hermie Manalo

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT: South-Man Engineering PROJECT NO. 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

| Date Sampled: | 05-Dec-17 | Date Received: | 05-Dec-17 | Sieve Analysis | | Hydrometer Analysis | |
|--------------------------------|------------|----------------|-----------|----------------|-----------|---------------------|---------|
| Sampled By: | Client | Date Tested: | 07-Dec-17 | Sieve (mm) | % Passing | Diameter | % Finer |
| | | | | 50.00 | 100.0 | | |
| | | | | 37.50 | 100.0 | | |
| | | | | 25.00 | 100.0 | | |
| | | | | 19.00 | 100.0 | | |
| | | | | 16.00 | 100.0 | | |
| Material Identification | | | | 12.50 | 99.4 | 0.0435 | 52.8 |
| B.H./T.H. No. | TH 3 @ 20' | | | 9.50 | 97.7 | 0.0310 | 51.0 |
| Sample No. | 6 | | | 4.75 | 93.5 | 0.0224 | 45.7 |
| Sample Source | | | | 2.00 | 88.1 | 0.0116 | 38.4 |
| Specific Gravity of Material: | 2.65 | | | 1.18 | 84.7 | 0.0086 | 35.5 |
| | | | | 0.425 | 74.4 | 0.0061 | 33.5 |
| | | | | 0.180 | 63.2 | 0.0031 | 27.3 |
| | | | | 0.075 | 56.6 | 0.0013 | 20.7 |



| SOIL DESCRIPTION | % Composition | | D10 | |
|------------------|---------------|------|--------|---------|
| | | 16.8 | Gravel | D30 |
| SILT LOAM | 26.8 | Sand | D60 | 0.07500 |
| | 35.9 | Silt | Cu | #DIV/0! |
| | 20.7 | Clay | Cc | #DIV/0! |

Remarks: Test Method: ASTM D422, D2216, D4318
Technician: GM/VL

Reviewed by: Hermie Manalo

| ATTERBERG LIMITS | | | | | |
|--|---|-----------------------|-------|--|--------------|
| CLIENT: | South-Man Engineering 1599 Dugald Road Winnipeg, MB R2J 0H3 | PROJECT NO.: 101-1715 | | | |
| ATTENTION: | Peter Grieger | | | | |
| PROJECT: | Westview | | | | |
| Liquid Limit Determination | | | | | |
| Dish No.: | 1 | 2 | 3 | | Liquid Limit |
| Wet Soil + Dish: | 14.63 | 13.38 | 16.33 | | 25 Blows |
| Dry Soil + Dish: | 11.84 | 10.8 | 12.89 | | |
| Moisture: | 2.79 | 2.58 | 3.44 | | |
| Dish: | 4.84 | 4.41 | 4.53 | | |
| Dry Soil: | 7 | 6.39 | 8.36 | | |
| % Moisture: | 39.86 | 40.38 | 41.15 | | |
| No. of Blows: | 35 | 27 | 19 | | |
| Liquid Limits: | 42 | 41 | 40 | | 41 |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p style="text-align: center;">Liquid Limit</p> <p style="text-align: center;">No. of Blows, N</p> </div> <div style="width: 35%;"> <p>Material Identification:</p> <p style="text-align: right;">TH 1</p> <p style="text-align: right;">Depth: 5 ft.</p> <p style="text-align: right;">Liquid Limit, %: 41</p> <p style="text-align: right;">Plastic Limit, %: 17</p> <p style="text-align: right;">Plasticity Index: 24 (LL-PL)</p> </div> </div> | | | | | |
| Plastic Limit Determination | | | | | |
| Dish No.: | 1 | 2 | 3 | | |
| Wet Soil + Dish: | 12.11 | 10.81 | 12.02 | | |
| Dry Soil + Dish: | 11.06 | 9.88 | 10.94 | | |
| Moisture: | 1.05 | 0.93 | 1.08 | | |
| Dish: | 4.2 | 4.26 | 4.82 | | |
| Dry Soil: | 6.86 | 5.62 | 6.12 | | |
| % Moisture: | 15.31 | 16.55 | 17.65 | | |
| Average: | | | | | 17 |

Test Method : ASTM: D4318, D2216
 HMCL Tech: GM
 Date Tested: 08-Dec-17

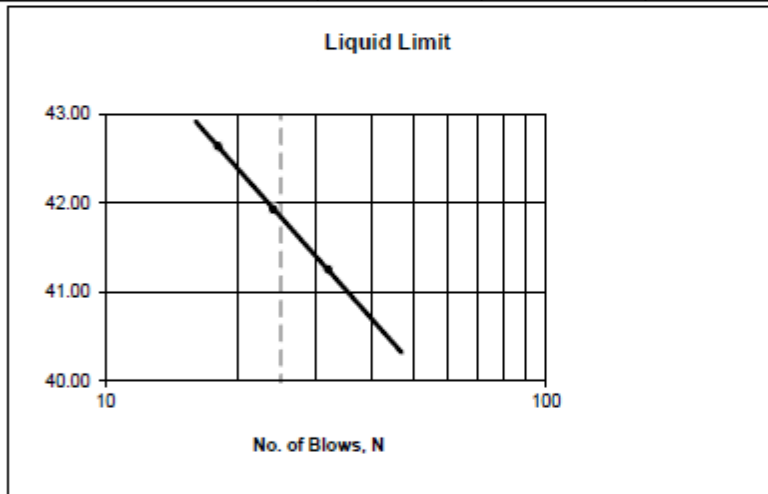
H. Manalo
 Reviewed by: Hermie Manalo

ATTERBERG LIMITS

CLIENT: South-Man Engineering PROJECT NO.: 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

Liquid Limit Determination

| Dish No.: | 1 | 2 | 3 | | Liquid Limit |
|------------------|-------|-------|-------|--|--------------|
| Wet Soil + Dish: | 15.91 | 15.6 | 13.82 | | 25 Blows |
| Dry Soil + Dish: | 12.49 | 12.3 | 10.95 | | |
| Moisture: | 3.42 | 3.3 | 2.87 | | |
| Dish: | 4.2 | 4.43 | 4.22 | | |
| Dry Soil: | 8.29 | 7.87 | 6.73 | | |
| % Moisture: | 41.25 | 41.93 | 42.64 | | |
| No. of Blows: | 32 | 24 | 18 | | |
| Liquid Limits: | 43 | 42 | 41 | | |



Material Identification:

TH 2
Depth: 5 ft.
Liquid Limit, %: 42
Plastic Limit, %: 16
Plasticity Index: 26
(LL-PL)

Plastic Limit Determination

| Dish No.: | 1 | 2 | 3 | | |
|------------------|-------|-------|-------|--|----|
| Wet Soil + Dish: | 11.27 | 11.32 | 11.68 | | |
| Dry Soil + Dish: | 10.4 | 10.34 | 10.69 | | |
| Moisture: | 0.87 | 0.98 | 0.99 | | |
| Dish: | 4.71 | 4.16 | 4.26 | | |
| Dry Soil: | 5.69 | 6.18 | 6.43 | | |
| % Moisture: | 15.29 | 15.86 | 15.40 | | |
| Average: | | | | | 16 |

Test Method : ASTM: D4318, D2216
HMCL Tech: GM
Date Tested: 08-Dec-17

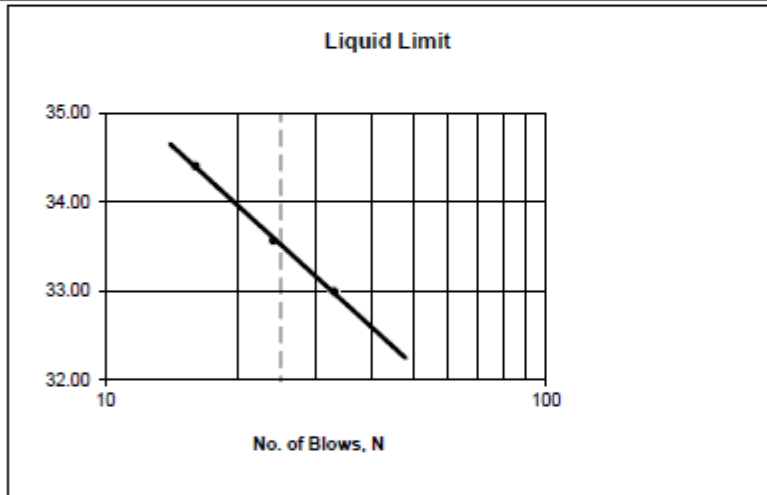
Reviewed by: Hermie Manalo

ATTERBERG LIMITS

CLIENT: South-Man Engineering
1599 Dugald Road
Winnipeg, MB R2J 0H3
PROJECT NO.: 101-1715
ATTENTION: Peter Grieger
PROJECT: Westview

Liquid Limit Determination

| Dish No.: | 1 | 2 | 3 | | Liquid Limit 25 Blows |
|------------------|-------|-------|-------|--|--------------------------|
| Wet Soil + Dish: | 15.12 | 15.61 | 16.21 | | |
| Dry Soil + Dish: | 12.51 | 12.78 | 13.12 | | |
| Moisture: | 2.61 | 2.83 | 3.09 | | |
| Dish: | 4.6 | 4.35 | 4.14 | | |
| Dry Soil: | 7.91 | 8.43 | 8.98 | | |
| % Moisture: | 33.00 | 33.57 | 34.41 | | |
| No. of Blows: | 33 | 24 | 16 | | |
| Liquid Limits: | 34 | 33 | 33 | | |



Material Identification:

TH 2
Depth: 25 ft.
Liquid Limit, %: 33
Plastic Limit, %: 13
Plasticity Index: 20
(LL-PL)

Plastic Limit Determination

| Dish No.: | 1 | 2 | 3 | | |
|------------------|-------|-------|-------|--|----|
| Wet Soil + Dish: | 12 | 11.42 | 12.18 | | |
| Dry Soil + Dish: | 11.08 | 10.62 | 11.28 | | |
| Moisture: | 0.92 | 0.8 | 0.9 | | |
| Dish: | 4.17 | 4.39 | 4.38 | | |
| Dry Soil: | 6.91 | 6.23 | 6.9 | | |
| % Moisture: | 13.31 | 12.84 | 13.04 | | |
| Average: | | | | | 13 |

Test Method : ASTM: D4318, D2216
HMCL Tech: GM
Date Tested: 08-Dec-17

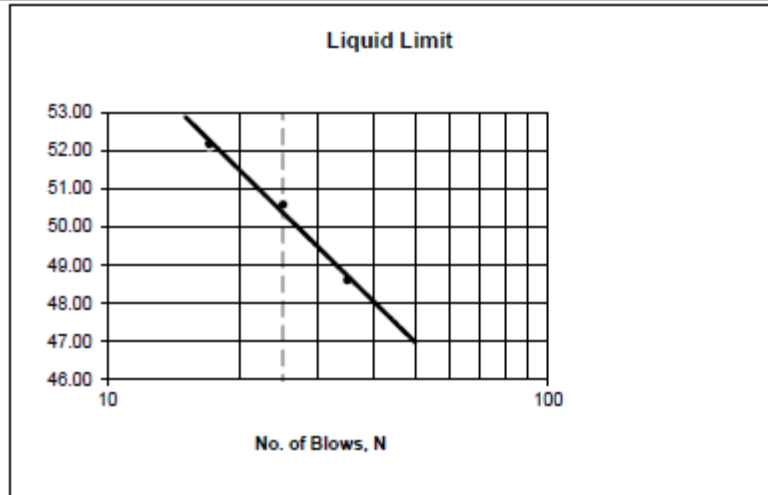
Reviewed by: Hermie Manalo

ATTERBERG LIMITS

CLIENT: South-Man Engineering PROJECT NO.: 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

Liquid Limit Determination

| Dish No.: | 1 | 2 | 3 | | Liquid Limit 25 Blows |
|------------------|-------|-------|-------|--|--------------------------|
| Wet Soil + Dish: | 13.91 | 14.41 | 14.31 | | |
| Dry Soil + Dish: | 10.75 | 11 | 10.85 | | |
| Moisture: | 3.16 | 3.41 | 3.46 | | |
| Dish: | 4.25 | 4.26 | 4.22 | | |
| Dry Soil: | 6.5 | 6.74 | 6.63 | | |
| % Moisture: | 48.62 | 50.59 | 52.19 | | |
| No. of Blows: | 35 | 25 | 17 | | |
| Liquid Limits: | 51 | 51 | 50 | | 50 |



Material Identification:

TH 3
Depth: 2 ft.
Liquid Limit, %: 50
Plastic Limit, %: 19
Plasticity Index: 31
(LL-PL)

Plastic Limit Determination

| Dish No.: | 1 | 2 | 3 | | |
|------------------|-------|-------|-------|--|----|
| Wet Soil + Dish: | 11.3 | 10.9 | 11.41 | | |
| Dry Soil + Dish: | 10.26 | 9.86 | 10.26 | | |
| Moisture: | 1.04 | 1.04 | 1.15 | | |
| Dish: | 4.64 | 4.43 | 4.26 | | |
| Dry Soil: | 5.62 | 5.43 | 6 | | |
| % Moisture: | 18.51 | 19.15 | 19.17 | | |
| Average: | | | | | 19 |

Test Method : ASTM: D4318, D2216
HMCL Tech: GM
Date Tested: 08-Dec-17

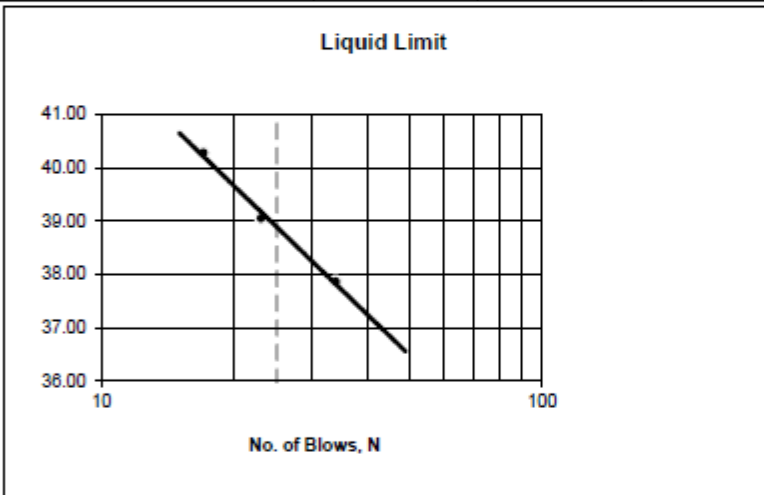
Reviewed by: Hermie Manalo

ATTERBERG LIMITS

CLIENT: South-Man Engineering PROJECT NO.: 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

Liquid Limit Determination

| Dish No.: | 1 | 2 | 3 | | Liquid Limit 25 Blows |
|------------------|-------|-------|-------|--|--------------------------|
| Wet Soil + Dish: | 15.52 | 14.84 | 14.23 | | |
| Dry Soil + Dish: | 12.43 | 11.86 | 11.39 | | |
| Moisture: | 3.09 | 2.98 | 2.84 | | |
| Dish: | 4.27 | 4.23 | 4.34 | | |
| Dry Soil: | 8.16 | 7.63 | 7.05 | | |
| % Moisture: | 37.87 | 39.06 | 40.28 | | |
| No. of Blows: | 34 | 23 | 17 | | |
| Liquid Limits: | 39 | 39 | 38 | | 39 |



Material Identification:

TH 3
Depth: 10 ft.
Liquid Limit, %: 39
Plastic Limit, %: 16
Plasticity Index: 23
(LL-PL)

Plastic Limit Determination

| Dish No.: | 1 | 2 | 3 | | |
|------------------|-------|-------|-------|--|----|
| Wet Soil + Dish: | 11.17 | 11.12 | 12.07 | | |
| Dry Soil + Dish: | 10.18 | 10.16 | 11 | | |
| Moisture: | 0.99 | 0.96 | 1.07 | | |
| Dish: | 4.22 | 4.23 | 4.3 | | |
| Dry Soil: | 5.96 | 5.93 | 6.7 | | |
| % Moisture: | 16.61 | 16.19 | 15.97 | | |
| Average: | | | | | 16 |

Test Method : ASTM: D4318, D2216
HMCL Tech: GM
Date Tested: 08-Dec-17

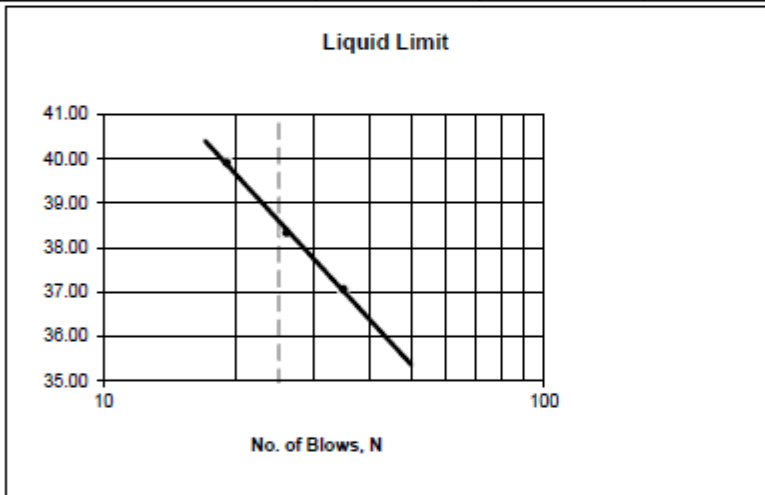
Reviewed by: Hermie Manalo

ATTERBERG LIMITS

CLIENT: South-Man Engineering PROJECT NO.: 101-1715
1599 Dugald Road
Winnipeg, MB R2J 0H3
ATTENTION: Peter Grieger
PROJECT: Westview

Liquid Limit Determination

| Dish No.: | 1 | 2 | 3 | | Liquid Limit 25 Blows |
|------------------|-------|-------|-------|--|--------------------------|
| Wet Soil + Dish: | 14.57 | 15.71 | 15.14 | | |
| Dry Soil + Dish: | 11.79 | 12.57 | 12.11 | | |
| Moisture: | 2.78 | 3.14 | 3.03 | | |
| Dish: | 4.29 | 4.38 | 4.52 | | |
| Dry Soil: | 7.5 | 8.19 | 7.59 | | |
| % Moisture: | 37.07 | 38.34 | 39.92 | | |
| No. of Blows: | 35 | 26 | 19 | | |
| Liquid Limits: | 39 | 39 | 39 | | |



Material Identification:

TH 3
Depth: 20 ft.
Liquid Limit, %: 39
Plastic Limit, %: 17
Plasticity Index: 22
(LL-PL)

Plastic Limit Determination

| Dish No.: | 1 | 2 | 3 | | |
|------------------|-------|-------|-------|--|----|
| Wet Soil + Dish: | 11.72 | 11.4 | 11.84 | | |
| Dry Soil + Dish: | 10.68 | 10.36 | 10.74 | | |
| Moisture: | 1.04 | 1.04 | 1.1 | | |
| Dish: | 4.33 | 4.21 | 4.25 | | |
| Dry Soil: | 6.35 | 6.15 | 6.49 | | |
| % Moisture: | 16.38 | 16.91 | 16.95 | | |
| Average: | | | | | 17 |

Test Method : ASTM: D4318, D2216
HMCL Tech: GM
Date Tested: 08-Dec-17

Reviewed by: Hermie Manalo

16 Appendix D – Correspondences

Westview Colony-Wastewater Treatment Lagoon

2 messages

Desalegn Edossa

Wed, Nov 22, 2017 at 9:49

<desalegn.southmaneng@gmail.com>

AM

To: "Butterfield, Tamara (SD)" <Tamara.Butterfield@gov.mb.ca>

Cc: Peter Grieger <peter@southmaneng.com>, "Matthews, Rob (SD)"

<Rob.Matthews@gov.mb.ca>

Dear Tamara,

I am contacting you once again for information regarding licensed surface water users. We are in the process of preparing a proposal for Environment Act Licence for the construction and operation of a Wastewater Treatment Lagoon for Westview Colony located at NW 22-14-21W in the Rural Municipality of Oakview. The Colony is planning to discharge the effluent to a roadside ditch (123W) west of the proposed development site which joins Broughton's Creek at about 17 km and eventually discharges to Lake Wahtopana at about 23 km downstream of the project site (discharge route plan is attached). Could you please provide us with information if there are licensed water users downstream of the development site up to Lake Wahtopana.

Regards,

--

=====
Desalegn Edossa (D.Eng., EIT)
South-Man Engineering,
15-1599 Dugald Rd,
Winnipeg, MB R2J 0H3
=====

Butterfield, Tamara (SD)

Thu, Nov 23, 2017 at 9:40

<Tamara.Butterfield@gov.mb.ca>

AM

To: Desalegn Edossa <desalegn.southmaneng@gmail.com>

Cc: Peter Grieger <peter@southmaneng.com>, "Stonehouse, Perry (SD)"

<Perry.Stonehouse@gov.mb.ca>

Hi Desalegn,

As per your request and map, there are no registered/licensed surface water projects in our database on the route indicated. But the Town of Rivers has a licensed pump site on Lake Wahtopana (Little Saskatchewan River) for municipal purposes. The pump site is downstream of where the route would enter Lake Wahtopana.

Please note, that we do not licence a project if the water use associated with the project falls below the domestic exemption category (< 25 000 Litres/day). Therefore, we would not have any records of domestic users in the area of interest.

Let me know if you need anything else.

I have copied Perry Stonehouse on this email as he is our Director and who I now report to.

Cheers,

Tamara

Ph. 204-945-7431

Cell 204-918-6273

Information about historical record of flooding in the area

Information about Flood History at NW 22-14-21W

3 messages

Desalegn Edossa

Wed, Nov 22, 2017 at 10:08

<desalegn.southmaneng@gmail.com>

AM

To: "Belton, Robert (MI)" <Robert.Belton@gov.mb.ca>

Cc: Peter Grieger <peter@southmaneng.com>, "Allum, Brad (MI)"

<Brad.Allum@gov.mb.ca>, "Methot, Michelle (MI)" <Michelle.Methot@gov.mb.ca>

Dear Robert,

I am contacting you once again for information about historical record of flood at NW 22-14-21W. A Wastewater Treatment Lagoon is proposed to be constructed for Westview Colony located at NW 22-14-21W in the Rural Municipality of Oakview. The colony is planning to discharge the treated effluent to a roadside ditch (123W) located west of the proposed site. Could you please let us know if there is any historical record of flooding in the proposed project site. Please also let us know if we need any prior authorization to discharge the effluent to this roadside ditch.

Regards,

--

=====
Desalegn Edossa (D.Eng., EIT)

South-Man Engineering,

15-1599 Dugald Rd,

Winnipeg, MB R2J 0H3

=====

Belton, Robert (MI) <Robert.Belton@gov.mb.ca> Mon, Nov 27, 2017 at 10:21 AM
To: Desalegn Edossa <desalegn.southmaneng@gmail.com>

Good morning Desalegn,

Water Management, Planning and Standards do not possess any historic flood imagery, water levels, or LiDAR topographic information for this location. We are not aware of any major overland flooding, but as noted our information is limited.

I can confirm we do not require a Provincial Waterways Authorization for discharge into the adjacent roadside ditch as that ditch is not a Provincial Waterway. I would suggest contacting the Little Saskatchewan River Conservation District for further information as they may have requirements.

Regards,

Robert

Westview Colony Wastewater Treatment Lagoon

1 message

Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca> Mon, Dec 4, 2017 at 10:12 AM
To: "desalegn.southmaneng@gmail.com" <desalegn.southmaneng@gmail.com>

Desalegn

Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's rare species database and found no occurrences at this time for your area of interest.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. An absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present; in many areas, comprehensive surveys have never been completed. Therefore, this information should be regarded neither as a final statement on the occurrence of any species of concern, nor as a substitute for on-site surveys for species as part of environmental assessments.

Because the Manitoba CDC's Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request. Please contact the Manitoba CDC for an update on this natural heritage information if more than six months pass before it is utilized.

Third party requests for products wholly or partially derived from Biotics must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using Biotics data, as follows as: Data developed by the Manitoba Conservation Data Centre; Wildlife & Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or

approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information please contact me directly at (204) 945-7747.

Chris Friesen
Coordinator
Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
<http://www.manitoba.ca/sd/cdc/>

-----Original Message-----

From:
Sent: November-22-17 9:20 AM
To: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Subject: WWW Form Submission

Below is the result of your feedback form. It was submitted by WWW Information Request () on Wednesday, November 22, 2017 at 09:19:43

DocumentID: Manitoba_Conservation

Project Title: Westview Colony Wastewater Treatment Lagoon

Date Needed: 2017/11/29

Name: Desalegn Edossa

Company/Organization: South-Man Engineering

Address: 15-1599 Dugald Rd

City: Winnipeg

Province/State: MB

Phone: 204-668-9652

Fax: 204-668-9204

Email: desalegn.southmaneng@gmail.com

Project Description: The information will be used to determine the impacts on species by the proposed wastewater treatment lagoon.

Information Requested: Would like to know if there is any species at risk or endangered in the region that may be impacted by the wastewater treatment lagoon.

Format Requested: Microsoft Word Document as email attachment.

Location: NW 22-14-21W in the RM of Oakview.

action: Submit

Information about heritage sites in the area



Memorandum

DATE: December, 2017

TO: Desalegn Edossa
South-Man Engineering
15-1599 Dugald Rd,
Winnipeg, MB R2J 0H3
Phone: (204) 688-9652
Fax: (204) 688-9204
desalegn.southmaneng@gmail.com

FROM: Perry Blomquist
Archaeological
Services Officer
Historic Resources
Branch
Main Floor 213 Notre
Dame Avenue
Winnipeg MB
R3B 1N3
PHONE NO: (204) 945-1071

SUBJECT: RM Oakiew
Wastewater Treatment Lagoon
NW-22-14-21-W

HRB FILE: AAS-17-12532

Further to your memo regarding the above-noted Wastewater Treatment Lagoon project, I have examined the locations in conjunction with Branch records for areas of potential concern. The potential to impact significant heritage resources has been deemed low for this development therefore, the Historic Resources Branch has no concerns with the project.

If at any time however, heritage resources are encountered in association with these lands during development, the Historic Resources Branch may require that an acceptable heritage resource management strategy be implemented by the developer to mitigate the affects of development on the heritage resources.

If you have any questions or comments, please feel free to contact me (Perry Blomquist), Archaeological Assessment Services at: 945-1071.

Perry Blomquist

17 Appendix E - Design Drawings

PROJECT NAME:

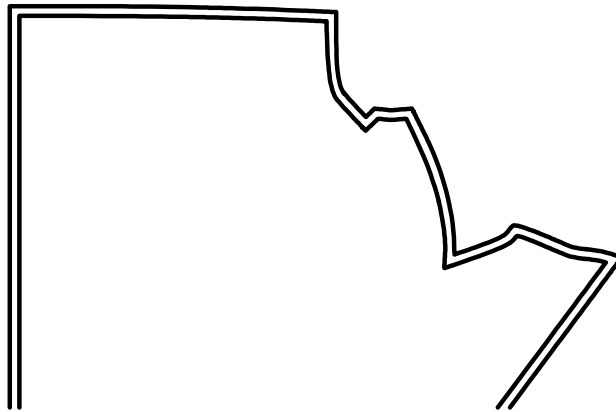
WESTVIEW COLONY

S¹/₂ NW 22-14-21W

RM of OAKVIEW

CLAY-LINED

DOMESTIC WASTE WATER LAGOON



South-Man Engineering



UNIT 15-1599 DUGALD ROAD | WINNIPEG, MANITOBA | R2J 0H3

PH: 204.668.9652 | FAX: 204.668.9204

sme@southmaneng.com

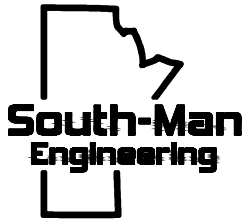
| SHT NO. | SHEET SCHEDULE |
|---------|-------------------------------------|
| CS | COVER SHEET |
| GN-1 | GENERAL NOTES |
| GN-2 | GENERAL NOTES |
| GN-3 | GENERAL NOTES |
| S-P | SITE PLAN |
| S-1 | FLOOR PLAN |
| S-2 | CROSS-SECTION DETAILS |
| S-3 | INLET PIPING AND SPLASH PAD DETAILS |
| S-4 | TRENCH DETAIL |
| S-5 | RAMP DETAILS |
| S-6 | REBAR SPLICE DETAIL |
| S-7 | GATE VALVE DETAILS |
| S-8 | GATE & FENCE DETAIL |
| | |

| | | | |
|--|--|--|--------------------|
| PROJECT NAME WESTVIEW COLONY S ¹ / ₂ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE COVER SHEET | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE N/A | SHEET NUMBER CS |
| THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | | |

GENERAL NOTES:

THIS WASTEWATER LAGOON AND ASSOCIATED PRODUCTS SHALL CONFORM TO ASTM AND AWWA STD. SPECIFICATIONS. ALL CONSTRUCTION SHALL CONFORM TO SPECIFICATIONS.

- STRIP ALL ORGANIC MATERIAL AND TOPSOIL FROM STORAGE SITE TO OUTSIDE TOE OF BERM. REMOVE MATERIAL TO STOCK PILE FOR USE IN LANDSCAPING IN THE FUTURE.
- PROVIDE A 0.30m DEEP X 2.44m WIDE KEYWAY BENEATH BERMS PRIOR TO STARTING CONSTRUCTION OF BERMS. REMOVE ALL TOP SOIL AND ORGANIC MATERIAL BENEATH NEW BERM CONSTRUCTION.
- CONSTRUCT BERMS IN MAXIMUM 150mm LIFTS. COMPACT EACH LIFT USING A FULLY BALLASTED SHEEPSFOOT PACKER (2400kPa OF COMPACTION PRESSURE) TO ACHIEVE 95% OF STANDARD PROCTOR DENSITY. PRIOR APPROVAL REQUIRED FOR OTHER TYPES OF PACKING EQUIPMENT.
- UNACCEPTABLE MATERIAL CONSISTING OF ORGANIC MATERIAL, HIGH PERCENTAGE SILT AND SAND, FROZEN SOIL OR STONES GREATER THAN 75mm SHALL NOT BE USED IN CONSTRUCTION OF THE BERMS. CONSULT ENGINEER IF QUALITY OF MATERIAL IS QUESTIONABLE.
- STORAGE IS TO BE CONSTRUCTED WITH A 1.0m THICK RE-COMPACTED CLAY LINER OVER THE ENTIRE INTERIOR SURFACE OF STORAGE. RE-COMPACTED LAYER TO BE CONSTRUCTED IN MAXIMUM 150mm LIFTS AND COMPACTED TO 95% OF MAXIMUM DRY DENSITY. DISCING OF CONSECUTIVE LAYERS MAY BE REQUIRED WHERE COMPACTION ALONE DOES NOT SUFFICIENTLY DISTURB THE INTERNAL SOIL STRUCTURE.
- ANY POCKETS OR SEAMS OF UNSUITABLE MATERIAL ENCOUNTERED ARE TO BE EXCAVATED AND REMOVED TO STOCKPILE. DO NOT INCLUDE IN LINER CONSTRUCTION.
- DRYING BETWEEN CONSECUTIVE LIFTS IS TO BE AVOIDED TO ENSURE THE NEW LIFT WILL PROPERLY BLEND WITH THE PREVIOUS LAYER. IF THE SURFACE HAS DRIED, SCARIFICATION USING A DISC WILL BE REQUIRED PRIOR TO PLACING NEW MATERIAL.
- THE MOISTURE CONTENT OF THE FILL MATERIAL SHALL BE SUCH THAT PROPER PACKING CAN BE ACHIEVED (0.9-1.2 OPTIMUM). MATERIAL SHOULD BE STIFF TO THE TOUCH BUT NOT CRUMBLE WHEN HANDLED. ALLOW DRYING OR PROVIDE WETTING BETWEEN CONSECUTIVE LIFTS AS REQUIRED.
- SEED BERMS WITH GRASS TO PREVENT LONG TERM EROSION.
- RAMPS TO BE CONSTRUCTED USING 150mm REINFORCED CONCRETE, C/W 10M @ 400mm O/C BOTH WAYS. WHERE LIQUIDS RUN DOWN SLOPE, PROVIDE RAISED EDGES TO CONTAIN FLOW. ACCESS RAMPS TO HAVE 150mm WIDE BY 300mm HIGH RAISED CURB ALONG EDGES. MAXIMUM OPENING SIZE IN CURBS TO BE 150mmØ.
- MINIMUM SPLICE LENGTH FOR 10M REINFORCING BARS TO BE 450mm.
- ALL CONCRETE TO BE 25MPa TYPE 10 W/5-7% AIR ENTRAINMENT.
- CONCRETE PLACED IN COLD WEATHER (BELOW 0°C AIR TEMP. AND WINDCHILL) SHALL BE PROTECTED WITH INSULATED TARPS. BELOW -3°C CONCRETE IS TO BE HEATED TO MAINTAIN 10° CELSIUS FOR A MINIMUM OF TWO DAYS AFTER PLACEMENT. REMOVE INSULATION AND HEATING GRADUALLY TO AVOID THERMAL SHOCK.
- SIGNAGE SHALL BE PROVIDED INDICATING THAT POTENTIAL FOR DANGER EXISTS.
- SIGNAGE SHALL BE POSTED IN ACCORDANCE TO ASAE S441 AND INCLUDE CONTACT NUMBERS IN CASE OF EMERGENCY.
- INSTALL FENCE AROUND ENTIRE PERIMETER OF WASTE WATER STORAGE AS PER DETAIL ATTACHED.

| | | | | |
|---|-------------------------------------|------------------------------------|-----|--|
|  <p>15-1599 Dugald Road Winnipeg, Manitoba R2J 0H3 PH. (204) 668-9652 FAX (204) 668-9204</p> | PROJECT NAME | BUILDING AREA | | |
| | WESTVIEW COLONY S ½ NW 22-14-21W | | N/A | |
| | SHEET TITLE | DRAWN BY | | |
| | GENERAL NOTES | R. FLORES SOUTH-MAN ENGINEERING | | |
| DATE DRAWN | DRAWING SCALE | SHEET NUMBER | | |
| DECEMBER 2017 | N/A | GN-1 | | |
| THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | | | |

QUALITY CONTROL/QUALITY ASSURANCE PROTOCOL

CLAY-LINER QUALITY:

PRIOR TO THE INITIATION OF THE LINER INSTALLATION, THE REQUIREMENTS FOR THE LINER MATERIAL ARE DISCUSSED WITH THE CONTRACTOR AND HIS OPERATORS TO ESTABLISH WHAT IS ACCEPTABLE MATERIAL. IN THE EVENT THAT AN EXCAVATOR IS ON SITE AT THIS TIME, TEST PITS ARE PERFORMED TO DEMONSTRATE THE EXTENT OF ACCEPTABLE MATERIAL. DURING THE COURSE OF CONSTRUCTION, VISUAL INSPECTION AND HAND TEXTURING ARE PERFORMED TO VERIFY ACCEPTABLE MATERIAL PROPERTIES.

PRE-CONSTRUCTION – SUB-GRADE PREPARATION

A PRE-CONSTRUCTION INSPECTION IS CARRIED OUT PRIOR TO THE COMMENCEMENT OF BERM CONSTRUCTION TO ENSURE ALL ORGANIC MATERIAL AND TOPSOIL HAS BEEN STRIPPED FROM THE STORAGE SITE.

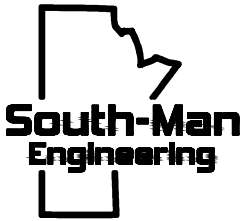
BERM CONSTRUCTION

THE SITE IS ATTENDED AT VARIOUS STAGES OF BERM CONSTRUCTION. BERM COMPACTION IS MONITORED AT FREQUENT INTERVALS THROUGHOUT BERM CONSTRUCTION BY A THIRD PARTY (INDEPENDENT) LABORATORY IN ACCORDANCE WITH ASTM D6938 FOR IN-PLACE DENSITY AND WATER CONTENT OF SOIL AND SOIL AGGREGATE BY NUCLEAR METHODS. WHERE FILL MATERIAL PROPERTIES CHANGE, ADDITIONAL TESTS ARE PERFORMED TO HAVE REPRESENTATIVE RESULTS DURING DIFFERENT STAGES OF CONSTRUCTION. DRY BULK DENSITY MEASUREMENTS ARE COLLECTED TWO (2) TIMES WHERE THE FILL DEPTH IS GREATER THAN 0.50m, BUT LESS THAN 1.0m. SUBSEQUENTLY, A MINIMUM OF ONE (1) DRY DENSITY MEASUREMENT IS TAKEN FOR EACH ADDITIONAL 1.0m OF FILL, AT REPRESENTATIVE LOCATIONS THROUGHOUT THE STORAGE.

WHERE A COMPACTED CLAY LINER IS INSTALLED, STANDARD PROCTOR DENSITY TESTS ARE PERFORMED BY A THIRD PARTY (INDEPENDENT) LABORATORY ACCORDING TO ASTM D698 TO DETERMINE THE DRY UNIT WEIGHT AND MOISTURE CONTENT FOR EACH SOIL TYPE USED IN THE COMPACTED CLAY-LINER. WHERE THE LINER MATERIAL IS DEEMED TOO WET, THE AFFECTED MATERIAL IS REMOVED, REPLACED OR MANIPULATED TO PROVIDE DRYING, AND RE-COMPACTED WITH NEW MATERIAL TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY. VISUAL VERIFICATION OF FILL MATERIAL IS PERFORMED THROUGHOUT, AND REMEDIAL MEASURES ARE TAKEN AS NECESSARY.

PIPELINE INSTALLATION

AT THE TIME OF THE PIPELINE INSTALLATION, THE SITE IS ATTENDED TO VERIFY THE PIPELINE MATERIAL, SPECIFICATIONS AND INSTALLATION TECHNIQUES. PRESSURE TESTING OF PIPELINES ARE PERFORMED AS PER MWSB PIPELINE PRESSURE TESTING PROTOCOL.

| | | | |
|--|--|--|----------------------|
|  15-1599 Dugald Road Winnipeg, Manitoba R2J 0H3 PH. (204) 668-9652 FAX (204) 668-9204 | PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | BUILDING AREA N/A | |
| | SHEET TITLE GENERAL NOTES | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| | DATE DRAWN DECEMBER 2017 | DRAWING SCALE N/A | SHEET NUMBER GN-2 |
| | THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | |

QUALITY CONTROL/QUALITY ASSURANCE PROTOCOL (continued...)

INSTALLATION OF APPURTENANCES

CONCRETE QUALITY TESTING IS NOT PERFORMED FOR THE INSTALLATION OF CONCRETE RAMPS, SPLASH PADS, AND THRUST BLOCKS. CONCRETE STRENGTH AND PRESENCE OF AIR ENTRAINMENT IS VERIFIED FROM DELIVERY SLIP FROM REDIMIX SUPPLIER.

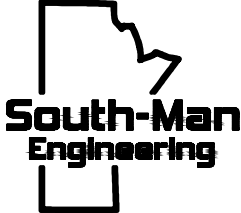
WITH REGARDS TO CONCRETE RAMPS AND SPLASH PADS, INSPECTION OF THE REINFORCING STEEL IS CARRIED OUT PRIOR TO CLOSING OR CONCEALING OF ANY OF THE WORK BY FORMING, OR OTHER SUCH BARRIERS THAT WOULD MAKE INSPECTION OF THE COMPLETE INSTALLATION NOT POSSIBLE. THE INSPECTION CONSISTS OF VERIFICATION OF REBAR SIZE AND GRADE, SPLICE LENGTHS AND OFFSETS, PLACEMENT OF STEEL IN ASSEMBLY INCLUDING SPACERS AND/OR CHAIRING TO ENSURE APPROPRIATE CONCRETE COVER, AND APPROPRIATE TYING OF STEEL TO KEEP REINFORCING IN PLACE DURING CONCRETE PLACEMENT. WHERE THE INSTALLATION OF REINFORCING IS NOT COMPLETE DURING THE PRELIMINARY INSPECTION, A SUBSEQUENT INSPECTION IS CARRIED OUT PRIOR TO POURING TO VERIFY THAT THE REMAINING WORK WAS COMPLETED SATISFACTORILY.

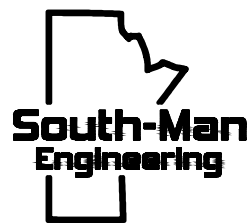
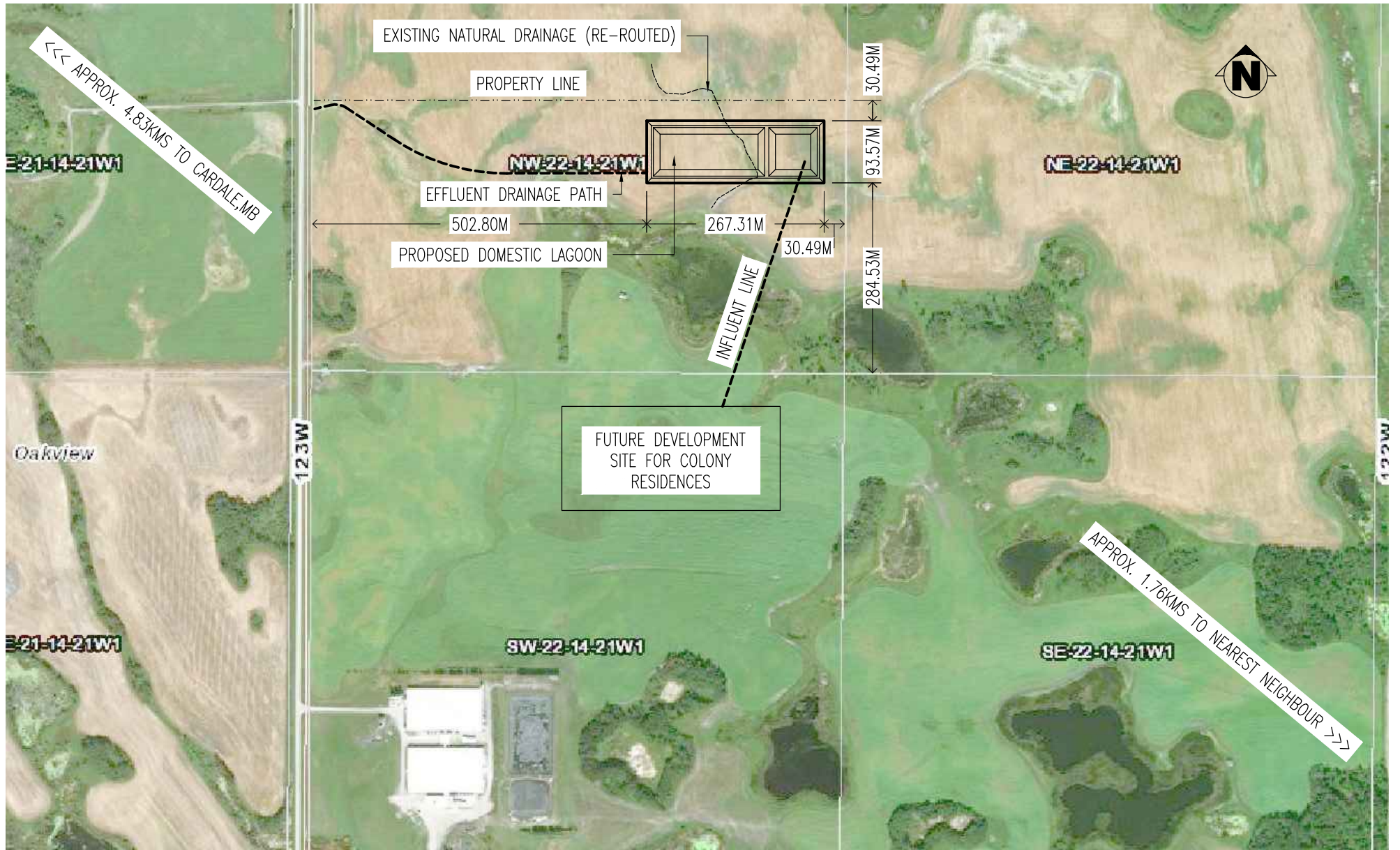
DURING THE PLACEMENT OF THE CONCRETE, MONITORING OF THE POUR IS PROVIDED TO ENSURE THAT PLACEMENT TECHNIQUES AND CONSOLIDATION OF CONCRETE IS CONSISTENT WITH NORMAL STANDARDS OF PRACTICE. WHILE ON-SITE, THE METHOD OF CURING IS ALSO ESTABLISHED BASED ON THE CONDITIONS EXPERIENCED ON-SITE THAT DAY. APPROPRIATE MEASURES ARE EMPLOYED IN ORDER TO PREVENT RAPID DRYING, OR TO PROVIDE TEMPERATURE PROTECTION AS MAY BE DEEMED NECESSARY.

CERTIFICATION

A FINAL INSPECTION IS CARRIED OUT AFTER COMPLETION OF CONSTRUCTION WORK, BUT PRIOR TO THE COMMISSIONING OF THE LAGOON. AT THIS TIME, TOP OF BERM AND FLOOR ELEVATIONS ARE CONFIRMED AND INFORMATION FOR RECORD DRAWINGS IS COLLECTED.

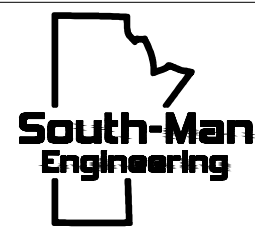
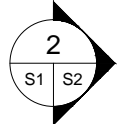
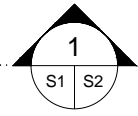
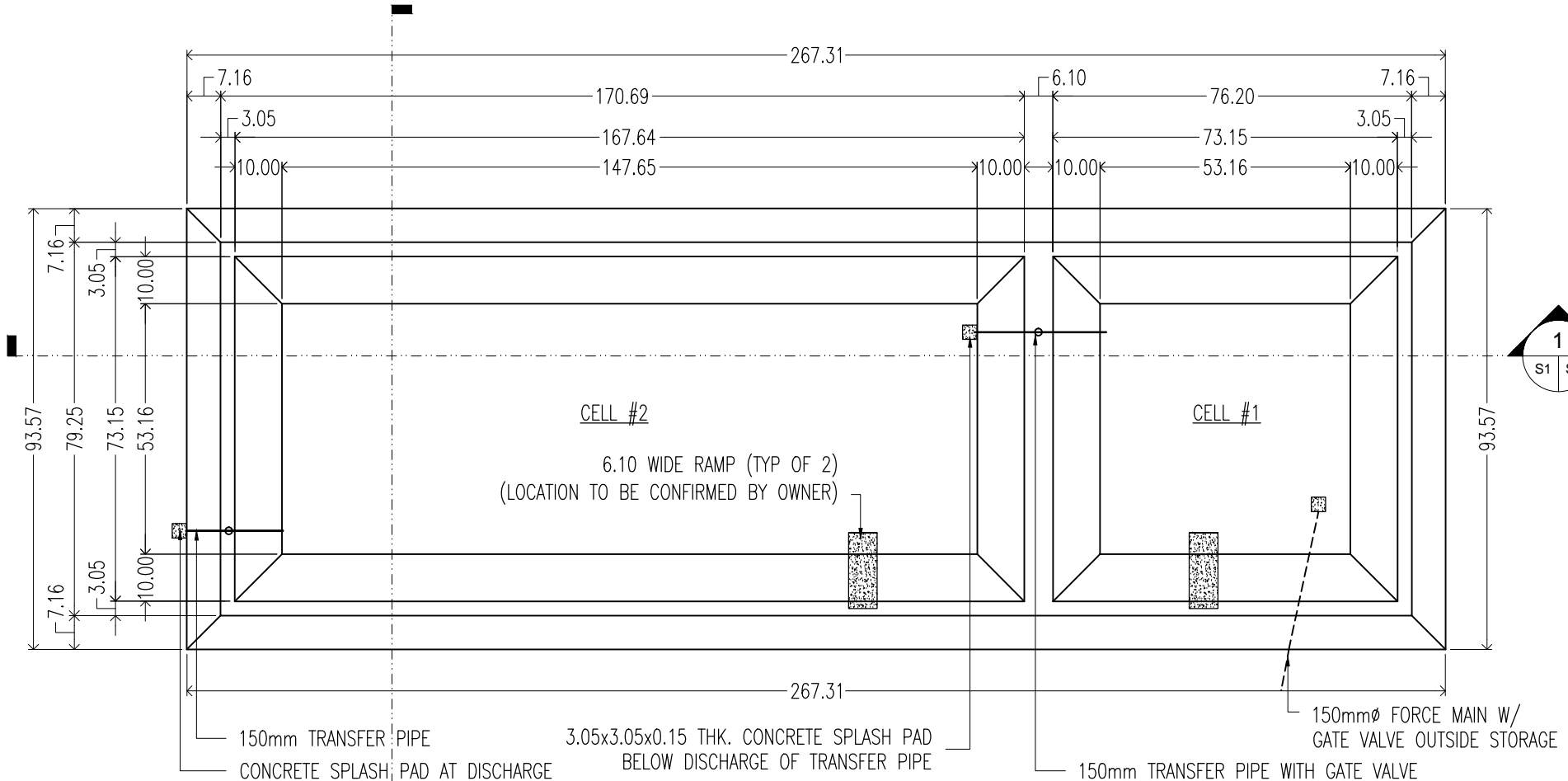
WHERE A CLAY LINER IS INSTALLED, THE THICKNESS OF THE CLAY LINER IS DETERMINED TO ENSURE A THICKNESS OF 39" (1 METER) OVER THE EXTENT OF THE ENTIRE AREA BY PERFORMING RANDOM SAMPLING. SHELBY TUBES ARE TAKEN, AND HYDRAULIC CONDUCTIVITY TESTS ARE PERFORMED TO DEMONSTRATE THAT THE "AS-CONSTRUCTED" CLAY LINER HAS A HYDRAULIC CONDUCTIVITY OF 1×10^{-9} M/S OR LESS.

| | | | |
|--|---|---|-----------------------------|
|  <small>15-1599 Dugald Road Winnipeg, Manitoba R2J 0H3 PH. (204) 668-9652 FAX (204) 668-9204</small> | PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | BUILDING AREA N/A | |
| | SHEET TITLE GENERAL NOTES | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| | DATE DRAWN DECEMBER 2017 | DRAWING SCALE N/A | SHEET NUMBER GN-3 |
| | THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | |



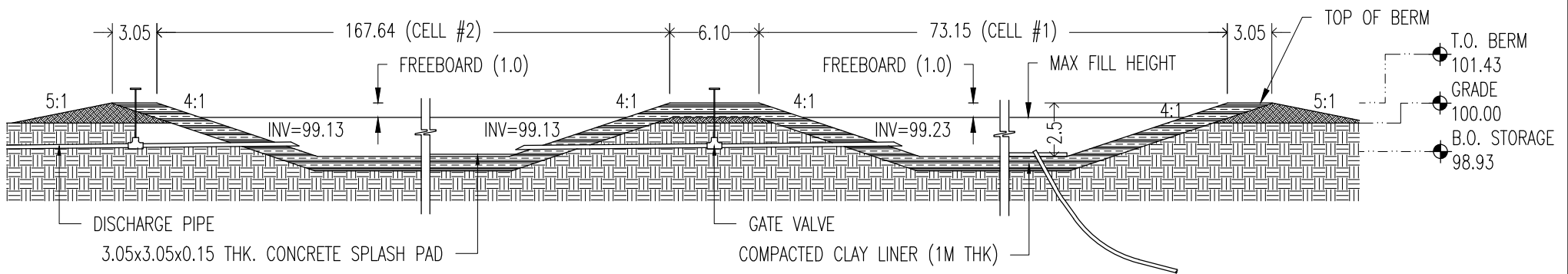
15-1599 Dugald Road | Winnipeg, Manitoba | R2J 0H3
 PH. (204) 668-9652 | FAX (204) 668-9204

| | | | |
|--|--|--|--------------------|
| PROJECT NAME WESTVIEW COLONY S 1/2 NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE SITE PLAN | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE METRIC | SHEET NUMBER SP |
| THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | | |

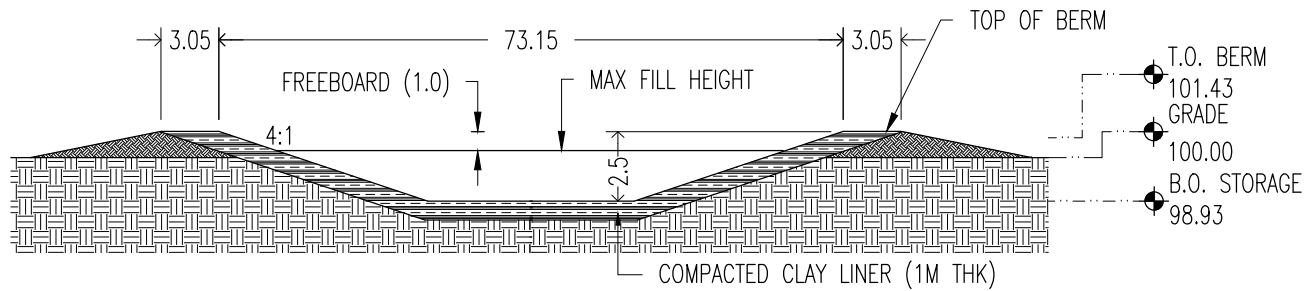


15-1599 Dugald Road | Winnipeg, Manitoba | R2J 0H3
PH. (204) 668-9652 | FAX (204) 668-9204

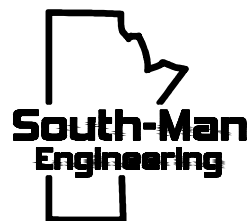
| | | | |
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| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE FLOOR PLAN | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE METRIC | SHEET NUMBER S-1 |
| THIS DRAWING IS THE PROPERTY OF SOUTH-MAN ENGINEERING, WINNIPEG, MANITOBA, CANADA. | | | |



1 CROSS SECTION DETAIL
 S1 S2 SCALE METRIC

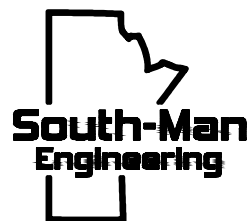
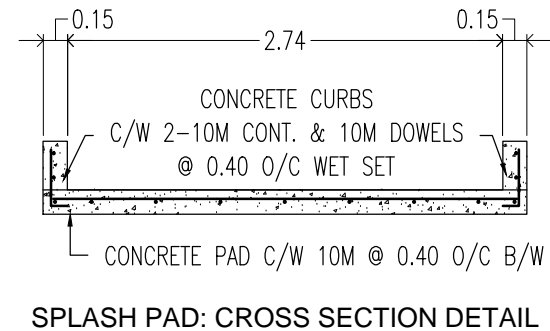
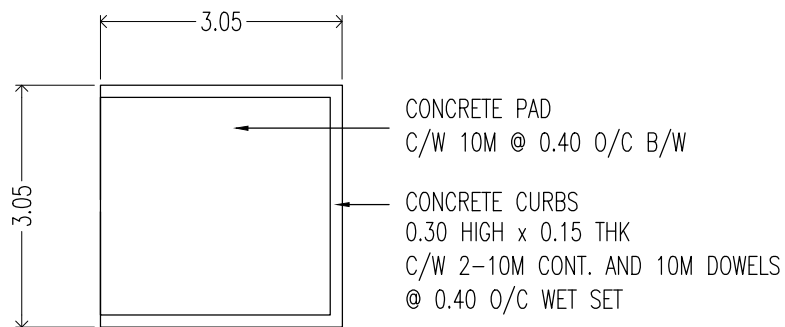
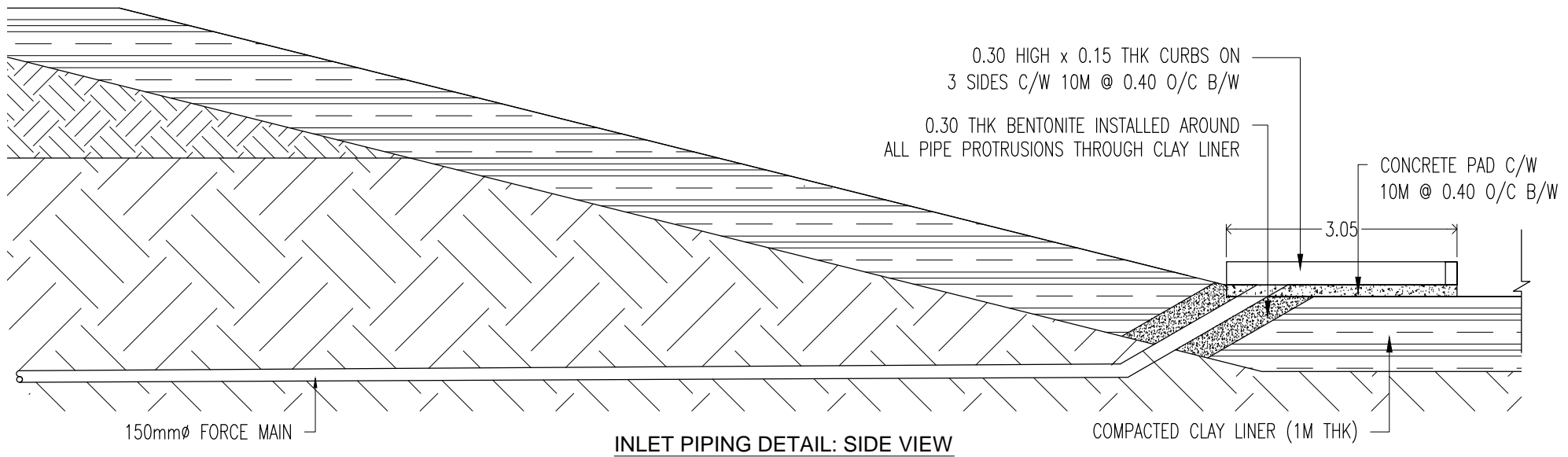


2 CROSS SECTION DETAIL
 S1 S2 SCALE METRIC



15-1599 Dugald Road | Winnipeg, Manitoba | R2J 0H3
 PH. (204) 668-9652 | FAX (204) 668-9204

| | | | |
|--|--|--|---------------------|
| PROJECT NAME WESTVIEW COLONY S 1/2 NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE CROSS SECTION DETAILS | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE AS NOTED | SHEET NUMBER S-2 |
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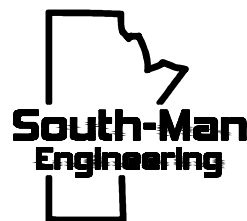
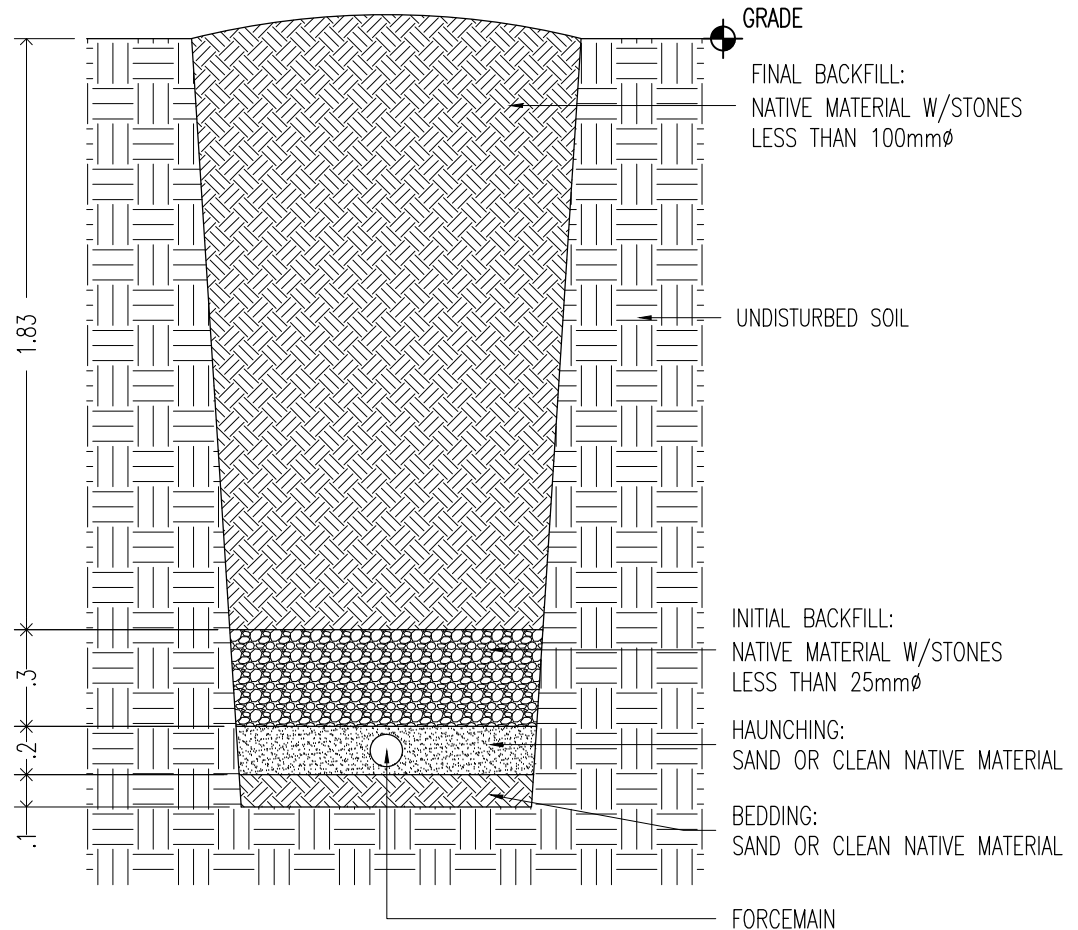


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| | | | |
|--|--|--|---------------------|
| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE INLET PIPING & CHECK VALVE DETAILS | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE METRIC | SHEET NUMBER S-3 |
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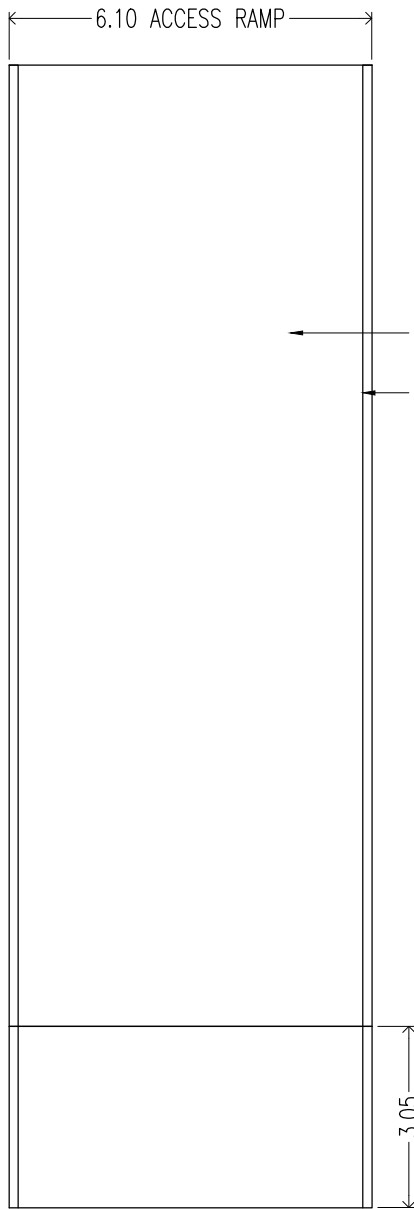
PIPING GENERAL NOTES:

1. ALL PIPELINE CONSTRUCTION AND PRODUCTS INCORPORATED INTO PROJECT SHALL CONFORM TO ASTM AND AWWA STANDARD SPECIFICATIONS.
2. INSTALLATION TO CONFORM WITH PIPE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
3. FROZEN MATERIAL SHOULD NOT BE USED TO SUPPORT OR BED THE PIPE.
4. AT LEAST 100mm OF BEDDING MATERIAL SHOULD BE PLACED UNDER THE PIPE IF ROCKY CONDITIONS EXIST. PROJECTING BELLS OF THE PIPE SHOULD BE PROPERLY RELIEVED IN THE TRENCH BOTTOM SO THAT THE ENTIRE PIPE IS EVENLY SUPPORTED BY THE BEDDING.
5. DO NOT THROW THE PIPE & FITTINGS INTO THE TRENCH, OR ALLOW ANY PART OF THE PIPE TO TAKE AN UNRESTRAINED FALL ON TO THE TRENCH BOTTOM.
6. PIPE MACHINING & CHAMFERING:
CUT PIPE SHOULD BE CUT AS SQUARE AS POSSIBLE AND CHAMFERED SIMILAR TO THE PIPE SUPPLIED FROM THE FACTORY.
7. WHERE THE PIPE LINE EXPERIENCES CHANGES IN DIRECTION, THRUST BLOCKS CONSISTING OF CONCRETE ARE TO BE INSTALLED. MINIMUM THRUST BLOCK AREA IS 1.8msq. CONCRETE USED FOR THRUST BLOCKS ARE TO HAVE A MIN. 28 DAY COMPRESSIVE STRENGTH OF 15MPa. CONCRETE SHALL BE SULPHATE RESISTANT (TYPE GU/TYPER 10 CEMENT), AND FOLLOW THE CURRENT CSA STANDARD A23.1. WATER USED FOR CONCRETE SHALL BE CLEAN AND EQUAL TO POTABLE (DRINKABLE) WATER IN PHYSICAL AND CHEMICAL PROPERTIES.
8. PRESSURE PIPE & FITTINGS TO MEET THE FOLLOWING STANDARDS
CANADIAN STANDARDS ASSOCIATION
B137.2 RIGID PVC PIPE FOR PRESSURE APPLICATIONS
B137.3 LARGE DIAMETER FABRICATED FITTINGS
AMERICAN WATER WORKS ASSOCIATION
AWWA C900 PVC PRESSURE PIPE, 1.2m THROUGH - 3.7m FOR WATER
AWWA C907 PVC PRESSURE FITTINGS FOR WATER - 1.2m THROUGH 3.7m
ASTM D2241 PVC PRESSURE RATED PIPE (SDR SERIES) OR DR17 HDPE PIPE
PIPING: SCHEDULE 40 PVC GLUED CONNECTIONS, SDR26 SERIES 160 PVC OR DR17 HDPE
9. ALL UNDERGROUND PIPING IS TO BE PRESSURE TESTED TO ENSURE THE INTEGRITY OF THE PIPE AND CONNECTIONS. THE PRESSURE TEST SHALL BE CARRIED OUT AT 700 kPa PRESSURE WITH PRESSURE DROP OVER 1 HR PERIOD NOT TO EXCEED 1.5%.
10. CLEANOUTS TO BE PROVIDED ON PIPELINE AT MAXIMUM 300m (1000 ft) INTERVALS.

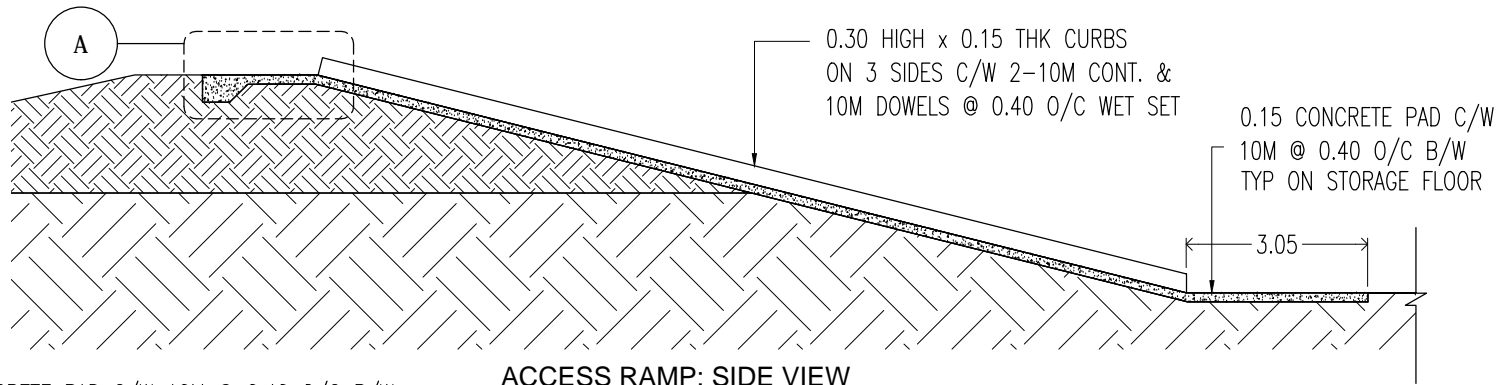


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|--|--------------------------------|--|
| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A |
| SHEET TITLE TRENCH DETAIL | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING |
| DATE DRAWN DECEMBER 2017 | DRAWING SCALE METRIC | SHEET NUMBER S-4 |
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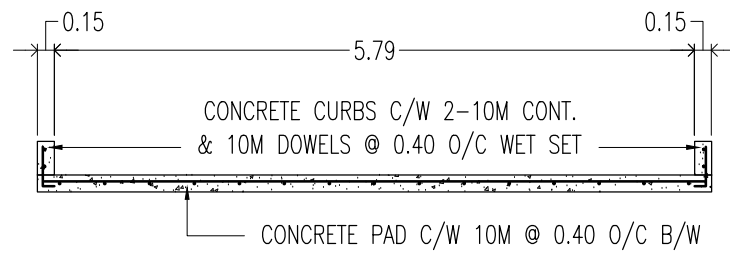


ACCESS RAMP: TOP VIEW

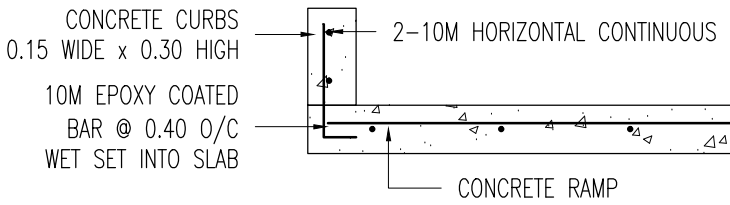


ACCESS RAMP: SIDE VIEW

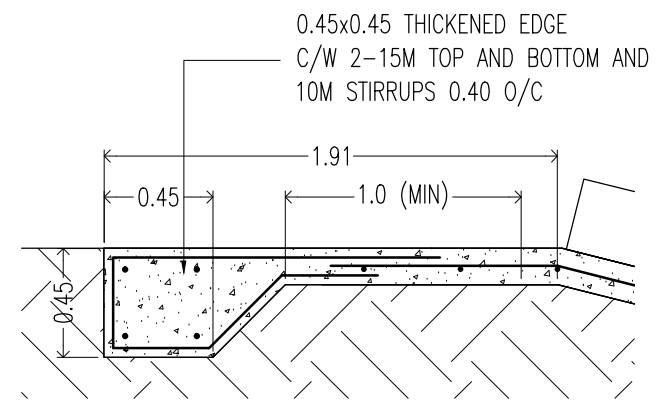
CONCRETE PAD C/W 10M @ 0.40 O/C B/W
 CONCRETE CURBS 0.30 HIGH x 0.15 THK
 C/W 2-10M CONT. AND 10M DOWELS @ 0.40 O/C WET SET



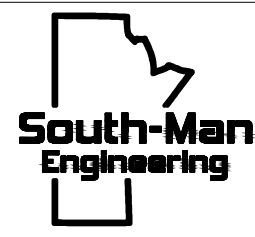
ACCESS RAMP: CROSS SECTION DETAIL



ACCESS RAMP CURBS: CROSS SECTION DETAIL

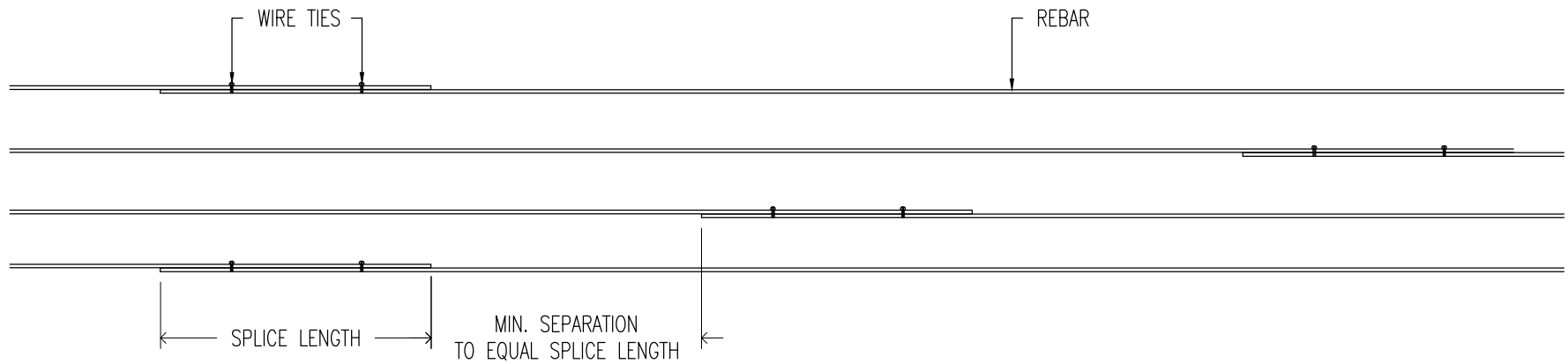


ACCESS RAMP: ANCHORAGE DETAIL



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|--|--|--|----------------------------|
| PROJECT NAME WESTVIEW COLONY S 1/2 NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE RAMP DETAILS | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE METRIC | SHEET NUMBER S-5 |
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REBAR SPLICE DETAIL

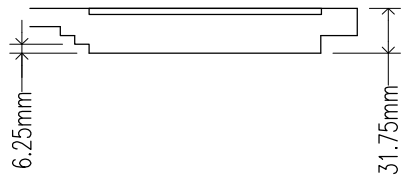
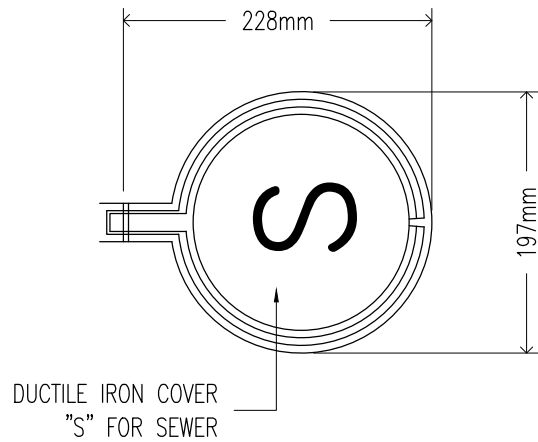
NOTE:

- SPLICE POSITION REPEATED MAX. EVERY 4TH ROW.
- ALTERNATELY IF SPLICES ALIGNED INCREASE SPLICE LENGTH BY 50% (10M-27", 15M-36").

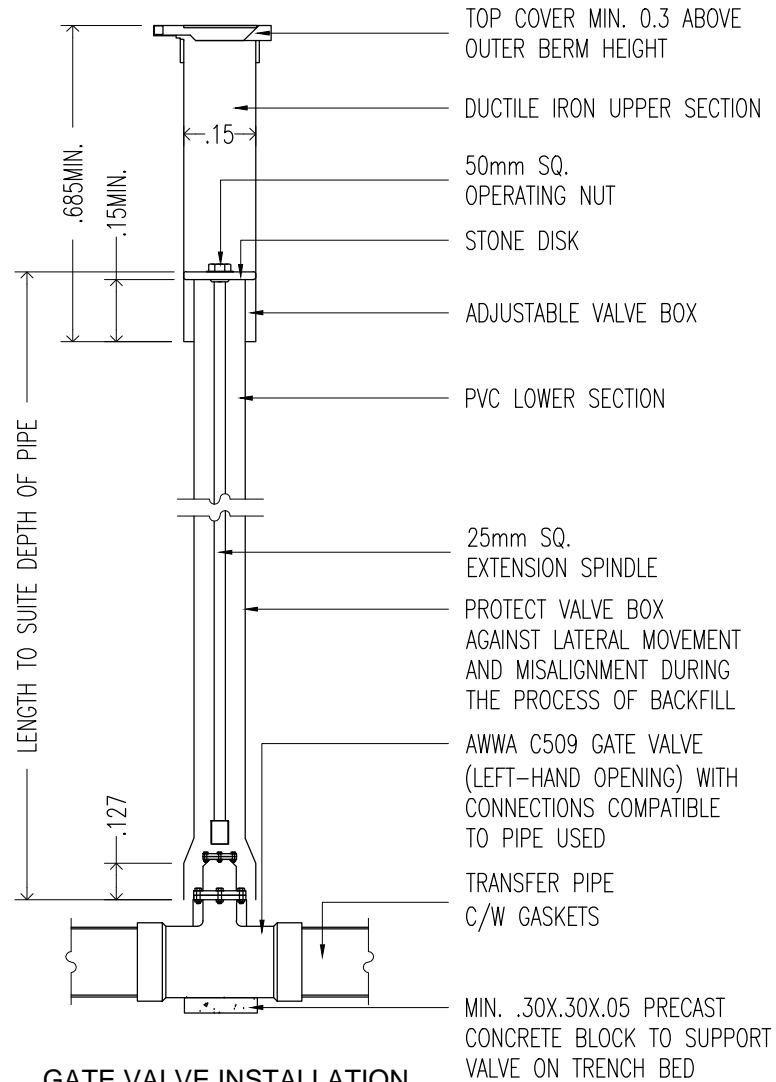


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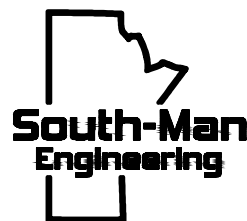
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| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE REBAR SPLICE DETAILS | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE N.T.S. | SHEET NUMBER S-6 |
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GATE VALVE COVER

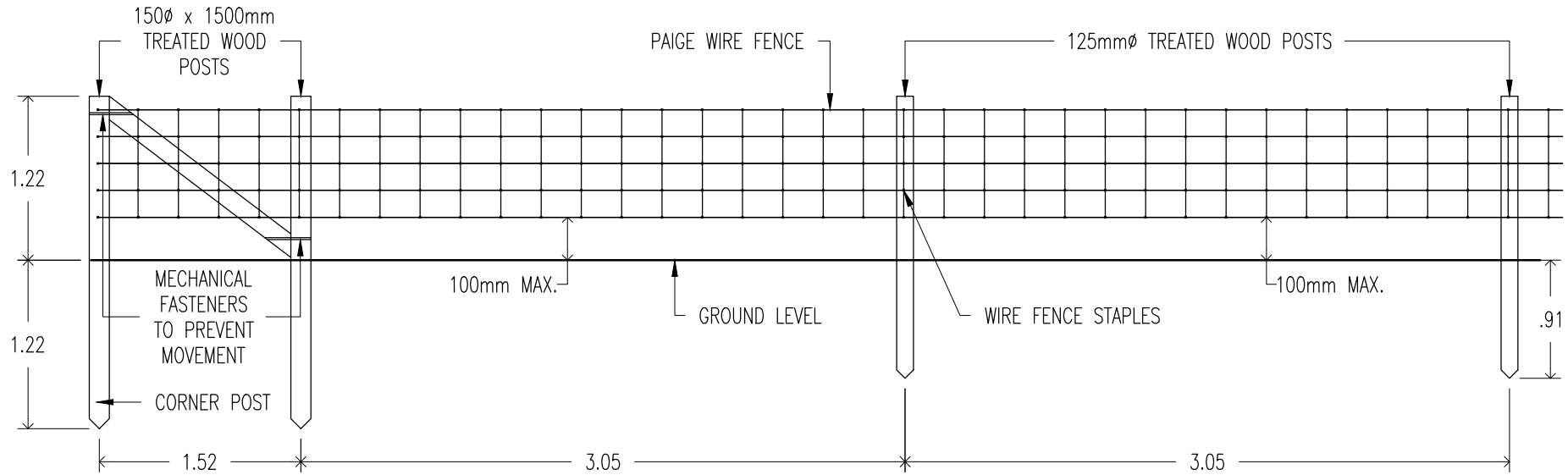


GATE VALVE INSTALLATION

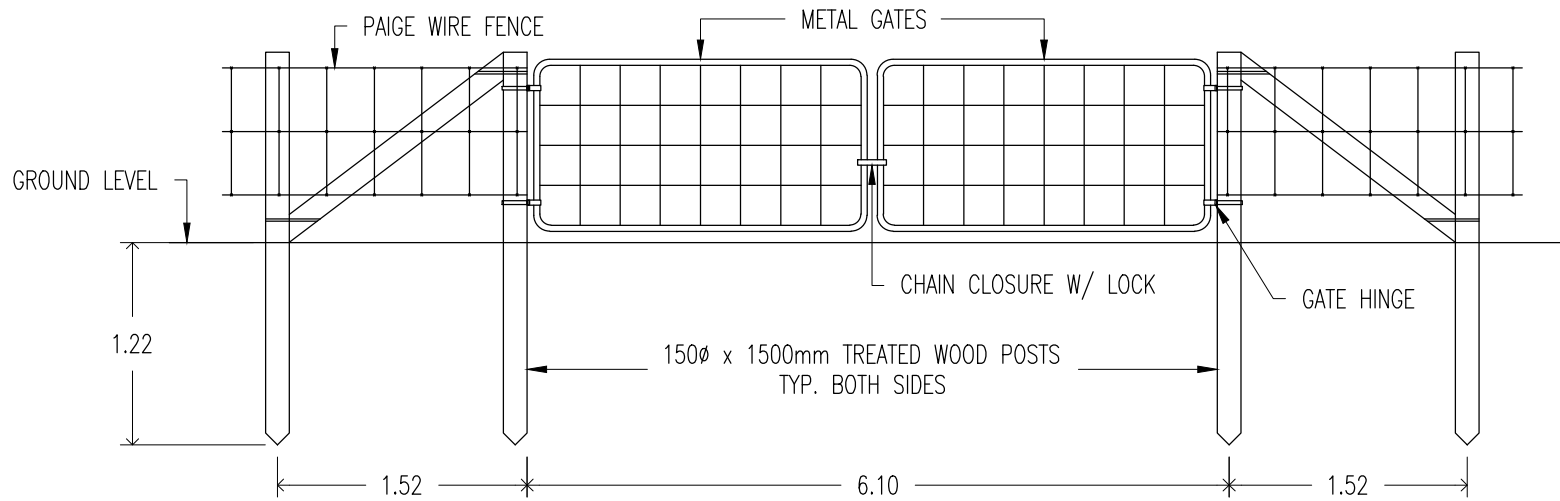


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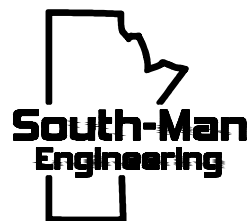
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| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE GATE VALVE DETAILS | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE N.T.S. | SHEET NUMBER S-7 |
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FENCE CORNER DETAIL



GATE DETAIL



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| | | | |
|--|--|--|---------------------|
| PROJECT NAME WESTVIEW COLONY S ½ NW 22-14-21W | | BUILDING AREA N/A | |
| SHEET TITLE TRANSFER CHANNEL DETAIL | | DRAWN BY R. FLORES SOUTH-MAN ENGINEERING | |
| DATE DRAWN DECEMBER 2017 | | DRAWING SCALE METRIC | SHEET NUMBER S-8 |
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