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PLAN CONTEXT

This Comprehensive Development Review report (CDR) is being submitted in support of the subdivision of 22 industrial lots within the SE ¼ Section 15-38-5-W3M known herein as the West Corman Industrial Park (WCIP). The subject property was previously rezoned to a M2 – Rural Industrial Park 2 District following the submission of a CDR in 2012 by the previous land owner, Mr. Glen Reimer. Although the site was rezoned in 2012, a servicing agreement was never executed and the subject property was consequently never subdivided. The property has since been sold to Premium Portable Washrooms Ltd (PPW), who intends to proceed with development of the industrial park. This CDR report is being submitted at the request of the RM Administration as an update to the original CDR recognizing that policy and regulatory changes have been occurred since its original approval in 2012 and to update the servicing strategies identified in the 2012 CDR report.

Development Summary

The developer is seeking to subdivide 22 lots for industrial use within three phases from a 52.4 ha (129.5 acre) source parcel as summarized in Table 1. Phase 1 would include proposed lots 1-4. Phase 2 is anticipated to include lots 5-14 with the remaining 8 lots to be considered in a third and final phase as illustrated in Figure 1. All of the proposed sites meet the M2 District’s minimum site area requirement of 1.8 hectares (4.4 acres).

The developer’s intention is to dedicate municipal reserve on a phase by phase basis. The basis for defining the net developable area subject to municipal reserve dedication is provided in Table 1 below. Phase 1 includes the construction and dedication of the storm detention pond and the drainage canal but will not require the subdivision or construction of any internal roadways to provide access to the proposed new lots. It is anticipated that the internal road network would be developed within future phases.

Based upon a market value of $370,000 per hectare in a subdivided and serviced state and a net development area of 9.60 hectares, the total value of the land subject to municipal reserve within Phase 1 is estimated to be $3,552,000.00. Based upon the Servicing Summary Worksheet attached to this report as Appendix I, the anticipated servicing costs for this initial phase is approximately $1.7 million dollars. Using these values, it is estimated that the per hectare value of the first phase in a subdivided but unserviced state would be approximately $193,000 per hectare resulting in a cash in lieu of municipal reserve dedication of approximately $92,000.00. We expect that the exact amount of this monetary contribution will be negotiated as part of the servicing agreement.

Table 1: Plan Phasing Summary

<table>
<thead>
<tr>
<th>Phase</th>
<th>Net Developable Area (ha)</th>
<th>MR Requirement (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>9.60</td>
<td>0.48</td>
</tr>
<tr>
<td>Phase 2</td>
<td>21.98</td>
<td>1.09</td>
</tr>
<tr>
<td>Phase 3</td>
<td>15.54</td>
<td>0.78</td>
</tr>
<tr>
<td>Totals</td>
<td>47.12</td>
<td>2.35</td>
</tr>
</tbody>
</table>
Land Use Context

The subject property is currently used as pasture land and is considered to have a Class 4 soil capability based upon the Canada Land Inventory Soil Capability for Agriculture. There are currently no permanent buildings or structures located on the site although a development permit has recently been issued to accommodate the establishment of a single site manufacturing establishment. The location has been selected due to its close proximity to two major provincial highways and to local and regional markets. There are a full range of existing shallow utilities, including three-phase power in the immediate vicinity which reduces the need for establishing new utility systems to support the proposed subdivision.

Surrounding land uses within a 1.6 km radius of the subject property maybe summarized as follows:
- North Corman Industrial Park to the east
- Northern Landfill to the west
- Martensville Lagoon to the northwest
Several single site industrial sites to the south and southwest
Undeveloped pasture land to the north
Three single site residential developments are situated northeast of the subject site.

There are no multi-parcel county residences within 1.6 kilometres; however, the southeastern boundary of the City of Martensville is located approximately 1.6 kilometres of the site which we note meets the RM’s requirements in this regard.

Figure 2: Land Use Context Map
Physical Conditions

The land surface elevation at the site ranges between 507 and 509 meters and slopes gradually to the north and southeast toward the South Saskatchewan River, located approximately 5 km to the east. The local topography consists of a combination of hummocky mounds and smaller depressions often referred to as a knob and kettle landscape. Overall the site is relatively flat with approximately 85% of the land area sloping to the northeast with the remaining 15% sloping to the southeast. Based upon a review of available aerial photos, it appears that the subject property has been previously excavated for gravel which has resulted in a significant alteration of the natural conditions on the site. There are small pockets of scrub vegetation located in the central and northeast portions of the site. This existing vegetation will likely be removed as part of the site development.

A series of geotechnical investigations were performed by P. Machibroda Engineering Ltd. (PMEL) on September 7, 2010 and September 11, 2011 to evaluate the existing local subsurface soil and groundwater conditions and to provide general geotechnical recommendations for the construction of the building foundations on the development site.

A total of 29 test holes were drilled using truck mounted drilling equipment during two separate field investigations due to wet conditions in the west half of the development site. The PMEL geotechnical investigation report for the first 17 of 29 of test hole drilling and investigation has been included with this report as Appendix H. According to the first PMEL report, the subgrade soils consist of a thin layer (100 to 200 mm) of organic topsoil overlaying deposits of sand and gravel, clay and/or silt to a maximum depth of 1.3 meters below ground surface. These deposits are underlain by glacial till to approximately 12.4 meters below grade, the maximum depth penetrated by test holes on the site. Inter/intra till sand and/or gravel deposits were encountered in several test holes. Groundwater seepage and sloughing conditions were encountered during test drilling. Due to the high groundwater table, site grading should be kept as high as possible and dewatering may be required for excavations left open for an extended period of time.

The report recommends that all organic topsoil should be removed from building footprints, walkways, and parking areas. A deep foundation system consisting of drilled, cast-in-place concrete piles and/or belled caissons should perform satisfactorily at this site. No detectable evidence of environmentally sensitive materials such as hydrocarbon odor was detected during the actual time of the field test drilling program. PMEL returned in late 2011 to complete the test-hole drilling and work associated with a roadway assessment report. A second report covering the findings from the remaining 12 test holes has also been included with this report as Appendix H.

According to the second PMEL report, the subgrade soils consisted of a thin layer of organic topsoil overlying deposits of clay, sand and/or gravel to a depth up to 1.2 m below grade. These deposits were over glacial till at a depth of at least 15 m. Sand was encountered at approximately 11 m below grade in the majority of the test holes and a single test hole found a zone of saturated sand from 12.5 to 14.7 m below grade. Groundwater seepage and sloughing conditions were encountered during test drilling. Due to the high groundwater table, site grading should be kept as high as possible and dewatering may be required for excavations left open for an extended period of time. Shallow foundations such as spread footings or deep foundations using piles or belled caissons should perform satisfactorily at this site. Both PMEL geotechnical reports recommended site-specific investigations prior to development and construction of building foundation systems.
Natural Resources

A search of the Saskatchewan Conservation Data Centre online screening tool confirmed that there are no significant terrestrial or aquatic resources located in the area. A copy of this online data is illustrated on the map in Appendix B.

In addition to the online screening, a Phase I Environmental Site Assessment (ESA) was completed by P. Machibroda Engineering which consisted of a review of available background and historical information, a visual site review, and a summary report of the findings. The purpose of the ESA was to determine if any potential contaminants or environmental concerns exist on the subject property from previous uses on or near the site. The ESA concluded that the subject property is considered to have a low environmental hazard potential and states that no further investigation (i.e., Phase II EA) is warranted at this time. A copy of this report is included in this report as Appendix I.

Heritage Resources

The RM of Corman Park policies imply a commitment to the protection of historic, archaeological, and other cultural features and sites from incompatible development. The Heritage Conservation Branch of the Ministry of Parks, Culture, and Sport governs heritage resources in the province. The Heritage Conservation Branch provides an online searchable database which can be used by developers to determine whether a parcel of land contains heritage or archaeological resources. Where this potential is identified, a copy of the development concept for the property must be submitted for comment by their office to confirm the need for any additional investigation.

The Heritage Resources Branch was contacted to determine the potential for heritage resources on the subject property. It was determined through this consultation that due to the nature of the current land use, that the potential to find significant heritage sites is low; eliminating the need for further investigations. A copy of the correspondence with the Heritage Branch is located in Appendix B.

CONCEPTUAL SERVICING PLAN

Municipal Roadways and Access

The proposed internal road network has been designed as a crescent to facilitate the efficient movement of large trucks within the park. Following consultations with the RM Administration, it has been determined that the internal roads will be constructed on a 32 metre right of way to provide the RM will increased snow storage capacity. The internal roadways are intended to be constructed to a gravel surface standard with a 10 metre carriageway constructed on a 16 metre subgrade as illustrated in Figure 3.

Figure 3: Internal Roadway Cross Section
The subject property has physical access to Highway No. 11 and Highway No. 12 via Lutheran Road at two existing highway intersections. A Traffic Impact Study (TIS) was previously completed by Associated Engineering in 2011 and was included as part of the original CDR submission along with a Municipal Roadway Structure Assessment prepared by P. Machibroda Engineering Ltd. Both reports are appended to this report as Appendix C.

The Municipal Roadway Structure Assessment included impacted portions of Range Road 3052 and Lutheran Road. A total of six test holes were drilled and subsurface soils were analyzed on both roadways. The report concluded that subsurface conditions were variable between test holes consisting of sand, gravel and clay along Range Road 3052 and predominantly sand and gravel with some organic soils represented within the Lutheran Road sub-base.

The TIS provided an assessment of the current and future function and level of service of existing roadways resulting from the proposed subdivision with the intention of identifying any improvements necessary to maintain an acceptable level of service. The TIS provided the following summary conclusions:

• The traffic volume at Lutheran Road and Range Road 3052 will increase from 256 vehicles in the PM Peak hour to approximately 840 vehicles in 2022, of which 470 vehicles are related to the new development.
• During the pm peak hour, 525 new trips are generated by the development. Of these trips, 116 trips are entering and 409 trips are leaving the site.
• Heavy truck traffic will increase proportionately on Lutheran Road and Range Road 3052.
• The current lane configuration and traffic control provides a satisfactory level of service in the 2012 build year and a satisfactory to poor level of service in the 2022 forecast year.
• The proposed development would impact the delay at the intersection Range Road 3052 and Lutheran Road where performance would be maintained at LOS D or higher for the pm peak hour beyond the 10-year horizon.
• The low v/c ratio suggests that the reason there is a LOS D in the 2022 Forecast Year is because the stop condition and the high volume of conflicting traffic. In some circumstances, a LOS D for one leg of an intersection may encourage further review. However, because only 149 vehicles are delayed in the AM peak hour and 64 in the PM, an intersection improvement is not recommended.
• Traffic control improvements would not be required at the study intersection for at least ten years.
• Bushes are obstructing sight lines for vehicles travelling in the north and west bound directions.

The TIS recommended that no traffic improvements related to the proposed development at the intersection of Range Road 3052 and Lutheran Road are required with the exception of the installation of yield signs at the intersection of Range Road 3052 and the internal subdivision roadway. Efforts should also be made to clear the obstructions in the southeast corner of the Range Road 3052 and Lutheran Road intersection. We note that these recommendations are consistent with the findings in the Highway No. 11/12 Planning Study prepared by MMM Group in February 2013 and following additional consultation with AE Transportation Engineers, the original recommendations remain valid. A copy of the previous correspondence received from the Ministry of Highways is reproduced in Appendix C.
Since the submission of the 2012 CDR report, we note that the Water Security Agency (WSA) has adopted new drainage regulations that change the approach and objectives associated with managing stormwater within commercial and industrial developments.

Available topographic data suggests that the site has a grade-break located along the southern boundary of the subject property resulting in approximately 15% of the quarter section draining to the southeast, and 85% draining to the northeast as illustrated in Figure 4.

One of the key changes in the new provincial drainage regulations is the need to consider and account for the retention or re-creation of the permanent predevelopment storage within the development site. The topographic contours were imported into AutoCAD Civil 3D to create a surface used to estimate the predevelopment storage characteristics and volumes on the development site. As with most lands situated in this area, the local topography is predominantly knob and kettle characterized by small depressions distributed throughout the site which will incrementally fill and spill in the general direction of flows following storm events and spring melt.

Figure 4: Existing Drainage
Water remaining in these depressions under the spill elevation is considered to be permanently stored on the site relying on evaporation and infiltration as the sole means of reducing water volumes. Based upon the 3D surface model, it is estimated that in a natural or predevelopment state, approximately 19,800 m$^3$ of permanent storage would exist on the site. Figure 5 illustrates the results of the drainage modelling, showing the location of the natural ponding areas from which the permanent storage volumes were determined.

**Figure 5: Natural Ponding Areas**

In addition to retaining the permanent storage volumes, the conceptual drainage plan needs to recognize and provide for the permanent detention of the incremental increase in run-off generated by development of the site. The modified rational method was used to calculate the pre (natural prairie) to post (rural industrial park) run-off volumes associated with a 1:100 year storm event and to define the post development storage requirements which equated to 18,300 m$^3$. The proposed conceptual grading plan is attached as Figure 6.

Based on the updated WSA requirements the total storage requirements for the site is 38,100 m$^3$. 
The perimeter canal system is intended to be constructed along the back of lots as shown on the drainage plan illustrated in Figure 6. The canal will be designed to collect run-off from external and internal sources and promote the efficient conveyance of this run-off to the natural point of discharge located at the northeast corner of the quarter section. An engineered control structure will be constructed at this location to restrict the off-site discharge to the predevelopment flow rate. Following this discharge, run-off is anticipated to flow north along the Range Road 3052 ditch and crosses to the east at an existing culvert. From this point, the run-off enters an existing natural drainage corridor that extends into the Opimahaw Creek system.
The canal will require a 30 metre right of way which is intended to be dedicated as environmental and municipal reserve. It is anticipated that the formal canal will require approximately 26 metres and will be constructed to a depth of approximately 1.0 metre as illustrated in Figure 7 above. The canal will act in the same manner as the natural knob and kettle topography by filling following storm events and spring thaw and upon reaching full capacity, spilling out of the engineered control structure designed to restrict the rate of off-site discharge to the predevelopment flow rate along Range Road 3052. The canal is being designed with a maximum 3:1 side slope which is intended to be seeded with native grass to eliminate the maintenance requirements. As with any storm retention facility, there may be some need to dredge the canal as silt is deposited within the run-off. The right-of-way is of sufficient size for municipal crews to access and maintain the facility during extended dry periods as needed.

The second catchment comprises a series of swales combined with lot grading to capture and convey run-off into a stormwater detention pond situated in the southeast corner of the quarter section. The pond footprint is estimated to be 1.0 hectares and will be constructed to a depth of approximately 1.0 metre. Figure 8 illustrates the cross section of the proposed storm detention pond. The pond will act in the same manner as the natural knob and kettle topography by filling following storm events and spring thaw and upon reaching full capacity, spilling out of the engineered control structure designed to restrict the rate of off-site discharge to the predevelopment flow rate along Range Road 3052. Once discharged, run-off is expected to flow towards a culvert located adjacent to the western leg of the Lutheran Road/Range Road 3052 intersection and continue in a southeasterly direction eventually entering the Opimahaw Creek system.
The following table provides a summary of the anticipated site storage volumes in both constructed catchments. Permanent storage is defined as the combined volume of the natural and pre vs. post storage whereas the free-board represents run-off which will be temporarily detained and subsequently discharged from the site at a controlled rate.

Table 2: Storage Volumes

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Permanent Storage (m³)</th>
<th>Free-board (m³)</th>
<th>Total Storage (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canal</td>
<td>32,400</td>
<td>7500</td>
<td>39,900</td>
</tr>
<tr>
<td>Storm Pond</td>
<td>5700</td>
<td>1000</td>
<td>6700</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38,100</td>
<td>8500</td>
<td>46,600</td>
</tr>
</tbody>
</table>

The conceptual drainage plan as appended has been presented to the WSA and the initial comments received have been favorable. A formal application for a drainage permit has been made and we are awaiting confirmation of approval.

Wastewater Disposal

On-site wastewater disposal for individual lots in the WCIP will be exclusively limited to holding tanks. Property owners will be required to install and operate holding tanks according to applicable provincial regulations and have waste materials trucked off-site by one of several service providers for disposal at a licensed facility. The installation of the disposal system is expected to occur as part of a building permit associated with the construction of the principal building. Prior to the installation of the disposal system, the property owner will be required to obtain an on-site sewage permit from the Saskatoon Health District. Envirotec Services Incorporated has been contacted and has confirmed their ability to provide septic service to the proposed sites. A copy of this correspondence is attached in Appendix F.

Potable Water Supply

The Developer intends to obtain potable water from an existing Intervalley Water (IW) supply line situated within the Lutheran Road right-of-way. A review of water usage records for the existing industrial properties in the neighboring Corman Industrial Park indicates a monthly average usage of approximately 47 m³ per lot. As it is anticipated that future uses within the West Corman Industrial Park will share common characteristics with existing adjacent developments, the actual water usage records from the Corman Industrial Park were used to estimate projected water usage within the subject property. The IW supply line is a low pressure water supply line which is fully capable of meeting the average day and peak demands for the proposed development. It is expected that flow restrictors will be employed on each service connection limiting supply to a maximum of 1.9 litres/minute for each lot which supports a peak monthly usage of 98 m³. Each property is expected to construct a cistern to manage storage and distribution of domestic water within the site and to provide an adequate water source for fire suppression as required by the National Building Code based upon the building design. Partnering with IW would allow the developer to remove themselves from the daily operations of a water utility. Correspondence from IW was previously provided and included in the 2012 CDR. A representative from IW was able to reconfirm their willingness and capability to supply water to this development subject to receiving authorization for an increased allocation from SaskWater. A copy of the original letter and the most recent correspondence is attached as Appendix E.
**Shallow Utilities**

SaskEnergy, SaskPower, and SaskTel all operate facilities in the immediate vicinity with sufficient capacity to service the proposed new industrial development. SaskPower will supply 3-phase power with overhead lines and a high capacity natural gas line will be supplied by SaskEnergy. A summary of the utility system layouts are attached as Appendix D. We note that the layouts represented in this submission maybe subject to revision as the project moves through the subsequent design phases following further consultations with the various utilities.

**Solid Waste Management**

Solid waste generated by individual property owners in the WCIP will require hauling and disposal off-site. Solid waste disposal will be managed by one of several licensed companies operating in the Saskatoon area for a fee. The Developer has no plans to construct, own, or operate a waste management facility at this location.

**Fire and Police Protection**

The RM of Corman Park participates in the North Corman Park Fire Chief’s Association, which includes the Cities of Martensville and Warman, to provide fire protection services to the portion of the RM that is north of Penner Road. Given the close proximity of the WCIP to the City of Martensville it is anticipated that the Martensville Fire Department would respond to an emergency situation. The Martensville Fire Department has three engines, 2 rapid response 4x4s to respond to grass fires which include a 400 gallon tank and a 250 gallon tank, as well as a 1500 gallon portable water supply. If the emergency event is large enough, other municipal fire departments will assist with emergency response.

Police services will be provided by the Corman Park Police Service and the Warman Detachment of the RCMP. The RCMP is primarily responsible for criminal matters in the RM and the Corman Park Police have a specific mandate of enforcement of provincial statutes, municipal bylaws, and providing assistance to other police agencies as may be required within the RM.

**POLICY CONTEXT**

As previously indicated, the subject property was rezoned to an M2 District following the submission and subsequent approval of the 2012 CDR report. This supplemental CDR is intended to focus on recognizing any changes in policy and to establish a servicing strategy to support the subsequent subdivision of the lands. Since the 2012 CDR was approved, the only policy change that applies to the proposed WCIP is an amendment to Section 6.2.3 of the RM of Corman Park Official Community Plan, respecting the determination of a minimum separation distance between Rural Industrial Parks and multi-parcel country residential or intensive recreational developments.

Section 6.2.3 states “Rural Industrial Parks shall not be located within a) 1 km (0.6 mile) of multi parcel country residential or intensive recreational development measured from the property boundary of closest developable parcel located within the multi parcel country residential development or intensive recreational development to the property boundary of the closest developable parcel within the Rural Industrial Park” (Bylaw 35/14, Approved November 12, 2014)

This policy amendment has no implications to the proposed subdivision as there is no multi-parcel country residential or intensive recreational development located within 1 kilometre of the proposed WCIP.
CONSULTATIONS AND ENGAGEMENT

Public Engagement

Public consultation was also undertaken in 2012 as part of the original CDR which included an open house information session and a questionnaire and information sheet was distributed by mail to property owners the 1.6 kilometre radius. In addition, a Public Hearing where affected residents could voice their concerns was held as part of the bylaw amendment process when the subject lands were rezoned to M2 – Rural Industrial Park 2 District.

Regulatory Consultations (2012)

<table>
<thead>
<tr>
<th>Regulatory Agency</th>
<th>The Ministry of Highways and Infrastructure was contacted to provide comments for this proposed subdivision. The Ministry has indicated that no new access to Highway No. 11 will be permitted beyond the existing intersection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Highways and Infrastructure</td>
<td>In an effort to address concerns from the RM of Corman Park with regards to the anticipated increased traffic flow in the area, a Traffic Impact Study was completed. A copy of the study is included as Appendix C. The study recommended no major traffic improvements in the area. Minor traffic system recommendations include the installation of a yield sign on Reimer Road at Range Road 3052 and the removal of obstructions (line of sight blocking vegetation) in the south-east corner of the Range Road 3052 and Luther Road intersection. The Traffic Impact Study report was submitted to the Ministry of Highways for review and comment. The response was that as a result of the study, the Ministry has no further concerns. A copy of the email received can be seen in Appendix C.</td>
</tr>
<tr>
<td>Heritage Conservation Branch, Ministry of Parks, Culture and Sport</td>
<td>A pre-screening of the parcel of land on SE-15-38-05-W3 was investigated for heritage sensitivity using the online screening tool provided by the Heritage Conservation Branch. According to the online tool, this quarter-section is not heritage sensitive and it is not necessary to submit the project to the Heritage Conservation Branch for screening. A copy of the on-line screening search results has been included as Appendix B. A previous inquiry to the Heritage Resources Branch by the RM of Corman Park resulted in a letter dated September 13, 2007, that stated the Ministry has no heritage concerns in the area. A copy of that letter has been included as Appendix B.</td>
</tr>
<tr>
<td>Water Security Agency</td>
<td>The Water Security Agency has no concerns with the plan moving forward. A formal permit application has been submitted and a decision is pending.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>City of Martensville Fire Protective Services</td>
<td>The RM has an agreement with the City of Martensville Fire Department as part of the North Corman Park Fire Chiefs Association to provide fire protection to the area.</td>
</tr>
<tr>
<td>Police Services</td>
<td>Will be provided by the Corman Park Police Service and the RCMP.</td>
</tr>
</tbody>
</table>
27 September 2007

Mr. Eric McDougall
R.M. of Corman Park
111 Pinehouse Drive
Saskatoon, SK

Dear Mr. MacDougall:

Saskatchewan Environment has reviewed the letter dated August 22nd 2007 regarding the subdivision review for North Corman Park E½-15-38-5-W3 and N½-14-38-5-W3. Based on the information provided, the department sees no inconsistencies with the proposed land use and adjacent land uses. We suggest the R.M. should notify all purchasers of adjacent land use to ensure compatibility.

This letter is not an approval under any act or regulation administered by Saskatchewan Environment. Each proponent will have to determine their own particular permitting requirements for their business or land use.

Sincerely,

Ralph Bock
Environmental Project Officer
APPENDIX B: TRAFFIC IMPACT ASSESSMENT & PHYSICAL ROAD ASSESSMENT
April 19, 2010

Glen Reimer  
RR# 7, Site 707, Compartment 8  
Saskatoon, SK  
S7K 1N2

Dear Mr. Reimer

Re: Proposed Development in the Corman Industrial Park, SE 15-38-5-W3M

The proposed development in the Corman Industrial Park will result in the generation of additional traffic, especially truck traffic. The key access points for accessing the proposed development area are the following intersections:

- Hwy 11 & Lutheran Road;
- Hwy 11 & Industrial Road; and
- Hwy 12 & Lutheran Rd.

It is noted that these intersections already accommodate a significant amount of traffic and this trend will continue into the future. In response to the high traffic demand various intersections treatments have been constructed at these locations. It is noted that with the future increase in traffic volumes, the need for additional intersection upgrades may arise. The Ministry is interested in collaborating with the R.M. of Corman Park on assessing the needs of the highway users destined to the Corman Industrial Park. Given the anticipated increase in the intersection utilization at the key access points, a plan for maintaining the required level of service and safety should be discussed and identified.

Sincerely,

[Signature]

Goran Saric, P. Eng  
Regional Design and Operations Engineer  
Central Region

cc: Eric MacDougall, RM of Corman Park # 344

Ministry Contact: Lavern Yagelnesky Phone (306) 933-5801, Fax (306) 933-5805
Hi Nicole,

The Ministry has reviewed the Traffic Impact Study submitted by Associated Engineering and we have no concerns. We will consider the requirements of Goran’s letter dated April 19, 2010 to be fulfilled.

Jennifer Fertuck, P.Eng | Senior Project Manager - Asset Management | p. 306.933.8003  c. 306.380.6103
Ministry of Highways and Infrastructure | 18-3603 Millar Ave, Saskatoon SK S7P 0B2

Please consider the environment before printing this email.

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Nicole:

Thank you for submitting the study report for the Ministry’s review and comments. Please note that as of May 1st, 2011, I have been in a new position within the Ministry; the new person responsible for traffic operations issues in our region is Brandon Harris. I have forwarded a copy of this e-mail to Brandon for his review and reply.

Regards,
Goran

Goran Saric, P.Eng.
Director of Operations
Central Region
Ministry of Highways and Infrastructure
phone: 306.933.6217
cell: 306.221.6148
fax: 306.933.5188

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Mr. Saric,
Report

G & S Development

Traffic Impact Study

July 2011
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<tr>
<td>List of Tables</td>
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Appendix B - Sightline Triangles
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<td>3-3</td>
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<tr>
<td>3-4</td>
<td>2012 Background PM Peak Hour Traffic</td>
<td>3-3</td>
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<td>2022 Background AM Peak Hour Traffic</td>
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<tr>
<td>3-6</td>
<td>2022 Background PM Peak Hour Traffic</td>
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<td>3-7</td>
<td>2012 Combined AM Peak Hour Traffic</td>
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<tr>
<td>3-8</td>
<td>2012 Combined PM Peak Hour Traffic</td>
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<tr>
<td>3-9</td>
<td>2022 Combined AM Peak Hour Traffic</td>
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</tr>
<tr>
<td>3-10</td>
<td>2022 Combined PM Peak Hour Traffic</td>
<td>3-8</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 BACKGROUND

G & S Development is planning to develop a quarter section of land in the Rural Municipality of Corman Park (RM) located northwest of Saskatoon near the intersection of Lutheran Road and Range Road 3052. This development is anticipated to be constructed in 2012. The RM has requested the completion of a Traffic Impact Study (TIS) as part of the discretionary use application for the site. Associated Engineering (AE) has been commissioned to complete this work.

1.2 OBJECTIVES

The objectives for the TIS are to obtain a clear understanding of the proposed development, a summary of the anticipated impacts, and a summary of the required improvements to ensure that the road network can maintain its existing level of service. As requested by the RM, this study determines the traffic impacts of the G & S Development on the intersection of Range Road 3052 and Lutheran Road. A separate report as part of the comprehensive development assessment analyzes the existing structure of the roadway and determines if it is sufficient to withstand the additional traffic loading.

1.3 METHODOLOGY

The TIS was completed using the following methodology:

- Discuss with the RM the requirements for the TIS.
- Collect data including traffic counts performed on May 26, 2011.
- Conduct site visit to determine existing conditions and traffic control.
- Establish the existing and future background traffic conditions in the vicinity of the proposed development.
- Determine, using the ITE Trip Generation Handbook, the future vehicular trip patterns generated to and from the site for full build out in 2012 and the 10-year time horizon.
- Establish the trip distribution pattern in the surrounding area and assign trips to adjacent roadways.
- Complete an intersection capacity analysis.
- Provide recommendations for roadway improvements if required.
- Create a report documenting the TIS.
Site Context

2.1 OVERVIEW

The proposed site for G & S Development is situated at SE15-38-05-W3 to the north of Saskatoon, approximately 1 km west of Highway 11 and immediately west of the Corman Park Industrial Park. Two accesses to the site will be provided off of Range Road 3052 which intersects with Lutheran Road to the south. Figure 2-1 shows the study area and Figure 2-2 shows the proposed site plan.

Figure 2-1
Study Area
Figure 2-2
Site Plan
2.2 ROAD NETWORK

Figure 2-1 shows the existing roadway network in the vicinity of the proposed development. Descriptions of the existing roadways that are of interest to the TIS follow:

Range Road 3052 begins in Saskatoon as Warman Road / Wanuskewin Road and is renamed to Range Road 3052 once it exits City limits. As the road travels north of Saskatoon, it intersects Highway 11 at a ninety degree angle before realigning to the grid boundary and travels 2.6 kilometers before crossing Lutheran Road to the north. Range Road 3052 follows the grid boundary as it travels north past the Town of Warman. This road is asphalt, which averages 8.1 meters in width excluding shoulders and 9.8 meters in width including shoulders. The asphalt is in fairly good condition with some alligator cracking north of the intersection. Centerline markings were either non-existent or very faded at the time of the site visit. The posted speed for the roadway is 80 km/hr. The intersection with Lutheran Road is at a ninety degree angle with stop control in the eastbound and westbound directions.

Lutheran Road runs in an east-west direction crossing Highways 16 and 12 before intersecting Range Road 3052 and crossing Highway 11, 1.2 kilometers to the east at an approximate angle of sixty degrees. Lutheran Road is renamed Township Road 382 on the east side of Highway 11 and travels east until it ends at the South Saskatchewan River. This road is asphalt, which averages 8.7 meters in width excluding shoulders and 11.2 meters in width including shoulders. Lutheran Road also has a posted speed limit of 80 km/hr.

A private residence is located in the Southeast corner of the intersection. This residence has bushes lining the west and north borders measuring approximately 55 meters and 90 meters in length respectively. These bushes are currently interfering with sightlines for vehicles travelling northbound and westbound.

2.3 LAND USE

The area surrounding the proposed site is predominately agricultural with a light industrial area, Corman Industrial Park, adjacent to the proposed development. To the north and south of the proposed development is agricultural land. A private residence is located approximately 250 meters south of the Range Road 3052 and Lutheran Road intersection. One mile west is the North Sanitary Landfill and the City of Martensville Lagoon. The study area is shown in Figure 2-1.

The proposed G & S Development is within the concept plan area for the Corman Industrial Park and is identified as a light industrial development containing 70 hectares of land. As shown in Figure 2-2, the development will be divided into 21 lots ranging in size from 1.6 hectares to 4.05 hectares. All lots will use ditches and septage sanitary system. The development will also contain a municipal reserve. It is understood and assumed that this land will not be developed and has not been included into the trip generation calculations. The development has one interior roadway, Reimer Road, which intersects with Range Road 3052 between lots 1 and 14 and intersects again between lots 20 and 13.
3. Traffic Generation and Distribution

3.1 BACKGROUND TRAFFIC

The background traffic is the existing traffic on Range Road 3052 and Lutheran Road as well as the future traffic that would be on the road regardless of the development.

3.1.1 Existing Background Traffic

Background traffic includes observed traffic as well as estimates derived from historical data. AE conducted traffic counts at the intersection Range Road 3052 and Lutheran Road on May 26th, 2011 for two hour periods in the am and pm peak. The counts also distinguished between passenger vehicle and heavy trucks. The observed am and pm peak hour traffic is shown in Figures 3-1 and 3-2 respectively.

The count data available from the Ministry of Highways and Infrastructure (MHI) (included in Appendix A) were collected at a location on Lutheran Road south of the existing light industrial development and a location on Range Road 3052 south of Lutheran Road and north of Highway 11. The count data included average daily traffic (ADT) for the years 2000, 2005, and 2010 and truck average daily traffic (TADT) volumes in 2010. This data was used to determine a growth rate for the background traffic.

The annual growth rate for this area was derived from an analysis completed on the 10-year traffic volume history. The non-compounded annual growth rate for Range Road 3052 and Lutheran Road were determined to be 2% and 7% respectively. The historical growth rate for this area is on average 5.0%. Volumes on both roads are relatively low, which makes annual growth appear high when the total has only increased by a few vehicles. An annual growth rate of 5% is aggressive and unlikely to be sustained throughout the next 10 years. The typical annual growth rate is 3.0% and therefore a rate of 4.0% has been selected to account for the high historical growth rate.

3.1.2 2012 Build Year

Annual growth rates of 4% were applied to 2011 traffic volumes to project 2012 traffic volume. The 2012 background traffic volumes are shown in Figures 3-3 and 3-4.

3.1.3 2022 Forecast Year

Non compounded annual growth rates of 4%, as previously determined, were applied to 2011 traffic volumes to project 2022 traffic volumes. The 2022 background traffic volumes are presented in Figures 3-5 and 3-6.
Figure 3-5
2022 Background AM Peak Hour Traffic

Figure 3-6
2022 Background PM Peak Hour Traffic
3.2 DEVELOPMENT TRAFFIC

The lot area for the proposed G & S Development, excluding roadways and the Municipal Reserve, is 111 acres. This data was used to determine the number of trips this site would generate using the ITE Trip Generation Handbook (8th Edition) General Light Industrial land use category. This is an applicable land use because it is suited for free-standing facilities devoted to a single use which typically has emphasis on activities other than manufacturing with minimal office space. The trip generation rate on a per acre basis was used because it uses the gross land area without needing to know the size of buildings on each lot.

For the general light industrial land use, the ITE generation rate is 51.80 per acre for a weekday and 7.26 per acre for the pm peak hour. The distribution of trips during pm peak hour is 22 percent entering and 78 percent leaving. Table 3-1 lists the trip generation for daily, am peak and pm peak hour travel for expected development. This development will be fully constructed and operational by the end of 2012, so these values are applicable for both the 2012 and 2022 time frames.

### Table 3-1
Summary of Traffic Generation

<table>
<thead>
<tr>
<th>Development</th>
<th>Lot Area (Acres)</th>
<th>Total Trips (Daily)</th>
<th>AM Peak Total Trips</th>
<th>AM Peak Total In</th>
<th>AM Peak Total Out</th>
<th>PM Peak Total Trips</th>
<th>PM Peak Total In</th>
<th>PM Peak Total Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>G &amp; S Development</td>
<td>111</td>
<td>4900</td>
<td>530</td>
<td>450</td>
<td>80</td>
<td>520</td>
<td>120</td>
<td>400</td>
</tr>
</tbody>
</table>

Calculated from ITE Trip Generation Handbook (8th Edition) using General Light Industrial (110)

Equation to calculate trips during PM Peak: \( T=3.68(x)+116.82 \)
Equation to calculate trips during the AM Peak: \( T=3.76(x)+117.88 \)
Equation to calculate Total Trips (Daily): \( T=42.22(x)+263.11 \)

\( x= \) number of acres

3.3 COMBINED TRAFFIC

The development traffic and background traffic combined together represent the total traffic which will utilize the study intersection.

3.3.1 2012 Build Year

The 2012 background traffic was combined with the site-generated traffic to obtain the combined pm peak hour traffic volumes. The 2012 combined traffic volumes are presented in Figures 3-7 and 3-8.
3.3.2 2022 Forecast Year

The 2022 background traffic was combined with the site-generated traffic to obtain the complete traffic volumes for the 2022 pm peak hour. The combined traffic volumes are presented in Figure 3-9 and 3-10.

Figure 3-7
2012 Combined AM Peak Hour Traffic
Figure 3-8
2012 Combined PM Peak Hour Traffic

Figure 3-9
2022 Combined AM Peak Hour Traffic

Legend
Total (Trucks)
Figure 3-10
2022 Combined PM Peak Hour Traffic

Legend
Total (Trucks)
4 Traffic Analysis

4.1 INTERSECTION CAPACITY ANALYSIS

Intersection capacity analysis was completed using Synchro to determine the future level of service and the need for improvements on roadways impacted by the proposed development. The Synchro traffic analysis program based on the Highway Capacity Manual (HCM) applies the methodology established by the HCM to output a level of service for a study intersection, given the lane designations, vehicular volumes, control type, heavy vehicle percentages etc. For all analyses the following assumptions were made:

- Heavy vehicle percentage: Calculated values from the 2011 traffic count for all roadways.
- Traffic control: Free flow for Range Road 3052, stop control for Lutheran Road.
- Peak hour factor: 0.92 as per Synchro default.
- Number of conflicting bicycles and pedestrians are negligible.

The critical measures used in this assessment of intersection capacity are control delay, Level of Service (LOS) and volume to capacity ratio (v/c). Descriptions of each measure include:

- Control delay is the amount of delay a vehicle experiences in seconds.
- LOS is a measure of the intersection delay converting it to a level between A to F where LOS A has the least average delay per vehicle (less than 10 seconds) and LOS F has the highest average delay. LOS F exceeds 50 seconds delay per vehicle for unsignalized intersections. The LOS definitions for an unsignalized intersection are included in Appendix A.
- V/C provides the amount of congestion for each turning movement and for each lane group for signalized intersection. A v/c value over 1 indicates that the movement or lane group is over capacity.

4.2 STOP WARRANT ANALYSIS

According to the Manual of Uniform Traffic Control Devices (MUTCD) for Canada, a four-way stop is warranted if volumes on intersecting roads are approximately equal and the lower volume roadway averages a minimum of 200 vehicles per hour for an 8 hour period or the average delay to the minor road exceeds 30 seconds per vehicle during the pm peak hour.
4.3 YIELD WARRANT ANALYSIS

According to the MUTCD for Canada, yield signs are warranted if the safe vehicle speed on the approach is greater than 15 km/h, where an acceleration lane is not provided or at an intersection of a divided highway where a stop sign is installed at the first entrance of the roadway and more control is necessary in the median at the entrance to the second roadway.

4.4 SIGHT LINE SAFETY

The Transportation Association of Canada’s (TAC) Geometric Design Guide for Canadian Roads contains criteria for achieving safe sightlines at the intersection of two roads. According to TAC, major roadways with a design speed of 90 km/h and a 20 m right of way should have 39 meters of unobstructed sightlines along the major roadway before the intersection and 14 meters along the minor roadway. See Appendix B for a diagram of sightline triangles and suggested dimensions.

4.5 RESULTS

Results for the Intersection Capacity Analysis, Stop Warrant Analysis, Yield Warrant Analysis, and Sight Line Safety are detailed below.

4.5.1 Intersection Capacity Analysis

Table 4-1 shows the PM Peak results of the intersection capacity analysis for the intersection of Range Road 3052 and Lutheran Road. Table 4-2 shows the AM Peak results. Outputs from Synchro have been provided in Appendix C.

The traffic analysis shows that the intersection of Range Road 3052 and Lutheran Road will operate “satisfactorily” in the 2012 build year and “satisfactorily to poorly” in the 2022 forecast year. Lutheran Road, which has a stop condition, will operate at LOS C or better in 2012 and LOS D or better in 2022. Range Road 3052, which is free flow, will operate at LOS A in 2012 and LOS A for 2022.

The addition of trips attributed to the G & S Development and background growth caused westbound traffic an additional delay of 14 seconds and eastbound traffic an additional 17 seconds in the 2022 Forecast Year. Additional delays attributed to the development in the northbound and southbound directions will be insignificant.

The maximum v/c ratio for the AM and PM peak in both horizons is 0.47 and 0.46 respectively. The eastbound and westbound v/c ratios are consistently higher than the northbound and southbound directions due to the stop condition.
Table 4-1
PM Peak Capacity Analysis for the Intersection of Lutheran Road and Range Road 3052

<table>
<thead>
<tr>
<th></th>
<th>Lutheran Road</th>
<th>Range Road 3052</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastbound</td>
<td>Westbound</td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>10.4</td>
<td>10.5</td>
</tr>
<tr>
<td>LOS</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>V/C Ratio</td>
<td>0.05</td>
<td>0.10</td>
</tr>
</tbody>
</table>

2012 Build Year- Background Traffic

<table>
<thead>
<tr>
<th></th>
<th>Lutheran Road</th>
<th>Range Road 3052</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastbound</td>
<td>Westbound</td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>10.4</td>
<td>10.5</td>
</tr>
<tr>
<td>LOS</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>V/C Ratio</td>
<td>0.05</td>
<td>0.10</td>
</tr>
</tbody>
</table>

2012 Build Year- Combined (Background and Development) Traffic

<table>
<thead>
<tr>
<th></th>
<th>Lutheran Road</th>
<th>Range Road 3052</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eastbound</td>
<td>Westbound</td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>22.6</td>
<td>17.8</td>
</tr>
<tr>
<td>LOS</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>V/C Ratio</td>
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2022 Forecast Horizon – Projected Background

<table>
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<th>Lutheran Road</th>
<th>Range Road 3052</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Eastbound</td>
<td>Westbound</td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>11.0</td>
<td>11.4</td>
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<tr>
<td>LOS</td>
<td>B</td>
<td>B</td>
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<tr>
<td>V/C Ratio</td>
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2022 Forecast Horizon- Combined (Background and Development) Traffic

<table>
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<th>Lutheran Road</th>
<th>Range Road 3052</th>
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<td></td>
<td>Eastbound</td>
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<tr>
<td>Control Delay (s)</td>
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<td>25.2</td>
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<tr>
<td>LOS</td>
<td>D</td>
<td>D</td>
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<tr>
<td>V/C Ratio</td>
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<td>0.46</td>
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Table 4-2
AM Peak Capacity Analysis for the Intersection of Lutheran Road and Range Road 3052

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<th>Lutheran Road</th>
<th>Range Road 3052</th>
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<tbody>
<tr>
<td></td>
<td>Eastbound</td>
<td>Westbound</td>
</tr>
<tr>
<td><strong>2012 Build Year- Background Traffic</strong></td>
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<td></td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>10.1</td>
<td>9.7</td>
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<td>LOS</td>
<td>B</td>
<td>A</td>
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<tr>
<td>V/C Ratio</td>
<td>0.09</td>
<td>0.05</td>
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<tr>
<td><strong>2012 Build Year- Combined (Background and Development) Traffic</strong></td>
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<tr>
<td>Control Delay (s)</td>
<td>21.6</td>
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<td>V/C Ratio</td>
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<td><strong>2022 Forecast Horizon – Projected Background</strong></td>
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<tr>
<td>Control Delay (s)</td>
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<td>10.1</td>
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<td>LOS</td>
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<td>B</td>
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<tr>
<td>V/C Ratio</td>
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<td>0.07</td>
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<tr>
<td><strong>2022 Forecast Horizon- Combined (Background and Development) Traffic</strong></td>
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<td></td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>25.7</td>
<td>13.5</td>
</tr>
<tr>
<td>LOS</td>
<td>D</td>
<td>B</td>
</tr>
<tr>
<td>V/C Ratio</td>
<td>0.47</td>
<td>0.37</td>
</tr>
</tbody>
</table>
4.5.2 Stop Warrant Analysis

Volumes on Lutheran Road are less than those on Range Road 3052 and total 170 vehicles in the pm peak hour. Since Lutheran Road volumes do not exceed 200 vehicles in the pm peak hour, the average for an 8 hour period will be less than 200. Additionally, the delay on the minor road is 27.9 seconds in the pm peak hour. Subsequently, the criteria are not met to warrant a four-way stop at this location.

As most background traffic is believed to be serving a similar light industrial land use, it is expected that heavy truck traffic will grow in similar proportions to background truck traffic. Therefore, it is assumed that heavy truck traffic percentages are to remain constant. As the number of trucks using the road network increases, the rate of deterioration and maintenance associated with the roads will also increase.

4.5.3 Yield Warrant Analysis

The speed limit on Reimer Road is expected to be greater than 15 km/h. Therefore, according to MUTCD Reimer Road warrants yield signs at the north and south intersections with Range Road 3052.

4.5.4 Sight Line Safety

The southeast corner of the Lutheran Road and Range Road 3052 intersection contains bushes that are obstructing sight lines for vehicles approaching the intersection. The bushes along Range Road 3052 start at the Lutheran Road right of way and extend 55 meters south. The bushes along Lutheran Road start at the Range Road 3052 right of way and extend 90 meters east. According to TAC, there should be 39 meters of clear sightlines approaching the intersection along Range Road 3052 and 14 meters of clear sightlines approaching the intersection from Lutheran Road. These conditions are not met.
5 Conclusions and Recommendations

5.1 CONCLUSIONS

This report documents the results of a traffic impact assessment completed for the proposed G & S Development. The study evaluated the traffic impacts that this proposed development would have on the Lutheran Road and Range Road 3052 intersection for the 2012 build year and 2022 time horizons.

The traffic analysis based on traffic generation and distribution assumptions concluded the following about the impact of the proposed development:

- The traffic volume at Lutheran Road and Range Road 3052 will increase from 256 vehicles in the PM Peak hour to approximately 840 vehicles in 2022, of which 470 vehicles are related to the new development.

- During the pm peak hour, 525 new trips are generated by the development. Of these trips, 116 trips are entering and 409 trips are leaving the site.

- Heavy truck traffic will increase proportionately on Lutheran Road and Range Road 3052.

- The current lane configuration and traffic control provides a satisfactory level of service in the 2012 build year and a satisfactory to poor level of service in the 2022 forecast year.

- The proposed development would impact the delay at the intersection Range Road 3052 and Lutheran Road where performance would be maintained at LOS D or higher for the pm peak hour beyond the 10-year horizon.

- The low v/c ratio suggests that the reason there is a LOS D in the 2022 Forecast Year is because the stop condition and the high volume of conflicting traffic. In some circumstances, a LOS D for one leg of an intersection may encourage further review. However, because only 149 vehicles are delayed in the AM peak hour and 64 in the PM, an intersection improvement is not recommended.

- Traffic control improvements would not be required at the study intersection for at least ten years.

- Bushes are obstructing sight lines for vehicles travelling in the north and west bound directions.
5.2 RECOMMENDATIONS

No traffic improvements related to the proposed development at the intersection of Range Road 3052 and Lutheran Road are recommended. The installation of yield signs on Reimer Road at Range Road 3052 is recommended to indicate right of way for Range Road 3052 traffic. Efforts should also be made to clear the obstructions in the southeast corner of the Range Road 3052 and Lutheran Road intersection.
Appendix A - Unsignalized Intersections LOS Definitions
LEVEL OF SERVICE DEFINITIONS AT UNSIGNALIZED INTERSECTIONS\(^{(2)}\)

The level of service criteria for unsignalized intersections are given in the table below. As used here, total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position. The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation.

<table>
<thead>
<tr>
<th>Level of Service</th>
<th>Features</th>
<th>Average Total Delay (sec/veh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Little or no traffic delay occurs. Approaches appear open, turning movements are easily made, and drivers have freedom of operation.</td>
<td>( \leq 10 )</td>
</tr>
<tr>
<td>B</td>
<td>Short traffic delays occur. Many drivers begin to feel somewhat restricted in terms of freedom of operation.</td>
<td>( &gt; 10 ) and ( \leq 15 )</td>
</tr>
<tr>
<td>C</td>
<td>Average traffic delays occur. Operations are generally stable, but drivers emerging from the minor street may experience difficulty in completing their movement. This may occasionally impact on the stability of flow on the major street.</td>
<td>( &gt; 15 ) and ( \leq 25 )</td>
</tr>
<tr>
<td>D</td>
<td>Long traffic delays occur. Motorists emerging from the minor street experience significant restriction and frustration. Drivers on the major street will experience congestion and delay as drivers emerging from the minor street interfere with the major through movements.</td>
<td>( &gt; 25 ) and ( \leq 35 )</td>
</tr>
<tr>
<td>E</td>
<td>Very long traffic delays occur. Operations approach the capacity of the intersection.</td>
<td>( &gt; 35 ) and ( \leq 50 )</td>
</tr>
<tr>
<td>F</td>
<td>Saturation occurs, with vehicle demand exceeding the available capacity. Very long traffic delays occur.</td>
<td>( &gt; 50 )</td>
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Appendix B - Sightline Triangles
Figure 2.3.3.5  Sight Distance and Visibility Triangle at 90° Intersections for Approaches with Stop Control

Notes:
- a = distance travelled in 3 s (m)
- X, Y = visibility triangle (m)
Table 2.3.3.3  Minimum Property Requirements at $90^\circ$ Intersections for Stop Control

**two-lane roadway**

<table>
<thead>
<tr>
<th>design speed on major roadway (km/h)</th>
<th>approach distance 'a' based on 3 s (m)</th>
<th>visibility triangle : $X \text{ &amp; } Y^a$</th>
<th>major roadway - right of way (m)</th>
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<tr>
<td></td>
<td></td>
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**four-lane roadway**

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<th>design speed on major roadway (km/h)</th>
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<th>visibility triangle : $X \text{ &amp; } Y^a$</th>
<th>major roadway - right of way (m)</th>
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Note: a. Refer to Figure 2.3.3.5.

Page 2.3.3.10  September 1999
Appendix C - Synchro Outputs
## HCM Unsignalized Intersection Capacity Analysis

### 3: Lutheran Road & Range Road 3052

**7/25/2011**

### Movement

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<th>Lane Configurations</th>
<th>EBL</th>
<th>EBT</th>
<th>EBR</th>
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<th>WBT</th>
<th>WBR</th>
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<th>NBT</th>
<th>NBR</th>
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<th>SBT</th>
<th>SBR</th>
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<td>Stop</td>
<td>Free</td>
<td>Free</td>
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<td>0.92</td>
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### Pedestrians

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<tr>
<th>Walking Speed (m/s)</th>
<th>Percent Blockage</th>
<th>Right turn flare (veh)</th>
<th>Median type</th>
<th>Median storage veh</th>
<th>Upstream signal (m)</th>
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### vC, conflicting volume

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### vCu, unblocked vol

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<th>tF (s)</th>
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<th>cM capacity (veh/h)</th>
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### Direction, Lane #

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<th>Volume Total</th>
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<th>cSH</th>
<th>Volume to Capacity</th>
<th>Queue Length 95th (m)</th>
<th>Control Delay (s)</th>
<th>Lane LOS</th>
<th>Approach Delay (s)</th>
<th>Approach LOS</th>
<th>Intersection Summary</th>
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### Intersection Summary

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<tr>
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<td>0.92</td>
<td>0.92</td>
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<tr>
<td>Hourly flow rate (vph)</td>
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### Pedestrians

<table>
<thead>
<tr>
<th>Pedestrians</th>
<th>Lane Width (m)</th>
<th>Walking Speed (m/s)</th>
<th>Percent Blockage</th>
<th>Right turn flare (veh)</th>
<th>Median type</th>
<th>Median storage veh</th>
<th>Upstream signal (m)</th>
<th>pX, platoon unblocked</th>
<th>vC, conflicting volume</th>
<th>vC1, stage 1 conf vol</th>
<th>vC2, stage 2 conf vol</th>
<th>vCu, unblocked vol</th>
<th>tC, single (s)</th>
<th>tC, 2 stage (s)</th>
<th>tF (s)</th>
<th>p0 queue free %</th>
<th>cM capacity (veh/h)</th>
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### Direction, Lane #

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<td>B</td>
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### Intersection Summary

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<th>Analysis Period (min)</th>
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2012 Background PM

Synchro 7 - Report

West Corman Industrial Park CDR
### Movement

<table>
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<td>0.92</td>
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### Pedestrians

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<th>Pedestrians</th>
<th>Lane Width (m)</th>
<th>Walking Speed (m/s)</th>
<th>Percent Blockage</th>
<th>Right turn flare (veh)</th>
<th>Median type</th>
<th>Median storage veh</th>
<th>Upstream signal (m)</th>
<th>pX, platoon unblocked</th>
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### Control Delay (s)

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### Intersection Summary

- **Average Delay**: 5.9
- **Intersection Capacity Utilization**: 21.4%
- **ICU Level of Service**: A
- **Analysis Period (min)**: 15
## HCM Unsignalized Intersection Capacity Analysis

### Background PM Synchro 7 - Report

#### 3: Lutheran Road & Range Road 3052

#### Analysis Period (min) 15

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#### Intersection Summary

| Average Delay      | 5.0 |
| Intersection Capacity Utilization | 30.4% |
| ICU Level of Service | A |
| Analysis Period (min) | 15 |

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58
### Lane Configurations

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<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Hour Factor</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hourly flow rate (vph)</td>
<td>74</td>
<td>72</td>
<td>3</td>
<td>7</td>
<td>26</td>
<td>216</td>
<td>3</td>
<td>253</td>
<td>29</td>
<td>45</td>
<td>61</td>
<td>20</td>
</tr>
</tbody>
</table>

### Pedestrians

<table>
<thead>
<tr>
<th>Pedestrians</th>
<th>Lane Width (m)</th>
<th>Walking Speed (m/s)</th>
<th>Percent Blockage</th>
<th>Right turn flare (veh)</th>
<th>Median type</th>
<th>Median storage veh</th>
<th>Upstream signal (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

### Intersection Summary

<table>
<thead>
<tr>
<th>Direction, Lane #</th>
<th>EB 1</th>
<th>WB 1</th>
<th>NB 1</th>
<th>SB 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume Total</td>
<td>149</td>
<td>249</td>
<td>286</td>
<td>125</td>
</tr>
<tr>
<td>Volume Left</td>
<td>74</td>
<td>7</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>Volume Right</td>
<td>3</td>
<td>216</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>cSH</td>
<td>320</td>
<td>672</td>
<td>1530</td>
<td>1140</td>
</tr>
<tr>
<td>Volume to Capacity</td>
<td>0.47</td>
<td>0.37</td>
<td>0.00</td>
<td>0.04</td>
</tr>
<tr>
<td>Queue Length 95th (m)</td>
<td>18.9</td>
<td>13.7</td>
<td>0.1</td>
<td>1.0</td>
</tr>
<tr>
<td>Control Delay (s)</td>
<td>25.7</td>
<td>13.5</td>
<td>0.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Lane LOS</td>
<td>D</td>
<td>B</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Approach Delay (s)</td>
<td>25.7</td>
<td>13.5</td>
<td>0.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Approach LOS</td>
<td>D</td>
<td>B</td>
<td></td>
<td></td>
</tr>
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### Average Delay

- 9.4

### Intersection Capacity Utilization

- 55.0%
- ICU Level of Service: B

### Analysis Period (min)

- 15
## Movement Lane Configurations

<table>
<thead>
<tr>
<th>Movement</th>
<th>EBL</th>
<th>EBT</th>
<th>EBR</th>
<th>WBL</th>
<th>WBT</th>
<th>WBR</th>
<th>NBL</th>
<th>NBT</th>
<th>NBR</th>
<th>SBL</th>
<th>SBT</th>
<th>SBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (veh/h)</td>
<td>25</td>
<td>22</td>
<td>12</td>
<td>42</td>
<td>32</td>
<td>63</td>
<td>14</td>
<td>88</td>
<td>16</td>
<td>190</td>
<td>282</td>
<td>57</td>
</tr>
<tr>
<td>Sign Control</td>
<td>Stop</td>
<td>Stop</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Grade</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Peak Hour Factor</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
<td>0.92</td>
</tr>
<tr>
<td>Hourly flow rate (vph)</td>
<td>27</td>
<td>24</td>
<td>13</td>
<td>46</td>
<td>35</td>
<td>68</td>
<td>15</td>
<td>96</td>
<td>17</td>
<td>207</td>
<td>307</td>
<td>62</td>
</tr>
</tbody>
</table>

## Pedestrians

<table>
<thead>
<tr>
<th>Lane Width (m)</th>
<th>Walking Speed (m/s)</th>
<th>Percent Blockage</th>
<th>Right turn flare (veh)</th>
<th>Median type</th>
<th>Median storage veh</th>
<th>Upstream signal (m)</th>
<th>pX, platoon unblocked</th>
<th>vC, conflicting volume</th>
<th>vC1, stage 1 conf vol</th>
<th>vC2, stage 2 conf vol</th>
<th>vCu, unblocked vol</th>
<th>tC, single (s)</th>
<th>tC, 2 stage (s)</th>
<th>tF (s)</th>
<th>p0 queue free %</th>
<th>cM capacity (veh/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
<td>971</td>
<td>894</td>
<td>338</td>
<td>910</td>
<td>916</td>
<td>104</td>
<td>368</td>
<td>113</td>
<td></td>
</tr>
</tbody>
</table>

## Direction, Lane #

<table>
<thead>
<tr>
<th>Volume Total</th>
<th>EB 1</th>
<th>WB 1</th>
<th>NB 1</th>
<th>SB 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>149</td>
<td>128</td>
<td>575</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>46</td>
<td>15</td>
<td>207</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>68</td>
<td>17</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>221</td>
<td>324</td>
<td>1201</td>
<td>1489</td>
<td></td>
</tr>
</tbody>
</table>

## Volume to Capacity

| Volume to Capacity | 0.29 | 0.46 | 0.01 | 0.14 |
| Queue Length 95th (m) | 9.2  | 18.5 | 0.3  | 3.9  |
| Control Delay (s) | 27.8 | 25.2 | 1.0  | 3.7  |
| Lane LOS | D    | D    | A    | A    |
| Approach Delay (s) | 27.8 | 25.2 | 1.0  | 3.7  |
| Approach LOS | D    | D    |     |      |

## Intersection Summary

| Average Delay | 8.5 |
| Intersection Capacity Utilization | 51.3\% |
| ICU Level of Service | A |
| Analysis Period (min) | 15 |
January 31, 2012

Mr. Glen Reimer
P.O. Box 81
Success, Saskatchewan
S0N 2R0

Dear Mr. Reimer:

RE: GRAVELLED ROADWAY STRUCTURE ASSESSMENT
TOWNSHIP ROAD NO. 382 (LUTHERAN ROAD) AND
RANGE ROAD NO. 3052
ADJACENT SE-15-38-05-W3M
RM OF CORMAN PARK, SASKATCHEWAN
PMEL FILE NO. S11-7471.2A

INTRODUCTION

Further to our report dated December 8, 2011 (i.e., refer to P. Machibroda Engineering Ltd. (PMEL) Report No. S11-7471.2), prepared for the above referenced site, PMEL has conducted an assessment of the existing high-grade gravel roads (i.e., Township Road No. 382 and Range Road No. 3052) located adjacent the proposed Industrial Park Subdivision within SE-15-38-05-W3M.

Authorization to proceed with this investigation was provided on August 6, 2010. The Terms of Reference for this investigation were presented in PMEL Proposal No. 0709-6204A, dated August 5, 2010.

FIELD INVESTIGATION

On September 16, 2011, six (6) test holes, located as shown on the enclosed Site Plan, Drawing No. S11-7471.2A-1, were drilled using our truck mounted continuous flight, solid stem auger drill rig. Three of the test holes were located along Range Road No. 3052 and three were located along Township Road No. 352 (Lutheran Road). The test holes were 150 mm in diameter and extended to approximately 2.1 m below existing grade.

Test hole drill logs were compiled during test drilling to record the soil stratification, the groundwater conditions, the position of unstable sloughing soils and the depths at which cobblestones and/or boulders were encountered. The test hole drill logs have been shown plotted on Drawing Nos. S11-7471.2A-2 to 7, inclusive.

Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.
FIELD DRILL LOGS

The field drill logs recorded during test drilling has been shown plotted on Drawing Nos. S11-7471.2A-2 to 7, inclusive.

Soil Profile

On Range Road No. 3052 (i.e., Test Hole Nos. 11-101, 11-102 and 11-103), the general soil profile consisted of sand and gravel fill extending to approximately 1.5 to 1.8 m below grade, followed by highly plastic clay fill extending to at least 2.1 m below grade.

On Township Road No. 352 (Lutheran Road), the general soil profile consisted of sand and gravel fill extending to at least 2.1 m below grade, the maximum depth explored by our test holes at the site. Black fill, possibly organics, were located at a depth of 0.5 to 0.7 m below grade in Test Hole Nos. 11-105 and 11-106.

Groundwater Conditions and Sloughing

Seepage and sloughing were apparent at approximately 1.6 m to 1.9 m below grade in Test Hole Nos. 11-101, 11-104, 11-105 and 11-106.

Cobblestones and Boulders

Cobblestones and/or boulders were not encountered in the test holes drilled at the site during the field investigation.

LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, water contents, Atterberg limits, unit weights, and grain size distribution analysis.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. S11-7471.2A-2 to 7, inclusive.

Grain Size Distribution Analyses

Results of grain size distribution analyses, conducted on samples recovered from the upper 0.6 m of each Test Hole, have been shown on the Test Hole Logs, Drawing Nos. S11-7471.2A-2 to 7, inclusive. The results of grain size distribution analyses of deeper sub-soils have been shown plotted on Drawing Nos. S11-7471.2A-8 to 11, inclusive. The grain size distribution analyses have been summarized in Table I.
Table I. Grain Size Distribution Analyses

<table>
<thead>
<tr>
<th>Road</th>
<th>Test Hole No.</th>
<th>Sample Depth (m)</th>
<th>% Finer than 75 μm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range Road No. 3052</td>
<td>11-101</td>
<td>0.3</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td>11-102</td>
<td>0.3</td>
<td>49.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.6</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>11-103</td>
<td>0.3</td>
<td>35.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.1</td>
<td>98.0</td>
</tr>
<tr>
<td>Township Road No. 352</td>
<td>11-104</td>
<td>0.3</td>
<td>28.2</td>
</tr>
<tr>
<td>(Lutheran Road)</td>
<td>11-105</td>
<td>0.6</td>
<td>33.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>11-106</td>
<td>0.6</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2</td>
<td>12.0</td>
</tr>
</tbody>
</table>

ROADWAY GRAVEL STRUCTURE ASSESSMENT

Review of the results presented in Table I indicate that the upper fill deposits contain a large percentage of fine-grained material (i.e., clay/silt). The clay/silt soils are susceptible to softening when wetted and will reduce the strength of the granular fill resulting in the development of ruts and/or potholes in the riding surface. A soft, black organic layer was also encountered at about 0.5 metres below the riding surface in Test Hole Nos. 11-105 and 11-106, which will also lead to a reduction in strength. As such, it is suggested that the upper 0.6 metres of the existing roadway structure be removed and replaced with a suitable granular soil (i.e., sub-base and base).

GRAVELLED ROADWAY STRUCTURE DESIGN

The following minimum recommendations should be incorporated into the design of the gravelled structure.

1. All organic topsoil (e.g., Test Hole Nos. 11-105 and 11-106 at approximately 0.5 metres below riding surface), loose fill and deleterious materials should be removed.

2. The surface (i.e., upper 150 mm) of the existing sub-base layer (i.e., 0.6 metres below the existing riding surface) should be levelled and compacted to 96 percent of standard Proctor density at optimum moisture content.

3. Proof roll the prepared sub-base with heavy wheeled equipment to detect soft areas. Soft areas should be excavated and replaced with suitable soil compacted to 96 percent of standard Proctor density at optimum moisture content. Geogrid/geotextile is recommended to provide soil stabilization and separation where soft soil conditions are encountered.

4. Sub-base fill, if required, should consist of granular soil. Sub-base fill should be placed in thin lifts (150 mm loose, maximum) and compacted to 96 percent of standard Proctor density at optimum moisture content.
5. As a subgrade support, the CBR (California Bearing Ratio) rating of the subgrade soil (located below 1.6 metres below existing roadway surface) should be a minimum of 3. Based a CBR rating of 3, the following gravelled structure has been presented.

**Table II. Thickness Design for Gravelled Structure**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Heavy Truck Traffic Wheel Loading (5,400 kg) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granular Base (Min CBR = 65)</td>
<td>200</td>
</tr>
<tr>
<td>Granular Sub-Base (Min CBR = 20)</td>
<td>400</td>
</tr>
<tr>
<td>Existing Sub-Base Layer</td>
<td>(150)</td>
</tr>
<tr>
<td><strong>Geogrid/Geotextile</strong></td>
<td>As Required</td>
</tr>
<tr>
<td><strong>Total Thickness</strong></td>
<td>600</td>
</tr>
</tbody>
</table>

*Geogrid/geotextile will be required where soft/wet/loose subgrade soil conditions are encountered.*

6. All granular fill placed above the existing sub-base elevation should be placed in thin lifts (150 mm loose) and compacted to a minimum of 98 percent of standard Proctor density. The granular base and sub-base course material should meet the following aggregate gradation requirements.

**Table III. Aggregate Gradation Requirements**

<table>
<thead>
<tr>
<th>Grain Size (mm)</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Course</td>
</tr>
<tr>
<td>50.0</td>
<td>--</td>
</tr>
<tr>
<td>25.0</td>
<td>100</td>
</tr>
<tr>
<td>18.0</td>
<td>87 - 100</td>
</tr>
<tr>
<td>12.5</td>
<td>72 - 93</td>
</tr>
<tr>
<td>5.0</td>
<td>45 - 77</td>
</tr>
<tr>
<td>2.0</td>
<td>26 - 56</td>
</tr>
<tr>
<td>0.900</td>
<td>18 - 39</td>
</tr>
<tr>
<td>0.400</td>
<td>13 - 26</td>
</tr>
<tr>
<td>0.160</td>
<td>7 - 16</td>
</tr>
<tr>
<td>0.071</td>
<td>6 - 11</td>
</tr>
<tr>
<td>Plasticity Index (%)</td>
<td>0 - 6</td>
</tr>
<tr>
<td>CBR (min.)</td>
<td>65</td>
</tr>
<tr>
<td>% Fracture (min.)</td>
<td>50</td>
</tr>
</tbody>
</table>
If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust the above meets with your approval. If you have any questions or require additional information, please contact our office.

P. MACHIBRODA ENGINEERING LTD.

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
P. MACHIBRODA ENGINEERING LTD.
Number 172
Permission to Consult held by:
Discipline Sk. Reg. No. Signature
Geotechnical 10461 K.Pander

Lorry Reynish, P.Eng.

Kelly Pardsoki, P.Eng.

LR:KP:zz

Enclosures:

Drawings
S11-7471.2A-1 Site Plan – Test Hole Locations
S11-7471.2A-2 Field Drill Log and Soil Test Results
S11-7471.2A-3 Field Drill Log and Soil Test Results
S11-7471.2A-4 Field Drill Log and Soil Test Results
S11-7471.2A-5 Field Drill Log and Soil Test Results
S11-7471.2A-6 Field Drill Log and Soil Test Results
S11-7471.2A-7 Field Drill Log and Soil Test Results
S11-7471.2A-8 Grain Size Distribution Analysis
S11-7471.2A-9 Grain Size Distribution Analysis
S11-7471.2A-10 Grain Size Distribution Analysis
S11-7471.2A-11 Grain Size Distribution Analysis
SITE PLAN - TEST HOLE AND PEIZOCONE LOCATIONS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION
SE-15-38-5-W3M, RM OF CORMAN PARK - NEAR SASKATOON, SK

APPROVED BY:
L. REYNISH

DRAWN BY:
G. SOLTYS

DRAWING NUMBER:

West Corman Industrial Park CDR
### TEST HOLE 11-101

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>N</th>
<th>U</th>
<th>( \gamma_w )</th>
<th>( P_w )</th>
<th>( L_w )</th>
<th>( w )</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 0</td>
<td></td>
<td></td>
<td>21.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1</td>
<td></td>
<td></td>
<td>4.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2</td>
<td></td>
<td></td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>32.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FILL**, clay, sandy, some silt, some gravel, soft, medium plastic, moist, mottled grey/black.
- \( P_{200} = 55.6\% \) at 300 mm.
- Wet, seepage, sloughing below 1.6 m.

**FILL**, clay, some silt, some sand, trace gravel, soft, highly plastic, moist to wet, mottled brown/grey.

**NOTE:**
1. Test Hole open to 1.8 m and dry I.A.D.

- \( \gamma_w \) = WET UNIT WEIGHT (kN/m³)
- \( L_w \) = LIQUID LIMIT
- \( P_w \) = PLASTIC LIMIT
- \( w \) = WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- \( U \) = UNCONFINED COMPRESSIVE STRENGTH (kPa)
- \( S_0 \) = SOIL TEST RESULTS
- \( P_{200} \) = % PASSING No. 200 SIEVE
- I.A.D. = IMMEDIATELY AFTER DRILLING
- \( \gamma \) = RECORDED WATER LEVEL (TEST HOLE I.A.D.)
- \( \nabla \) = RECORDED WATER LEVEL (PIEZO)

**LIMITATIONS:**
The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

---

**P. Machibroda Engineering Ltd.**

### FIELD DRILL LOG AND SOIL TEST RESULTS

**PROJECT:**
PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**
SE1/4-14-36-5-W3M
RM of Corman Park
Near Saskatoon, SK

<p>| NORTHING: | EASTING: |</p>
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>U</td>
<td>( \gamma_w )</td>
<td>Pw</td>
<td>Lw</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>pp</td>
<td></td>
<td>6.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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**FILL:** clay, sandy, some silt, some gravel, stiff, medium plastic, moist, brown, oxide stained.

\(-P200 = 49.6\% at 300 \text{ mm}.)

**FILL:** sand and gravel, some clay, dense, well graded, fine to coarse grained, moist, brown.

**FILL:** clay, some silt, some sand, trace gravel, soft, medium plastic, moist, black.

**FILL:** sand and gravel, trace clay, dense, well graded, fine to coarse grained, moist, brown.

**FILL:** clay, some silt, some sand, trace gravel, soft, highly plastic, moist to wet, mottled brown/grey.

**NOTE:**
1. Test Hole open to 2.1 m and dry I.A.D.

**LIMITATIONS:** The field drill log is a summary of the subsurface conditions encountered at the specific Test Hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific Test Hole location.

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:**
PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**
SE1/4-14-38-5-W3M
RM of Corman Park
Near Saskatoon, SK

**NORTHING:**
EASTING:
# TEST HOLE 11-103

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**NOTE:**
1. Test Hole sloughed to 1.9 m and dry I.A.D.

---

**LIMITATIONS:** The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

---

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:**
PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**
SE1/4-14-38-5-W3M RM OF CORMAN PARK
NEAR SASKATOON, SK

**NORTHING:**
**EASTING:**
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**NOTE:**
1. Test Hole sloughed to 1.9 m and dry I.A.D.

**FILL:** clay, sandy, some silt, some gravel, stiff, medium plastic, moist, brown, oxide stained.

\( P200 = 28.2\% \) at 300 mm.

**FILL:** sand and gravel, some clay, dense, well graded, fine to coarse grained, moist, brown, oxide stained.

\( \gamma_w \ldots \text{WET UNIT WEIGHT (kN/m}^3) \)

\( p_w \ldots \text{PLASTIC LIMIT} \)

\( \text{U} \ldots \text{UNCONFINED COMPRESSION STRENGTH (kPa)} \)

\( \text{N} \ldots \text{STANDARD PENETRATION TEST} \)

\( \text{S0} \ldots \text{SULPHATE CONTENT} \)

\( \text{P200} \ldots \% \text{ PASSING No. 200 SIEVE} \)

\( \text{I.A.D.} \ldots \text{IMMEDIATELY AFTER DRILLING} \)

\( \text{\text{\( \chi \)}...RECORDED WATER LEVEL} \)

\( \text{\text{\( \uparrow \)...RECORDED WATER LEVEL (PIEZO)}} \)

**LIMITATIONS:** The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

**P. MACHIBRODA ENGINEERING LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:**

PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**

SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

**NORTHING:**

**EASTING:**
**TEST HOLE 11-105**

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**FILL:** clay, sandy, some silt, trace gravel, stiff, medium plastic, moist, brown.
- soft, black below 500 mm.
- P200 = 33.2% at 600 mm.

**FILL:** sand and gravel, some clay, dense, well graded, fine to coarse grained, moist, brown, oxidized, stained.
- wet, seepage, sloughing below 1.7 m.

**NOTE:**
1. Test Hole sloughed to 1.7 m and dry I.A.D.

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**TOPSOIL**

**GRAVEL**

**SILT**

**BLACK SOIL**

**WATER CONTENT**

(Percent of Dry Soil Weight)

**LIQUID LIMIT**

**PLASTIC LIMIT**

**WET UNIT WEIGHT (kN/m³)**

**UNCONFINED COMPRESSIVE STRENGTH (kPa)**

**POCKET PENETROMETER (kg/cm²)**

**STANDARD PENETRATION TEST**

(SAFETY HAMMER w/AUTOMATIC TRIF 50/125 = BLOWS/SAMPLER PENETRATION (mm))

**SULPHATE CONTENT**

(Percent of Dry Soil Weight)

**P200...% PASSING No. 200 SIEVE**

**IMMEDIATELY AFTER DRILLING**

**RECORDED WATER LEVEL**

(TECH HOLE I.A.D.)

**RECORDED WATER LEVEL (PIEZO)**

---

**LIMITATIONS:**

The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

---

**P. MACHIBRODA ENGINEERING LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:**

PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**

SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

**NORTHING:**

**EASTING:**

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**72**
## TEST HOLE 11-106

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**NOTE:**
1. Test Hole sloughed to 1.8 m and dry I.A.D.

- **FILL:** clay, sandy, some silt, trace gravel, stiff, medium plastic, moist, grey.
- **w:** WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- **Lw:** LIQUID LIMIT
- **P:** PLASTIC LIMIT
- **w:** WET UNIT WEIGHT (kN/m³)
- **U:** UNCONFINED COMPRESSIVE STRENGTH (kPa)
- **pp:** POCKET PENETROMETER (kg/cm²)
- **N:** STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRII (50/125 = BOWS/SAMPLER PENETRATION (mm))
- **SO₂:** SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)
- **P200:** % PASSING No. 200 SIEVE
- **I.A.D.:** IMMEDIATELY AFTER DRILLING
- **GR:** RECORDED WATER LEVEL (TEST HOLE I.A.D.)
- **WP:** RECORDED WATER LEVEL (PIECO)
- **SHOEY:** TUBE
- **SPLIT:** SPOON
- **CUTTINGS**

**LIMITATIONS:** THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

**P. MACHIBRODA ENGINEERING LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:** PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION:**
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

**NORTHING:**
**EASTING:**

West Corman Industrial Park CDR
Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-101
Sample No.: 142
Depth (mm): 600

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>61</td>
<td>12</td>
</tr>
</tbody>
</table>

GRAVEL SIZES
COARSE FINE

SAND SIZES
COARSE MEDIUM FINE

SILT AND CLAY SIZES
INCHES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA
DRAWING NO.
74
Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4–14–38–5–W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-102
Sample No.: 154
Depth (m): 2.1

Material Description

<table>
<thead>
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<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
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<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>77</td>
<td>21</td>
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<table>
<thead>
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<th>GRAVEL SIZES</th>
<th>SAND SIZES</th>
<th>SILT AND CLAY SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE MEDIUM FINE</td>
</tr>
<tr>
<td>INCHES</td>
<td>SIEVE SIZES</td>
<td></td>
</tr>
</tbody>
</table>

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS
Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4—14—38—5—W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11—7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11—104
Sample No.: 165
Depth (m): 1.2

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>75</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRAVEL SIZES</th>
<th>SAND SIZES</th>
<th>SILT AND CLAY SIZES</th>
</tr>
</thead>
<tbody>
<tr>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
</tr>
<tr>
<td>INCHES</td>
<td>SIEVE SIZES</td>
<td></td>
</tr>
</tbody>
</table>

The provided graph and table are used to analyze the grain size distribution of the soil sample, with the horizontal axis representing grain size in millimeters and the vertical axis representing the percentage finer than the corresponding grain size.
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-106
Sample No.: 179
Depth (m): 1.2

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>59</td>
<td>12</td>
</tr>
</tbody>
</table>

GRAVEL SIZES
COARSE | FINE

SAND SIZES
COARSE | MEDIUM | FINE

SILT AND CLAY SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.
S11-7471.2A-11
27 Apr, 2016

Bill Delainey
Associated Engineering

Dear Bill:

Re: West Corman Industrial Park (SF-15-38-5W3) Potable Water Supply

IWI has the resources to provide potable water to the proposed development of the West Corman Industrial Park (SF-15-38-5-W3). The connection may connect to the existing line on Lutheran Road and if or an additional line may be required along RR 3052 (subject to engineering design). In addition, an application to Sask Water for additional allocation will be required.

The water supplied will be a low pressure line requiring on site storage as a reservoir. Initial flow restrictors are 1.9 litres/minute and are changed depending on the maximum water requested.

Sincerely,

[Signature]

Geoffrey Booth
Treasurer

Phone (306) 242-6663  Fax (306) 931-3870
G & S Developments
Box 81
Success, SK
S0N 2R0

Attention: Trent Reimer and Glen Reimer

Dear Sirs:

This letter is to confirm Intervale Water Inc's intent to supply water to your development project for 21 lots located on portion of SE-16-38-5 W3rd.

Timelines and financial arrangements are to be determined.

Yours truly,

[Signature]

Geoff Booth
Vice-Chairman

Sent By Email to: treimer@yourlink.ca

Phone (306) 242-6663   Fax (306) 931-3870
A call was made to Mr. Latimer, and a voice message was left. His return call yielded the following points of note:

- From Mr. Latimer's point of view, SaskHealth has no issues with the proposed development, but wants to be sure other agencies such as the RM and the Ministry of Environment are aware (which they are);
- When applying for a Permit to Construct, permits required from Saskatchewan Public Health are available on their website; and
- Permits may be required for sanitary sewage systems or major plumbing systems.

Mr. Latimer also noted that the regulations changed regarding plumbing and private sewage works last month (September?) and that planning or design moving forward should reflect those changes if applicable.

Conclusions/Decisions/Actions to be taken:
Good morning Bill,

Thank you for reaching out to Envirotec in respect to supporting septic service for an additional 22 light industrial lots situated directly west of the existing Corman Industrial Park. This email can be utilized as formal confirmation that Envirotec Services has the capacity to handle items related to Septic Service including recovery, transport and licensed disposal of sewage at the Saskatoon Waste Water Treatment Facility. In addition to the responsible treatment of the sewage, Envirotec holds the require Sewage Hauler Permit to provide services within the Province of Saskatchewan (permit attached).

Should you require any additional information, please feel free to contact me direct.

Kind Regards,

Ray Poppl | Manager, Customer Care

Envirotec Services Incorporated
P.O. Box 25055, Saskatoon, Saskatchewan S7K 8B7
100 Cory Road, East Cory Industrial Park, RM of Corman Park, Saskatchewan
Tel. (306) 244-9500

P.O. Box 27063, Regina, Saskatchewan S4R 0J0
2B Industrial Drive, Great Plains Industrial Park, Emerald Park, Saskatchewan
Tel. (306) 721-9500

Toll-Free (24 Hours) 1-877-244-9500 www.envirotec.ca

Good afternoon Ray, I received your contact information from Mike Pawluski in our office. We have engaged by the property owner of SE 15-38-5-W3 (Corman Park) who is proposing to subdivide an additional 22 light industrial lots situated directly west of the existing Corman Industrial Park. As with other rural industrial developments in Corman Park, all wastewater is intended to be managed through the use of septic holding tanks. Community Planning has been consistently requesting that subdivision applicants contact and secure confirmation of service from a licensed service provider. Are you able to supply us with an email confirming your company's ability to support the proposed subdivision and the intended location for ultimate disposal of the sewage?

Thank you for your consideration of this request. I have attached a Google Earth place mark which identifies the location of the proposed subdivision.

Bill Delainey
August 12, 2010

Associated Engineering
(Fax – 242-4904)

Attention: Mr. Mark Guidinger

Dear Sir:

Re: Reimer Development

Reference your enquiry regarding the parcel of land – SE 15 38 5 W3rd. This property is outside the response district of Saskatoon Fire and Protective Services. The closest available resources will be the volunteer department of Martensville.

If you require further information, please contact me at 975-2966.

Yours truly,

[Signature]

Dan Paulsen
Assistant Chief

/bjs
Darrell Rinas

From: Rebecca Row <rrow@rmcormanpark.ca>
Sent: Friday, March 30, 2012 3:55 PM
To: Darrell Rinas; treimer@yourlink.ca
Subject: FW: M’ville Fire Service to Reimer Ind. Park

Feel free to include a copy of this letter in your CDR as follow up from the RM re: fire services

Rebecca Row, PPS, MCIP
Municipal Planner
(306) 975-1654

From: Kurtis Dyck [mailto:kurtis.dyck@sasktel.net]
Sent: Friday, March 30, 2012 2:11 PM
To: Rebecca Row
Subject: Re: M’ville Fire Service to Reimer Ind. Park

Hello Rebecca

Yes, as per our current agreement, the Martensville Fire Department would respond to this new subdivision in the event of a fire.

Our relationship with the Warman Fire Department remains strong. We do have a mutual aid agreement so I would have no doubt that they would be there to back us up in the event of an emergency. The same would hold true for the other departments within our mutual aid agreement.

In regards to capital funding, your administration can expect a letter in the near future.

Kurtis Dyck

On 2012-03-29, at 1:32 PM, “Rebecca Row” <rrow@rmcormanpark.ca> wrote:

Hi Kurtis,

Further to our phone conversation a few weeks ago my way of this email I want to confirm that the Martensville/Warman Fire Department, as part of the agreement between yourselves and the RM of Corman Park, would respond to a fire in the proposed Reimer Industrial Park, located at SE 12-38-5-W3 adjacent to the existing Corman Industrial Park off Lutheran Road. It is understood that your department may require additional funding for upgraded equipment in the future, and as such the Planning Dept.’s expectation would be that a letter request would be submitted to our RM Administration and Council to request that funding. To is our understanding that the funding has been required for some time, and it is not driven by this exact development proposal, but is due in part to the large amount of development within the City of Martensville, the RM of Corman Park and the general region. I am not trying to underscore the need for this additional funding, but am wanting to confirm, as we discussed, that your department would respond to the fire as set out in the current agreement. If you could provide a positive response to this email confirming our understanding that would be great. If you like, in my report for recommendation on the Reimer subdivision, I could mention something about a future funding request being expected by your department, but will leave it to yourselves to actually formalize the request. Let me know asap if you have any major concern with this approach, thanks for your help!

Rebecca Row, PPS, MCIP
Municipal Planner
phone: (306) 975-1654
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL PARK SUBDIVISION
WITHIN SE-15-38-5-W3M
NEAR MARTENSVILLE, SASKATCHEWAN
PMEL FILE NO. S10-7471
NOVEMBER 19, 2010

PREPARED FOR:

MR. GLEN REIMER
P.O. BOX 81
SUCCESS, SASKATCHEWAN
S0N 2R0
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2.0 FIELD INVESTIGATION ................................... 1
3.0 FIELD DRILL LOGS ....................................... 2
   3.1 Soil Profile ........................................ 2
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   3.3 Cobblestones and/or Boulders .................... 3
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West Corman Industrial Park CDR
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S10-7471-6A Field Drill Log and Soil Test Results
S10-7471-7  Field Drill Log and Soil Test Results
S10-7471-8  Field Drill Log and Soil Test Results
S10-7471-9  Field Drill Log and Soil Test Results
S10-7471-10 Field Drill Log and Soil Test Results
S10-7471-11 Field Drill Log and Soil Test Results
S10-7471-12 Field Drill Log and Soil Test Results
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Appendix A  Explanation of Terms on Test Hole Logs
Appendix B  Topsoil, Organic Matter and Organics

P. MACHIBRODA ENGINEERING LTD.
1.0 INTRODUCTION

The following report has been prepared on the basis of the subsurface soil conditions encountered on a portion of the site of a proposed Industrial Park Subdivision within SE-15-38-5-W3M near Martensville, Saskatchewan. The Subdivision is proposed to occupy approximately 135 acres of the 160 acre quarter section. Since the west portion of the site was too wet to perform a field investigation with our truck-mounted drilling equipment, the current investigation was limited to the east half of the site with the west half to be drilled after freeze up. Seventeen (17) of the proposed twenty-nine (29) test holes were completed during this investigation. The north portion of the site was also too wet to allow access for our drilling equipment. The remaining twelve (12) test holes should be completed after freeze up has occurred.

Authorization to proceed with this investigation was provided on August 6, 2010. The Terms of Reference for this investigation were presented in PMEL Proposal No. 0709-6204A, dated August 5, 2010.

The field test drilling and soil sampling were conducted on several days in September, 2010.

2.0 FIELD INVESTIGATION

Seventeen test holes, located as shown on the Site Plan, Drawing No. S10-7471-1, were dry drilled using our truck-mounted continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and extended to depths of 2 to 12.4 metres below the existing ground surface.

Test hole drill logs were compiled during test drilling to record the soil stratification, the groundwater conditions, the position of unstable sloughing soils and the depths at which cobblesstones and/or boulders were encountered. The test hole drill logs have been shown plotted on Drawing Nos. S10-7471-2 to 18, inclusive.

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Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.

Standard penetration tests (N-index), utilizing a safety hammer with automatic trip were performed during test drilling.

3.0 **FIELD DRILL LOGS**

The field drill logs recorded during test drilling have been shown plotted on Drawing Nos. S10-7471-2 to 18, inclusive.

The ground surface elevation at the Test Hole locations was provided in a survey performed by Associated Engineering.

3.1 **Soil Profile**

Detailed descriptions of the site stratigraphy are presented on the Test Hole Logs, Drawing Nos. S10-7471-2 through 18, inclusive. In general, the subgrade soils consisted of a thin layer (100 to 200 mm) of organic topsoil overlying deposits of sand and gravel, clay and/or silt to a maximum depth of 1.3 metres below ground surface. The above deposits were underlain by glacial till to approximately 12.4 metres below grade, the maximum depth penetrated by our test holes at this site. Inter/intra till sand and/or gravel deposits were encountered in several test holes.

3.2 **Groundwater Conditions, Sloughing**

Groundwater seepage and sloughing conditions were encountered during test drilling. The depths at which groundwater seepage and sloughing conditions were encountered have been shown on Drawing Nos. S10-7471-2 to 18, inclusive.
A summary of the groundwater levels recorded in the piezometers installed during this investigation has been presented in Table I.

### TABLE I. RECORDED GROUNDWATER LEVELS

<table>
<thead>
<tr>
<th>Test Hole No.</th>
<th>Piezometer Rim Elevation (metres)</th>
<th>Ground Surface Elevation (metres)</th>
<th>* Recorded Groundwater Elevation (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-4</td>
<td>509.7</td>
<td>508.7</td>
<td>507.1</td>
</tr>
<tr>
<td>10-10</td>
<td>509.5</td>
<td>508.5</td>
<td>Dry</td>
</tr>
<tr>
<td>10-12</td>
<td>509.3</td>
<td>508.3</td>
<td>507.2</td>
</tr>
</tbody>
</table>

*The piezometers may not have stabilized. Higher static water levels should be expected during or following spring snowmelt and periods of precipitation.*

### 3.3 Cobblestones and/or Boulders

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. The glacial till strata also contained sorted deposits of the above particle sizes. In addition to the sorted deposits, a random distribution of larger particle sizes in the cobblestone (60 to 200 mm) and boulder-sized range (larger than 200 mm) were encountered at depths of approximately 10.6 and 12.1 metres below existing ground surface where auger refusal occurred.

It should be recognized that the statistical probability of encountering cobblestones and boulders in the seventeen, small diameter Test Holes drilled at this site was low. Intertill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the number of holes drilled or volume of soil excavated.
4.0 LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, water contents, Atterberg limits, unit weights, and grain size distribution analysis.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. S10-7471-2 to 18, inclusive. The results of the grain size distribution analysis have been shown plotted on Drawing Nos. S10-7471-19 to 22, inclusive.

5.0 DESIGN RECOMMENDATIONS

Based on the foregoing outline of soil test results, the following design considerations and recommendations have been presented.

5.1 Design Considerations

It is understood the proposed Industrial Park Subdivision will consist of 21 lots ranging from 4.5 to 10 acres in size as well as a 6.5 acre municipal reserve. The current drilling investigation covered portions of lots 11 to 16 inclusive, and lots 19, 20 and 21. It is also understood that the north and west portions of the site will be investigated when freeze up has occurred and the site will be easier to access with our drilling equipment.

The subsurface soil conditions consisted of a thin layer of organic topsoil overlying sand, gravel, clay and/or silt deposits followed by glacial till. Inter/intra till sand and gravel seems were encountered within the glacial till deposit. Groundwater seepage and sloughing conditions were encountered during test drilling. The groundwater level is located approximately 1 to 1.5 metres below grade. Higher groundwater levels should be expected during or following spring thaw or periods of precipitation. Due to the high groundwater table, site grading should be kept as high as possible and dewatering may be required for excavations left open for an extended period of time.

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A deep foundation system consisting of drilled, cast-in-place concrete piles and/or belled caissons should perform satisfactorily at this site. Construction difficulties should be anticipated in some pile holes due to the presence of cobbles, boulders and saturated inter/intra till sand deposits.

Recommendations have been presented for site preparation; drilled, cast-in-place concrete pile and/or belled caissons; excavations; floor slab; foundation concrete; grade beams and asphalt concrete pavement.

5.2 Site Preparation

All organic topsoil and deleterious materials should be removed from the building footprint, walkway and parking areas. Staining and root intrusion from the overlying organic material and roots may be encountered during excavation within the subsurface mineral soils. If these conditions are suspected, a representative of the geotechnical consultant should inspect the site during excavation to verify the depth of organic topsoil which should be removed in preparation of the site for construction. In addition to organic topsoil, all construction debris, loose fill and other deleterious materials should also be removed.

See Appendix B for further information in regards to topsoil composition and soil structure.

The surface of the subgrade should be levelled and compacted to the following minimum density requirements.

<table>
<thead>
<tr>
<th>Building Areas</th>
<th>98 percent of standard Proctor density at optimum moisture content;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway Areas</td>
<td>96 percent of standard Proctor density at optimum moisture content;</td>
</tr>
<tr>
<td>Landscape Areas</td>
<td>90 percent of standard Proctor density at optimum moisture content.</td>
</tr>
</tbody>
</table>
Subgrade fill, if required, should preferably consist of imported granular material or non-expansive (i.e., low plastic) fine grained soils (such as the on-site granular fill). The fill should be placed in thin lifts (maximum 150 mm loose) and compacted to 96 percent of standard Proctor density at optimum moisture content. All proposed subgrade fill should be approved by the Geotechnical Consultant prior to placement.

The site should be graded to ensure positive site drainage away from all structures.

5.3 Excavations

Depending on lateral constraints, excavations at this site may be completed with unbraced, sloped side walls. The long-term stability of the excavation walls will be affected by wetting and drying of the exposed excavation walls, the length of time that the excavation remains open and the consistency and structure (degree of fracturing, slickensiding, etc.) of the subgrade soils. The excavated soil should be removed from the excavation banks (and stockpiled) to minimize potential sloughing of the trench sidewalls due to the soil surcharge loading.

Excavations in clay and glacial till may be cut vertically to a maximum height of 1 metre. The recommended minimum sideslopes for the excavations at this site have been presented in Table II.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Minimum Recommended Sideslope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Horizontal</td>
</tr>
<tr>
<td>Clay</td>
<td>2</td>
</tr>
<tr>
<td>Glacial Till</td>
<td>1.5</td>
</tr>
</tbody>
</table>

* Slopes should be flattened where groundwater seepage and sloughing conditions are encountered.

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5.4 Drilled, Cast-In-Place Concrete Piles and/or Caissons

Construction difficulties should be anticipated in some pile holes due to the presence of cobbles, boulders and saturated inter/intra till sand deposits.

Drilled, straight shaft, cast-in-place, reinforced concrete piles may be designed on the basis of skin friction only. Belled caissons may be designed on the basis of skin friction and end bearing capacity.

The allowable skin friction bearing pressures of the undisturbed soil are as follows:

<table>
<thead>
<tr>
<th>Zone (metres)</th>
<th>Allowable Skin Friction Bearing Pressure (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2</td>
<td>0</td>
</tr>
<tr>
<td>2 to 7</td>
<td>30</td>
</tr>
<tr>
<td>Below 7</td>
<td>40</td>
</tr>
</tbody>
</table>

Notes:

1. To minimize frost heave potential, skin friction piles should be extended to and reinforced to a minimum depth of 6 metres below finished ground surface.

2. Piles should be reinforced.

3. A minimum pile diameter of 400 mm is recommended for the primary structural loads. Larger pile diameters may be required to allow for the removal of cobbles and boulders in some pile holes, if encountered.

4. The pile holes should be filled with concrete as soon as practical after drilling.

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5. Groundwater seepage and sloughing conditions were encountered during test drilling. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open for placing of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As casing is extracted, concrete in casing must have adequate head to displace all water in the annular space.

6. Due to the hard nature of the subgrade soils, high-powered piling equipment is recommended.

7. A minimum centre-to-centre pile spacing of not less than three pile diameters is recommended.

8. A representative of the Geotechnical Consultant should inspect and document the installation of the drilled, cast-in-place concrete piles.

**TABLE IV. END BEARING PRESSURES (BELLED CAISSONS)**

<table>
<thead>
<tr>
<th>Depth (metres)</th>
<th>Allowable End Bearing Pressure (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 6 (machine cleaned)</td>
<td>275</td>
</tr>
</tbody>
</table>

* Belling depth may have to be adjusted depending on the position of seepage, sloughing, cobbles and boulders. Bells must be constructed at an adequate depth below the underside of any saturated sand deposits (if encountered).

**Notes:**

1. End bearing caissons designed on the basis of 275 kPa must bear on undisturbed, naturally deposited, very stiff glacial till.

2. For determination of skin friction capacity, the effective shaft length for belled caissons may be taken as the depth of embedment of the straight sided portion of the pile shaft, minus a length equal to the pile diameter (i.e., the bottom-most portion of the pile shaft is neglected to account for interaction with the bell).

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3. End bearing caissons should be inspected to confirm the removal of loose, disturbed soil prior to placing concrete and steel.

4. Caisson shafts should be reinforced.

5. Concrete should be placed as soon as practical after cleaning the bell.

6. To prevent softening of the bearing strata, water should not be allowed to accumulate at the base of the caisson hole. Groundwater seepage and sloughing conditions were encountered during test drilling. Casing will be required where groundwater seepage and sloughing conditions are encountered to maintain the pile holes open for placing of the reinforcing steel and concrete. The annular space between the casing and drilled hole must be filled with concrete. As casing is extracted, concrete in casing must have adequate head to displace all water in the annular space.

7. Due to the hard nature of the subgrade soils, high-powered piling equipment is recommended.

8. End bearing caissons may be belled at the base to a maximum of three times the shaft diameter.

9. The height of the bell should be designed to provide adequate concrete to distribute the unit stresses into the concrete without over-stressing the outer, non-reinforced concrete within the bell.

10. Full time inspection by a representative of the Geotechnical Consultant, employed directly by the Owner, is required to confirm allowable bearing pressures and to document the installation of each end bearing caisson.

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5.5 **Floor Slab**

The near surface subgrade soils consisted of variable deposits of clay, silt, sand and/or gravel and glacial till. Other than the clay deposits, a grade supported floor slab based on the surficial soils should perform satisfactorily. Clay, where encountered, should be over-excavated and replaced with either granular material or a non-expansive fine-grained material (i.e., glacial till). The subgrade soils are frost susceptible. Within unheated areas, measures should be taken to minimize the degree of frost heaving and slab cracking.

The following minimum provisions should be incorporated into the design of a heated, grade-supported, cast-in-place, reinforced concrete slab subject to light floor loading.

1. Prepare the site in accordance with Section 5.2, Site Preparation. Over-excavate, as required, to allow for a minimum of 300 mm of compacted granular base course fill below the floor slab.

2. Level and compact the upper 150 mm of subgrade soil to 96 percent of standard Proctor density at optimum moisture content.

3. Proof roll the prepared subgrade with heavy wheeled equipment to detect soft areas. Excavate soft subgrade areas and replace with suitable, non-expansive fill, placed and compacted to 96 percent of standard Proctor density at optimum moisture content. High-strength, woven geotextile may be required to provide soil stabilization and separation where soft/wet soil conditions are encountered. Granular backfill is recommended if geotextiles are utilized for stabilization.

4. Clay, where encountered at the design subgrade elevation should be removed entirely or over-excavated a minimum depth of 1 metre and replaced with granular or glacial till fill compacted to 96 percent of standard Proctor density at optimum moisture content.

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5. Subgrade fill, if required, should consist of granular material or locally available glacial till soils, placed in thin lifts (maximum 150 mm loose) and compacted to at least 96 percent of standard Proctor density at optimum moisture content. Moisture conditioning (i.e., drying) of the near surface glacial till soils may be required.

6. The granular base course should be placed in thin lifts (150 mm loose, maximum) and compacted to 98 percent of standard Proctor density at optimum moisture content.

7. Isolate the slab from foundation walls, columns, etc., by means of separation joints.

8. Reinforce the concrete slab and articulate the slab at regular intervals to provide for controlled cracking.

9. Provide positive site drainage away from the proposed buildings.

10. Floor slabs should not be constructed on desiccated, wet, or frozen subgrade soil or base.

11. Frost should not be allowed to penetrate beneath the floor slab just prior to, during or after construction.

Floor slabs designed and constructed in accordance with the above recommendations should perform satisfactorily (i.e., differential movements in the order of 25 mm). Larger differential slab movements (i.e., in the order of 50 mm or more) could occur if clay that is encountered at the design subgrade elevation is left in place and not over-excavated.

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Grade-supported concrete slabs exposed to freezing conditions (i.e., exterior slabs/sidewalks, etc.) will be subject to differential movements associated with frost action. The potential for differential movements associated with frost action can be minimized by placing sub-horizontal rigid polystyrene insulation below the slabs/sidewalks. The insulation should have a minimum thickness of 75 mm and should extend below the sidewalk and sub-horizontally away from the outer edges of the slab/sidewalk a minimum distance of 1.2 metres. If differential movements cannot be tolerated, the slabs/sidewalks could be constructed as structural slabs (i.e., pile supported).

5.6 Foundation Concrete

Water-soluble salts (gypsum crystals) are known to exist within the geological deposits in the area. Sulphate resistant cement is recommended for all foundation concrete in contact with the soil. All concrete at this site should be manufactured in accordance with current CSA standards. It should be recognized that water soluble sulphate salts combined with moist soil conditions or low pH soils, could render the soil highly corrosive to some types of metal water lines, elbows, connectors, etc., in contact with the soil.

5.7 Grade Beams

Grade beams should be reinforced at both top and bottom throughout their entire length.

5.8 Asphalt Concrete Pavement

The following minimum recommendations should be incorporated into the design of the asphalt concrete pavement structure.

1. Prepare the site in accordance with Section 5.2, Site Preparation.
2. Soft subgrade areas should be excavated and replaced with suitable soil compacted to a minimum of 96 percent of standard Proctor density at optimum moisture content.

3. Based on the results of soil classification and index testing, a design CBR rating of 3 may be used for the compacted subgrade soil. The following pavement structures have been presented.

**TABLE V. THICKNESS DESIGN FOR PAVEMENT STRUCTURES**

<table>
<thead>
<tr>
<th>Pavement Structure</th>
<th>Heavy Truck Traffic Wheel Loading (5,400 kg) (mm)</th>
<th>Light Truck/Passenger Vehicle Traffic Wheel Loading (1,830 kg) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Asphalt Concrete</td>
<td>100</td>
<td>65</td>
</tr>
<tr>
<td>Granular Base (Min CBR = 65)</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Granular Sub-Base (Min CBR =30)</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td><strong>Geotextile</strong></td>
<td>As Required</td>
<td>As Required</td>
</tr>
<tr>
<td>Prepared Subgrade</td>
<td>(150)</td>
<td>(150)</td>
</tr>
<tr>
<td>Total Thickness</td>
<td>500</td>
<td>365</td>
</tr>
</tbody>
</table>

* Use 2:1 equivalency for granular base substitution of asphalt concrete.
** Geotextile requirement based on construction considerations.

4. Subgrade fill, if required, should preferably consist of granular soil or non-expansive soil, placed in thin lifts and compacted to at least 96 percent of standard Proctor density at optimum moisture content. The fill should be approved by the Geotechnical Consultant prior to utilizing.

5. All granular fill placed above the subgrade elevation should be placed in thin lifts (150 mm loose) and compacted to a minimum of 98 percent of standard Proctor density. The granular base and sub-base course material should meet the following aggregate gradation requirements.
### TABLE VI. AGGREGATE GRADATION REQUIREMENTS

<table>
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<tr>
<th>Grain Size (mm)</th>
<th>Percent Passing</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Base Course</td>
<td>Sub-Base Course</td>
<td></td>
</tr>
<tr>
<td>50.0</td>
<td>--</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>100</td>
<td>85 - 100</td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>87 - 100</td>
<td>80 - 100</td>
<td></td>
</tr>
<tr>
<td>12.5</td>
<td>72 - 93</td>
<td>70 - 100</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>45 - 77</td>
<td>50 - 85</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>26 - 56</td>
<td>35 - 75</td>
<td></td>
</tr>
<tr>
<td>0.900</td>
<td>18 - 39</td>
<td>25 - 50</td>
<td></td>
</tr>
<tr>
<td>0.400</td>
<td>13 - 26</td>
<td>15 - 35</td>
<td></td>
</tr>
<tr>
<td>0.160</td>
<td>7 - 16</td>
<td>8 - 22</td>
<td></td>
</tr>
<tr>
<td>0.071</td>
<td>6 - 11</td>
<td>0 - 13</td>
<td></td>
</tr>
<tr>
<td>Plasticity Index (%)</td>
<td>0 - 6</td>
<td></td>
<td>0 - 6</td>
</tr>
<tr>
<td>CBR (min.)</td>
<td>65</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>% Fracture (min.)</td>
<td>50</td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

6. Positive surface drainage is recommended to reduce the potential for moisture infiltration through the pavement structure.

7. Surface water should be prevented from seeping back under the outer edges of the pavement structure.

8. Periodic maintenance such as crack sealing will be required.
6.0 LIMITATIONS

The presentation of the summary of the field drill logs and foundation design recommendations has been completed as authorized. Seventeen, 150 mm diameter test holes were dry drilled using our truck-mounted, continuous flight, solid stem auger drill rig. A field drill log was compiled for each Test Hole during test drilling which, we believe, was representative of the subsurface conditions at the Test Hole locations at the time of drilling. Variations in the subsurface conditions from that shown on the drill logs at locations other than the exact Test Hole locations should be anticipated. If conditions should differ from those reported here, then we should be notified immediately in order that we may examine the conditions in the field and reassess our recommendations in the light of any new findings.

No detectable evidence of environmentally sensitive materials such as hydrocarbon odour was detected during the actual time of the field test drilling program. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of deep test holes. The test holes were backfilled at the completion of test drilling. Please be advised that some settlement of the backfill materials will occur which may leave a depression or an open hole. It is the responsibility of the client to inspect the site and backfill, as required, to ensure that the ground surface at each Test Hole location is maintained level with the existing grade.

This report has been prepared for the exclusive use of Mr. Glen Reimer and his agents for specific application to a proposed Industrial Park Subdivision to be constructed within SE-15-38-5-W3M near Martensville, Saskatchewan. It has been prepared in accordance with generally accepted geotechnical engineering practices and no other warranty, express or implied, is made. Any uses which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. PMEL accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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The acceptance of responsibility for the design/construction recommendations presented in this report are contingent on adequate and/or full time inspection (as required, based on site conditions at the time of construction) by a representative of the Geotechnical Consultant. P. Machibroda Engineering Ltd. (PMEL) will not accept any responsibility on this project for any unsatisfactory performance if adequate and/or full time inspection is not performed by a representative of PMEL.

If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust that this report fulfills your requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

Lorry Reynish, P. Eng.

Kelly Pardoski, P. Eng.

LR:KP:zz
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL PARK SUBDIVISION
WITHIN SE-15-38-05-W3M
NEAR MARTENSVILLE, SASKATCHEWAN
PMEL FILE NO. S11-7471.2
DECEMBER 8, 2011

PREPARED FOR:

MR. GLEN REIMER
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S0N 2R0

Member of the
Association of Consulting
Engineers of Canada
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Appendix A Explanation of Terms on Test Hole Logs
Appendix B Piezocone Penetration Test Plots

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West Corman Industrial Park CDR
1.0 INTRODUCTION

The following report has been prepared on the basis of the subsurface soil conditions encountered on a portion of the site of a proposed Industrial Park Subdivision within SE-15-38-6-W3M near Martensville, Saskatchewan. The Subdivision is proposed to occupy approximately 135 acres of the 160 acre quarter section. A preliminary geotechnical investigation was prepared for the southeast portion of the subject property in 2010 (see PMEL Report No. S11-7471.2, dated November 19, 2010). The current investigation covers the west and north portions of the subject property, which were too wet to drill in 2010.

Authorization to proceed with this investigation was provided on August 6, 2010. The Terms of Reference for this investigation were presented in PMEL Proposal No. 0709-6204A, dated August 5, 2010.

The field test drilling and soil sampling were conducted over several days in September, 2010.

2.0 FIELD INVESTIGATION

2.1 Test Hole Drilling

Ten (10) test holes, located as shown on the Site Plan, Drawing No. S11-7471.2-1, were dry drilled using our truck-mounted continuous flight, solid stem auger drill rig. The test holes were 150 mm in diameter and extended to depths of 2 to 15 m below existing ground surface.

Test hole drill logs were compiled during test drilling to record the soil stratification, the groundwater conditions, the position of unstable sloughing soils and the depths at which cobbles and/or boulders were encountered. The test hole drill logs have been shown plotted on Drawing Nos. S11-7471.2-12 to 17, inclusive.

Disturbed samples of auger cuttings, collected during test drilling, were sealed in plastic bags to minimize moisture loss. The soil samples were taken to our laboratory for analysis.

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2.2 Piezocone Penetration Testing

Three (3) piezocone penetration tests (CPTu), located as shown on the Site Plan, Drawing No. S11-7471.2-1, were conducted as part of the field investigation. The CPTu tests extended to depths of approximately 6.8 to 12.6 m below existing grade, where practical tip refusal was encountered in dense soils.

The piezocone penetration tests consisted of pushing a cone, on the end of a series of rods, into the ground at a constant rate and near continuous measurements were made of the resistance to penetration of the cone. Local side friction resistance measurements were also made on a friction sleeve during penetration. Pore-water pressure response generated from the advancement of the cone into the soil was measured via a pore pressure filter located directly behind the cone tip. The piezocone tip had an apex angle of 60° and a 15 cm² base area. The friction sleeve had a perimeter area of 225 cm². The equipment and procedures for conducting the cone penetration testing were undertaken in accordance with ASTM D-5778, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Testing of Soils".

The test plots recorded during the cone soundings have been presented in Appendix B.

3.0 FIELD DRILL LOGS

The field drill logs recorded during test drilling has been shown plotted on Drawing Nos. S11-7471.2-2 to 11, inclusive, while the test plots recorded during the cone soundings have been presented in Appendix B.

The location and ground surface elevation at the Test Hole and CPTu test locations was provided in a survey conducted by Associated Engineering Ltd.
The general soil profile consisted of a thin layer of organic topsoil followed by variable deposits of clay, sand, and/or gravel extending up to 1.2 m below grade. The above deposits were undertained by glacial till extending to at least 15 m below grade, the maximum depth explored at this site. A saturated sand deposit was encountered in Test Hole No. 11-4 at a depth of 12.5 to 14.7 m below grade. Sand seams and lenses were encountered below approximately 11.0 m below grade in the majority of the deep test holes drilled at this site.

3.2 Groundwater Conditions, Sloughing

Groundwater seepage and sloughing conditions were encountered during test drilling. The depths at which groundwater seepage and sloughing conditions were encountered have been shown on Drawing Nos. S11-7471.2-2 to 11, inclusive.

A summary of the groundwater levels recorded in the piezometers installed during this investigation, and the previous investigation conducted in 2010, has been presented in Table I.

**TABLE I. RECORDED GROUNDWATER LEVELS**

<table>
<thead>
<tr>
<th>Test Hole No.</th>
<th>Piezometer Rim Elevation (m)</th>
<th>Ground Surface Elevation (m)</th>
<th>Recorded Groundwater Elevation* (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>04-Oct-10</td>
</tr>
<tr>
<td>10-4</td>
<td>509.7</td>
<td>508.7</td>
<td>507.1</td>
</tr>
<tr>
<td>10-10</td>
<td>509.5</td>
<td>508.5</td>
<td>Dry</td>
</tr>
<tr>
<td>10-12</td>
<td>509.3</td>
<td>508.3</td>
<td>507.2</td>
</tr>
<tr>
<td>11-1</td>
<td>508.9</td>
<td>507.9</td>
<td>N/A</td>
</tr>
<tr>
<td>11-2</td>
<td>508.0</td>
<td>508.0</td>
<td>N/A</td>
</tr>
<tr>
<td>11-3</td>
<td>508.5</td>
<td>507.5</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*The piezometers may not have stabilized. Higher static water levels should be expected during or following spring snowmelt and periods of precipitation. N/A - Not Applicable, Piezometer Not Yet Installed.
3.3 Cobblestones and/or Boulders

Cobblestones and boulders were encountered during test drilling in Test Hole Nos. 11-1 and 11-3. The depths at which cobblestones and boulders were encountered have been shown on Drawing Nos. S11-7471.2-2 to 11, inclusive.

The glacial till consisted of a heterogeneous mixture of gravel, sand, silt and clay-sized particles. A random distribution of larger particle sizes in the cobblestone range (60 to 200 mm) and boulder-sized range (larger than 200 mm) should be expected at the subject site.

It should be recognized that the statistical probability of encountering cobblestones and/or boulders in the thirteen small diameter Test Holes / CPTu soundings conducted at this large site was low. Intertill deposits of cobblestones, boulders, boulder pavements and isolated deposits of saturated sand or gravel should be anticipated. The frequency of encountering such deposits will increase proportionately with the number of piles installed or volume of soil excavated.

4.0 LABORATORY ANALYSIS

The soil classification and index tests performed during this investigation consisted of a visual classification of the soil, water contents, Atterberg limits and grain size distribution analysis.

The results of the soil classification and index tests conducted on representative samples of soil have been plotted on the drill logs alongside the corresponding depths at which the samples were recovered, as shown on Drawing Nos. S11-7471.2-2 to 11, inclusive.

The results of the grain size distribution analyses have been shown plotted on Drawing Nos. S11-7471.2-12 to17, inclusive.

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5.0 DESIGN RECOMMENDATIONS

The purpose of this investigation was to evaluate the existing subsurface soil and groundwater conditions for potential site development. Site specific geotechnical investigations are recommended once the nature and location of the proposed structures have been finalized.

Based on the foregoing outline of soil test results, the following preliminary foundation design considerations and recommendations have been presented.

5.1 Design Considerations

It is assumed that the proposed land development project will consist of industrial development and that the buildings would be constructed with grade-supported floor slabs (i.e., no basement).

The general subsurface soil conditions consisted of a thin layer of organic topsoil overlying an extensive deposit of glacial till to at least 15 m below grade, the maximum depth explored by our drilled test holes at the site. Near surface (i.e., upper 1 m) deposits of clay, sand and/or gravel were encountered in some of the test holes.

The groundwater level was located between 1.0 to 3.6 m below existing grade. Higher groundwater levels should be expected during or following spring thaw or periods of precipitation.

Depending on the size of the building(s), a shallow foundation (i.e., spread footing) founded on the glacial till deposits would perform satisfactorily. If it is not economical for a shallow foundation to be constructed then a deep foundation system consisting of drilled, cast-in-place concrete piles and/or belled caissons should perform satisfactorily. Some construction difficulty may be encountered where cobblestones and boulders and/or sand layers exist. Temporary casing will be required where saturated sand layers/lenses are encountered within the depth of the pile hole.

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In light of the above, preliminary recommendations have been presented for: site preparation; footings; drilled, cast-in-place concrete piles and/or belled caissons; floor slabs; and foundation concrete.

5.2 Site Preparation

Site preparation should consist of the removal of all vegetation, topsoil, peat and organic material from the site. The surface of the subgrade should be leveled and compacted to a minimum of 96 percent of standard Proctor density at optimum moisture content. Subgrade fill should consist of granular material or non-expansive fine grained soil (i.e., low plastic) placed in thin lifts (max. 150 mm loose) and compacted to 98 percent of standard Proctor density at optimum moisture content.

5.3 Standard Strip or Spread Footings

A footing foundation based below the average depth of frost penetration on naturally deposited, undisturbed glacial till should perform satisfactorily at this site. Allowable bearing pressure in the order of 75 to 125 kPa would be considered appropriate for footing foundations bearing on undisturbed glacial till.

Drilled, cast-in-place concrete pile and/or caisson foundations should perform satisfactorily in support of the building foundations at this site. The allowable skin friction bearing pressures for pile foundations would range from approximately 15 to 35 kPa in the glacial till deposit. The consistency of the glacial till ranged from soft within the upper portion of the soil profile to very stiff/hard with depth. Construction difficulties may be encountered in some piles due to the presence of cobblestones and boulders and/or saturated sand seams, layers and/or deposits below approximately 4.5 m below grade.

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Temporary casing will be required to complete some piles where groundwater seepage and sloughing conditions are encountered. End bearing capacities would be in the order of 300 to 450 kPa within very stiff to hard glacial till deposits below approximately 7.5 m below grade.

5.5 Floor Slabs

The near surface subgrade soil conditions consisted predominantly of glacial till. Conventional grade-supported floor slabs should perform satisfactorily in heated buildings. Some near surface (i.e., 1.5 m) deposits of highly plastic clay were encountered in some of the test holes drilled at the site which could result in differential floor movements associated with volume changes in the clay. Over excavation and replacement of the clay (or a portion thereof) with non-expansive fill could be considered to minimize the potential for differential floor movements.

5.6 Foundation Concrete

Water-soluble salts (gypsum crystals) are known to exist within the geological deposits in the area. Sulphate resistant cement is recommended for all foundation concrete in contact with the soil. Foundation concrete should be manufactured in accordance with current CSA standards.

5.7 Roadways

The near surface subgrade soil conditions consisted predominantly of glacial till. Based on the results of soil classification and index testing, a design CBR rating of 3 may be used for the compacted subgrade glacial till soil yielding pavement structures in the order of 375 mm for light traffic and 500 mm for heavy traffic. Subgrade preparation will be required to remove any organic or softened soils within the pavement areas prior to placing granular fill.

P. MACHIBRODA ENGINEERING LTD.
6.0 LIMITATIONS

The presentation of the summary of the field drill logs and preliminary foundation design recommendations has been completed as authorized. Ten (10) 150 mm diameter test holes were dry drilled using our truck-mounted, continuous flight, solid stem auger drill rig. Field drill logs were compiled for the Test Holes during test drilling which, we believe, were representative of the subsurface conditions at the Test Hole locations at the time of drilling. Three (3) CPTu piezocone penetration tests were conducted during the field investigation. The inferred subsoil stratigraphy has been shown on the enclosed CPTu plots. Variations in the subsurface conditions from that shown on the drill logs and CPTu plots at locations other than the exact test locations should be anticipated. If conditions should differ from those reported here, then we should be notified immediately in order that we may examine the conditions in the field and reassess our recommendations in the light of any new findings. For detailed design, we recommend drilling additional test holes within the footprint of the site specific structure locations.

A Phase I ESA conducted for the subject property has been submitted under separate cover (see PMEL Report No. S10-7471.1, dated October 13, 2010). No detectable evidence of environmentally sensitive materials such as hydrocarbon odour was detected during the actual time of the field test drilling program. If, on the basis of any knowledge, other than that formally communicated to us, there is reason to suspect that environmentally sensitive materials may exist, then additional test holes should be drilled and samples recovered for chemical analysis.

The subsurface investigation necessitated the drilling of a deep test holes. The test holes were backfilled at the completion of test drilling. Please be advised that some settlement of the backfill materials will occur which may leave a depression or an open hole. It is the responsibility of the client to inspect the site and backfill, as required, to ensure that the ground surface at each Test Hole location is maintained level with the existing grade.

P. MACHIBRODA ENGINEERING LTD.
This report has been prepared for the exclusive use of Mr. Glen Reimer and his agents for specific application to the proposed Industrial Park Subdivision to be located within SE-15-38-5-W3M in the RM of Conman Park, Saskatchewan. It has been prepared in accordance with generally accepted geotechnical engineering practices and no other warranty, express or implied, is made. Any uses which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. PMEL accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

The recommendations presented in this report are for preliminary purposes only. A detailed, specific geotechnical investigation is recommended for each proposed building development once the building details and each building location has been finalized. PMEL will not accept responsibility on this project for any unsatisfactory performance if the preliminary recommendations presented in this report are utilized for the final building design in lieu of conducting a detailed, specific geotechnical investigation.

The acceptance of responsibility for the design/construction recommendations presented in this report are contingent on adequate and/or full time inspection (as required, based on site conditions at the time of construction) by a representative of the Geotechnical Consultant. P. Machibroda Engineering Ltd. (PMEL) will not accept any responsibility on this project for any unsatisfactory performance if adequate and/or full time inspection is not performed by a representative of PMEL.

If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

P. MACHIBRODA ENGINEERING LTD.
We trust that this report fulfills your preliminary design requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

Lorry Reynish, P.Eng.

Kelly Pardoski, P.Eng.

LR:KP:zz
TEST HOLE 11-1

ELEV: 507.9 m

- TOPSOIL, organic, moist, black, rootlets.
- SAND AND GRAVEL, some clay, some silt, compact, well graded, fine to coarse grained, moist, brown.
- trace seepage below 800 mm.
- GLACIAL TILL, clay, some silt, some sand, trace gravel, firm, low plastic, moist, brown, oxide stained.
- stiff below 1.7 m.

- W... WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- LW... LIQUID LIMIT
- PW... PLASTIC LIMIT
- \( \gamma_w \)... WET UNIT WEIGHT (kN/m³)
- U... UNCONFINED COMPRESSIVE STRENGTH (kPa)
- pp... POCKET PENETROMETER (kg/cm²)
- N... STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRU (50/125 = BLOWS/SAMPLER PENETRATION [mm])
- S04... SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)
- P200... % PASSING No. 200 SIEVE
- I.A.D... IMMEDIATELY AFTER DRILLING
- T... RECORDED WATER LEVEL (TEST HOLE I.A.D.)
- P... RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG
AND
SOIL TEST RESULTS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-5-W3M
RM OF CORNAM PARK
NEAR SASKATOON, SK
### Test Hole 11-1

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**Description:**
- **Glacial Till:** Clay, silt, some sand, gravel, hard, low plastic, moist, grey.
  - Very stiff below 12.5 m.
  - Sandy, low to medium plastic, wet, seepage, sloughing below 12.8 m.

**Definitions:**
- **w:** Water Content (Percent of Dry Soil Weight)
- **Lw:** Liquid Limit
- **Pw:** Plastic Limit
- **\( \gamma_w \):** Wet Unit Weight (kN/m³)
- **U:** Unconfined Compressive Strength (kPa)
- **Pp:** Pocket penetrometer (kg/cm²)
- **N:** Standard Penetration Test (Safety Hammer w/Automatic Trii; 50/125 = Blows/Sampler Penetration [mm])
- **SO₄:** Sulphate Content (Percent of Dry Soil Weight)
- **P200:** % Passing No. 200 Sieve
- **I.A.D.:** Immediately After Drilling
- **\( \gamma_w \):** Recorded Water Level (Test Hole I.A.D.)
- **\( \gamma \):** Recorded Water Level (Piezo)

**Limitations:**
The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

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**P. Machibroda Engineering Ltd.**

**Field Drill Log and Soil Test Results**

**Project:** Preliminary Geotechnical Investigation

**Location:**
- SE1/4-14-38-5-W3M
- RM of Corman Park
- Near Saskatoon, SK
TEST HOLE 11-2

DEPTH (m) | N | U | Yw | Pw | Lw | w | ELEV: 508.0 m
---|---|---|---|---|---|---|---
0 | pp | BENTONITE SEAL | 19.9 | | | |
1 | | | 10.5 | | | |
2 | 7 | 17 | 59 | 27.0 | | |
3 | | | 12.7 | | | |
4 | | | 24 | 21.9 | | |
5 | | | 10.3 | | | |
6 | 4.5 | | | | | |
7 | | | 9.5 | | | |
8 | 4.5 | | | | | |
9 | 4.5 | | | | | |
10 | 4.5 | | | | | |
11 | 4.5 | | | | | |

**TOPSOIL**: organic, moist, black, rootlets.

**CLAY**: some silt, trace sand, firm, medium plastic, moist, mottled grey/black, trace organics.

**GRAVEL**: some sand, trace silt, compact, well graded, fine to medium grained, moist, brown.

**GLACIAL TILL**: clay, some silt, some sand, trace gravel, firm, low plastic, moist, brown, oxide stained.

- Stiff below 3.0 m.
- Very stiff, grey below 4.3 m.
- Hard below 5.6 m.
- Sand lens, wet, see page 10.8 to 11.0 m.
- Very stiff to hard below 11.0 m.

**WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)**

**LIQUID LIMIT**

**PLASTIC LIMIT**

**WET UNIT WEIGHT (kN/m³)**

**UNCONFINED COMPRESSIVE STRENGTH (kPa)**

**POCKET PENETROMETER (kg/cm²)**

**STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIF (50/125 = BLOWS/SAMPLER PENETRATION [mm])**

**SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)**

**P200, % PASSING No. 200 SIEVE**

**I.A.D.: IMMEDIATELY AFTER DRILLING**

**RECORDED WATER LEVEL (TEST HOLE I.A.D.)**

**RECORDED WATER LEVEL (PIEZO)**

**LIMITATIONS**: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK
TEST HOLE 11-2

GLACIAL TILL, clay, some silt, some sand, trace gravel, very stiff to hard, low plastic, moist, grey, cobbles/boulders.

- sandy, low plastic, wet, seepage, sloughing below 13.7 m.

NOTE:
1. Test Hole sloughed to 13.7 m I.A.D.

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK
**TEST HOLE 11-3**

- **TOPSOIL**, organic, moist, black, rootlets.
- **CLAY**, some silt, trace sand, soft to firm, medium to highly plastic, moist, brown, gypsum crystals.
- **GLACIAL TILL**, clay, some silt, some sand, trace gravel, firm, low plastic, moist, brown, oxide stained, gypsum crystals.

**DEPTH (m)**

- **0**
  - N, U, W, L, W
  - 20.2

- **1**
  - BENTONITE SEAL
  - 19.0
  - 0.8

- **2**
  - 13.2

- **3**
  - 50 mm diam.
  - SCH 40, PVC RISER PIPE
  - 2.5
  - 11.2

- **4**
  - CUTTINGS
  - 3.8

- **6**
  - 3.8
  - 9.8

- **7**
  - 12.0
  - -...sand lens at 2.8 m.
  - -very stiff, grey below 3.8 m.

- **8**
  - 12.1
  - -...cobbles/boulders 4.6 to 5.5 m.

- **9**
  - 3.8
  - 19.1

- **10**
  - 50 mm diam.
  - SCH 40, PVC SLEEVE
  - 22.5

- **11**
  - 11.3

- **ELEV: 507.5 m**

**NOTES**:
- W = WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
- Lw = LIQUID LIMIT
- Pw = PLASTIC LIMIT
- Ww = WET UNIT WEIGHT (kN/m³)
- U = UNCONFINED COMPRESSION STRENGTH (kPa)
- pp = POCKET PENETROMETER (kg/cm²)

**N = STANDARD PENETRATION TEST (SAFETY HAMMER w/ AUTOMATIC TRIF)
(50/125 = BLOWS/SAMPLER PENETRATION [mm])

**SO₄ = SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)**

**P200 = % PASSING No. 200 SIEVE**

**I.A.D. = IMMEDIATELY AFTER DRILLING**

**w = RECORDED WATER LEVEL (TEST HOLE I.A.D.)**

**h = RECORDED WATER LEVEL (PIEZO)**

**LIMITATIONS**: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

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**P. Machibiroad Engineering LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT**: PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION**: SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

130
West Corman Industrial Park CDR
TEST HOLE 11-4

DEPTH (m)

- 12 N U \( \gamma_w \) \( P_w \) L w w

GLACIAL TILL, clay, silt, some sand, trace gravel, very stiff, low plastic, moist, grey, gypsum crystals.

SAND, trace silt, dense, poorly graded, fine grained, wet, grey, seepage, sloughing.

GLACIAL TILL, clay, silt, some sand, trace gravel, very stiff, low plastic, moist, grey, gypsum crystals.

NOTE:
1. Test Hole sloughed to 14.0 m I.A.D.

w...WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
Lw...LIQUID LIMIT
Pw...PLASTIC LIMIT
\( \gamma_w \)...WET UNIT WEIGHT (kN/m³)
U...UNCONFINED COMPRESSIVE STRENGTH (kPa)
pp...POCKET PENETROMETER (kg/cm²)
N...STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIF, 50/125 = BLOWS/SAMPLER PENETRATION [mm])
SO₄...SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)
P200...% PASSING No. 200 SIEVE
I.A.D.....IMMEDIATELY AFTER DRILLING
\( \nabla \)...RECORDED WATER LEVEL (TEST HOLE I.A.D.)
\( \nabla \)...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK
**TEST HOLE 11-5**

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<th>$P_w$</th>
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<td>13.9</td>
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**NOTE:**
1. Test Hole open to 2.0 m and dry I.A.D.

**TOPSOIL**
- organic, moist, black, footlets.

**CLAY**
- silty, trace sand, soft, medium plastic, moist, light grey, footlets.

**GLACIAL TILL**
- clay, sandy, some silt, some gravel, soft, low plastic, moist, brown.
- silty, trace gravel, firm, oxide stained, gypsum crystals below 600 mm.

**WATER CONTENT**
- (PERCENT OF DRY SOIL WEIGHT)

**LIQUID LIMIT**

**PLASTIC LIMIT**

**WET UNIT WEIGHT (kN/m³)**

**UNCONFINED COMPRESSIVE STRENGTH (kPa)**

**POCKET PENETROMETER (kg/cm²)**

**STANDARD PENETRATION TEST**
- (SAFETY HAMMER w/AUTOMATIC TRILL)
  - 50/125 = BLOWS/SAMPLER PENETRATION (mm)

**SULPHATE CONTENT**
- (PERCENT OF DRY SOIL WEIGHT)

**P200...% PASSING No. 200 SIEVE**

**I.A.D...IMMEDIATELY AFTER DRILLING**

**REPORTED WATER LEVEL**
- (TEST HOLE I.A.D.)

**REPORTED WATER LEVEL (PIEZO)**

**LIMITATIONS:**
- THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

**P. MACHIBRODA ENGINEERING LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT:**
- PRELIMINARY GEOТЕCHNICAL INVESTIGATION

**LOCATION:**
- SE1/4-14-38-5-W3M
- RM OF CORMAN PARK
- NEAR SASKATOON, SK
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<th>W</th>
<th>L</th>
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**TOPSOIL** organic, moist, black, rootlets.

**GLACIAL TILL**, clay, silty, some sand, trace gravel, firm, low plastic, moist, dark brown, brown, oxide stained, gypsum crystals below 500 mm.

**W**...WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)

**Lw**...LIQUID LIMIT

**Pw**...PLASTIC LIMIT

**\( \gamma_w \)**...WET UNIT WEIGHT (kN/m³)

**U**...UNCONFINED COMPRESSIVE STRENGTH (kPa)

**pp**...POCKET PENETROMETER (kg/cm²)

**N**...STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIF (50/125 = BLOWS/SAMPLER PENETRATION [mm]))

**SO₄**...SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)

**P200...% PASSING No. 200 SIEVE**

**I.A.D...IMMEDIATELY AFTER DRILLING**

\( \gamma \)...RECORDED WATER LEVEL (TEST HOLE I.A.D.)

\( \gamma \)...RECORDED WATER LEVEL (PIEZO)

**LIMITATIONS**: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

---

**P. MACHIBRODA ENGINEERING LTD.**

**FIELD DRILL LOG AND SOIL TEST RESULTS**

**PROJECT**: PRELIMINARY GEOTECHNICAL INVESTIGATION

**LOCATION**: SE1/4-14-38-5-W3M RM OF CORMAN PARK NEAR SASKATOON, SK
TEST HOLE 11-6

GLACIAL TILL, clay, silty, some sand, trace gravel, very stiff to hard, low plastic, moist, grey.

NOTE:
1. Test Hole open to 15.0 m and dry I.A.D.

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.
TEST HOLE 11-7

DEPTH (m) N U Yw Pw Lw w ELEV: 507.9 m

0 8.4
1 13
12.0
12.2
14.2
13.3

TOPSOIL, organic, moist, black, crumbly.
GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, low plastic, moist, brown.
-firm below 500 mm.

LEGEND:

W...WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
Lw...LIQUID LIMIT
Pw...PLASTIC LIMIT
Yw...WET UNIT WEIGHT (kN/m³)
U...UNCONFINED COMpressive STRENGTH (kPa)
pp...POCKET PENETROMETER (kg/cm²)
N...STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIP) (50/125 = BLOWS/SAMPLER PENETRATION [mm])
SO₄...SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)
P200...% PASSING No. 200 SIEVE
I.A.D...IMMEDIATELY AFTER DRILLING
...RECORDED WATER LEVEL (TEST HOLE I.A.D.)
...RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THE FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT: PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-6-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

NORTHING: EASTING:

DATE DRILLED: DRAWING NUMBER:
SEPT 16/11 S117471.2-8

NOTE:
1. Test Hole open to 2.0 m end dry I.A.D.
# TEST HOLE 11-8

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>N</th>
<th>U</th>
<th>τ_w</th>
<th>p_w</th>
<th>L_w</th>
<th>w</th>
<th>ELEV: 507.6 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>20.6</td>
<td></td>
<td></td>
<td>13.0</td>
<td>TOPSOIL, organic, moist, black, footlets.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14.3</td>
<td>GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, low plastic, moist, brown.</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.1</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
1. Test Hole open to 2.0 m and dry I.A.D.

**Limitations:** The field drill log is a summary of the subsurface conditions encountered at the specific test hole location at the time of test drilling. Subsurface conditions may vary at other locations of this site and, in time, may change at this specific test hole location.

## Field Drill Log and Soil Test Results

### Project:
PRELIMINARY GEOTECHNICAL INVESTIGATION

### Location:
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

---

West Corman Industrial Park CDR
TEST HOLE 11-10

DEPTH (m)
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11

N  U  \( \gamma_w \)  Pw  Lw  w  ELEV: 508.1 m
pp  10.8
  9.4
  11.1
  9.7
  9.1

TOPSOIL, organic, moist, block, rootlets.
GLACIAL TILL, clay, some silt, some sand, trace gravel, stiff, low plastic, moist, brown.

NOTE:
1. Test Hole open to 2.0 m and dry I.A.D.

w.....WATER CONTENT (PERCENT OF DRY SOIL WEIGHT)
Lw.....LIQUID LIMIT
Pw.....PLASTIC LIMIT
\( \gamma_w \).....WET UNIT WEIGHT (kN/m³)
U.....UNCONFINED COMPRESSIVE STRENGTH (kPa)
pp.....POCKET PENETROMETER (kg/cm²)
N.....STANDARD PENETRATION TEST (SAFETY HAMMER w/AUTOMATIC TRIF (50/125 = BLOWS/SAMPLER PENETRATION [mm]))
SO₄.....SULPHATE CONTENT (PERCENT OF DRY SOIL WEIGHT)
P200.....% PASSING No. 200 SIEVE
I.A.D.....IMMEDIATELY AFTER DRILLING
\( \gamma \).....RECORDED WATER LEVEL (TEST HOLE I.A.D.)
\( \psi \).....RECORDED WATER LEVEL (PIEZO)

LIMITATIONS: THIS FIELD DRILL LOG IS A SUMMARY OF THE SUBSURFACE CONDITIONS ENCOUNTERED AT THE SPECIFIC TEST HOLE LOCATION AT THE TIME OF TEST DRILLING. SUBSURFACE CONDITIONS MAY VARY AT OTHER LOCATIONS OF THIS SITE AND, IN TIME, MAY CHANGE AT THIS SPECIFIC TEST HOLE LOCATION.

P. MACHIBRODA ENGINEERING LTD.

FIELD DRILL LOG AND SOIL TEST RESULTS

PROJECT:
PRELIMINARY GEOTECHNICAL INVESTIGATION

LOCATION:
SE1/4-14-38-5-W3M
RM OF CORMAN PARK
NEAR SASKATOON, SK

138
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-1
Sample No.: 1
Depth (mm): 500

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>50</td>
<td>13</td>
</tr>
</tbody>
</table>

GRAVEL SIZES | SAND SIZES | SILT AND CLAY SIZES
COARSE | FINE | COARSE | MEDIUM | FINE

INCHES | INCHES | SIEVE SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.
S11-7471.2-12

West Corman Industrial Park CDR
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-1
Sample No.: 5
Depth (m): 4.5

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>49</td>
<td>10</td>
</tr>
</tbody>
</table>

GRAVEL SIZES | SAND SIZES
--------------|--------------
COARSE        | FINE         
SILT AND CLAY SIZES
---------------|--------------
INCHES        | SIEVE SIZES  
PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.
S11-7471.2-13
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-3
Sample No.: 131
Depth (mm): 500

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>94</td>
</tr>
</tbody>
</table>

GRAVEL SIZES          SAND SIZES
COARSE    FINE     COARSE    MEDIUM    FINE

INCHES   SIEVE SIZES

GRAN SIZE - MILLIMETERS

PERCENT FINER THAN

P. MACHIBRODA
ENGINEERING LTD.

DRAWING NO.
S11-7471.2-14

West Corman Industrial Park CDR
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-7
Sample No.: 27
Depth (mm): 600

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>32</td>
<td>39</td>
<td>22</td>
</tr>
</tbody>
</table>

GRAVEL SIZES | SAND SIZES | SILT AND CLAY SIZES
COARSE       | FINE        | COARSE       | MEDIUM       | FINE        |

INCHES | SIEVE SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.
DRAWING NO.
S11-7471.2-15

142
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-8
Sample No.: 33
Depth (m): 1.0

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>38</td>
<td>52</td>
<td>8</td>
</tr>
</tbody>
</table>

![Grain Size Distribution Diagram]

P. MACHIBRODA
ENGINEERING LTD.

DRAWING NO.

S11-7471.2-16

West Corman Industrial Park CDR
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-9
Sample No.: 39
Depth (m): 1.5

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2</td>
<td>77</td>
<td>14</td>
</tr>
</tbody>
</table>

GRAVEL SIZES | SAND SIZES | SILT AND CLAY SIZES
COARSE | FINE | COARSE | MEDIUM | FINE | INCHES | SIEVE SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. Machibroda Engineering Ltd.
DRAWING NO. S11-7471.2-17
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.:  S11-7471.2
Date Tested:  NOVEMBER 4, 2011
Test Hole No.:  11-11
Sample No.:  142
Depth (mm):  600

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>61</td>
<td>12</td>
</tr>
</tbody>
</table>

SIEVE SIZE (mm)  PERCENT PASSING
14.000  100.0
12.500  90.5
9.500   86.5
4.750   73.2
2.000   58.7
0.850   37.8
0.425   30.4
0.250   21.9
0.160   14.8
0.075   11.7

GRAVEL SIZES  SAND SIZES  SILT AND CLAY SIZES
COARSE  FINE  COARSE  MEDIUM  FINE
INCHES  SIEVE SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.

DRAWING NO.
S11-7471.2-18

West Corman Industrial Park CDR
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 7, 2011
Test Hole No.: 11-12
Sample No.: 154
Depth (m): 2.1

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt Sizes</th>
<th>% Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>77</td>
<td>21</td>
</tr>
</tbody>
</table>

GRAVEL SIZES | SAND SIZES | SILT AND CLAY SIZES
COARSE | FINE | COARSE | MEDIUM | FINE

INCHES

SIEVE SIZES

PERCENT FINE THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA ENGINEERING LTD.
DREWING NO.
S11-7471.2-19

146
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOFACIAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-14
Sample No.: 165
Depth (m): 1.2

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>75</td>
<td>5</td>
</tr>
</tbody>
</table>

![Grain size distribution graph]

P. MACHIBRODA ENGINEERING LTD.

DRAWING NO. S11-7471.2-20
GRAIN SIZE DISTRIBUTION TEST REPORT

Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
SE1/4-14-38-5-W3M, RM OF CORMAN PARK
NEAR SASKATOON, SK

Project No.: S11-7471.2
Date Tested: NOVEMBER 4, 2011
Test Hole No.: 11-16
Sample No.: 179
Depth (m): 1.2

Material Description

<table>
<thead>
<tr>
<th>% Gravel Sizes</th>
<th>% Sand Sizes</th>
<th>% Silt and Clay Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>59</td>
<td>12</td>
</tr>
</tbody>
</table>

GRAVEL SIZES

COARSE   FINE

SAND SIZES

COARSE   MEDIUM   FINE

SILT AND CLAY SIZES

PERCENT FINER THAN

GRAIN SIZE - MILLIMETERS

P. MACHIBRODA
ENGINEERING LTD.

DRAWING NO.
S11-7471.2-21
APPENDIX A
Explanation of Terms on Test Hole Logs
CLASSIFICATION OF SOILS

Coarse-Grained Soils: Soils containing particles that are visible to the naked eye. They include gravels and sands and are generally referred to as cohesionless or non-cohesive soils. Coarse-grained soils are soils having more than 50 percent of the dry weight larger than particle size 0.080 mm.

Fine-Grained Soils: Soils containing particles that are not visible to the naked eye. They include silts and clays. Fine-grained soils are soils having more than 50 percent of the dry weight smaller than particle size 0.080 mm.

Organic Soils: Soils containing a high natural organic content.

Soil Classification By Particle Size

<table>
<thead>
<tr>
<th>Particle Size</th>
<th>Less than 0.002 mm</th>
<th>0.002 - 0.060 mm</th>
<th>0.06 - 2.0 mm</th>
<th>2.0 - 60 mm</th>
<th>60 - 200 mm</th>
<th>Greater than 200 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay - particles of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silt - particles of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand - particles of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel - particles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobbles - particles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boulders - particles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse-grained soils: Described in terms of compactness condition and are often interpreted from the results of a Standard Penetration Test (SPT). The standard penetration test is described as the number of blows, N, required to drive a 51 mm outside diameter (O.D.) split barrel sampler into the soil a distance of 0.3 m (from 0.15 m to 0.45 m) with a 63.5 kg weight having a free fall of 0.76 m.

<table>
<thead>
<tr>
<th>Compactness Condition</th>
<th>SPT N-Index (blows per 0.3 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very loose</td>
<td>0-4</td>
</tr>
<tr>
<td>Loose</td>
<td>4-10</td>
</tr>
<tr>
<td>Compact</td>
<td>10-30</td>
</tr>
<tr>
<td>Dense</td>
<td>30-50</td>
</tr>
<tr>
<td>Very dense</td>
<td>Over 50</td>
</tr>
</tbody>
</table>

Fine-Grained Soils: Classified in relation to undrained shear strength.

<table>
<thead>
<tr>
<th>Consistency</th>
<th>Undrained Shear Strength (kPa)</th>
<th>N Value (Approximate)</th>
<th>Field Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>&lt;12</td>
<td>0-2</td>
<td>Easily penetrated several centimetres by the fist.</td>
</tr>
<tr>
<td>Soft</td>
<td>12-25</td>
<td>2-4</td>
<td>Easily penetrated several centimetres by the thumb.</td>
</tr>
<tr>
<td>Firm</td>
<td>25-50</td>
<td>4-8</td>
<td>Can be penetrated several centimetres by the thumb with moderate effort.</td>
</tr>
<tr>
<td>Stiff</td>
<td>50-100</td>
<td>8-15</td>
<td>Readily indented by the thumb, but penetrated only with great effort.</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>100-200</td>
<td>15-30</td>
<td>Readily indented by the thumb nail.</td>
</tr>
<tr>
<td>Hard</td>
<td>&gt;200</td>
<td>&gt;30</td>
<td>Indented with difficulty by the thumbnail.</td>
</tr>
</tbody>
</table>

Organic Soils: Readily identified by colour, odour, spongy feel and frequently by fibrous texture.

DESCRIPTIVE TERMS COMMONLY USED TO CHARACTERIZE SOILS

Poorly Graded - predominance of particles of one grain size.
Well Graded - having no excess of particles in any size range with no intermediate sizes lacking.
Mottled - marked with different coloured spots.
Nuggety - structure consisting of small prismatic cubes.
Laminated - structure consisting of thin layers of varying colour and texture.
Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks.
Fractured - broken by randomly oriented interconnecting cracks in all 3 dimensions.
<table>
<thead>
<tr>
<th>MAJOR DIVISION</th>
<th>GROUP SYMBOL</th>
<th>TYPICAL DESCRIPTION</th>
<th>LABORATORY CLASSIFICATION CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHLY ORGANIC SOILS</td>
<td>Pt</td>
<td>PEAT AND OTHER HIGHLY ORGANIC SOILS</td>
<td>STRONG COLOUR OR ODOUR AND OFTEN FIBROUS TEXTURE</td>
</tr>
<tr>
<td>CLEAN GRAVELS</td>
<td>GW</td>
<td>WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES &lt;5% FINES</td>
<td></td>
</tr>
<tr>
<td>DIRTY GRAVELS</td>
<td>GM</td>
<td>SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES &gt;12% FINES</td>
<td>ATTERTBERG LIMITS BELOW &quot;A&quot; LINE OR PI &lt; 4</td>
</tr>
<tr>
<td>CLEAN SANDS</td>
<td>SW</td>
<td>WELL-GRADED SANDS, GRAVELLY SANDS MIXTURES &lt;5% FINES</td>
<td></td>
</tr>
<tr>
<td>DIRTY SANDS</td>
<td>SM</td>
<td>SILTY SANDS, SAND-SILT MIXTURES &gt;12% FINES</td>
<td>ATTERTBERG LIMITS ABOVE &quot;A&quot; LINE WITH PI &gt; 7</td>
</tr>
<tr>
<td>SILTS Below &quot;A&quot; line on plasticity chart, negligible organic content</td>
<td>ML</td>
<td>INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &lt; 50</td>
</tr>
<tr>
<td>MH</td>
<td>INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &lt; 50</td>
<td></td>
</tr>
<tr>
<td>CLAYS Above &quot;A&quot; line on plasticity chart, negligible organic content</td>
<td>CL</td>
<td>INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &lt; 50</td>
</tr>
<tr>
<td>CI</td>
<td>INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &gt; 50 &lt; 50</td>
<td></td>
</tr>
<tr>
<td>CH</td>
<td>INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &gt; 50</td>
<td></td>
</tr>
<tr>
<td>ORGANIC SILTS &amp; ORGANIC CLAYS Below &quot;A&quot; line on plasticity chart</td>
<td>OL</td>
<td>ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &lt; 50</td>
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<tr>
<td>OH</td>
<td>ORGANIC CLAYS OF HIGH PLASTICITY</td>
<td>W&lt;sub&gt;L&lt;/sub&gt; &gt; 50</td>
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**PLASTICITY CHART FOR CLASSIFICATION OF FINE GRAINED SOILS.**

- **CL-ML:** ML or OL
- **ML:**
- **CH:** "A" LINE

---

West Corman Industrial Park CDR
APPENDIX B
Piezocone Penetration Test Plots
APPENDIX H: PHASE I ESA
PHASE I ENVIRONMENTAL SITE ASSESSMENT
PORTION OF SE-15-38-5-W3M
RM OF CORMAN PARK NO. 344, SASKATCHEWAN
PMEL FILE NO. S10-7471.1
OCTOBER 13, 2010

PREPARED FOR:

MR. GLEN REIMER
P.O. BOX 81
SUCCESS, SK
S0N 2R0

PRIVILEGED AND CONFIDENTIAL
EXECUTIVE SUMMARY

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- A Portion of the Southeast Quarter, Section 15, Township 38, Range 5, West of the Third Meridian.

The subject property is located at the northwest intersection of Lutheran Road (Township Road 382) and Range Road 3052, approximately 2 km southeast of the Town of Martensville and immediately west of the Corman Industrial Park, in the Rural Municipality of Corman Park No. 344, Saskatchewan.

In accordance with CSA Z768-01 (R2006), the Phase I ESA consisted of a review of available background and historical information, a visual site review and a report of our findings. The purpose of the Phase I ESA was to determine the potential existence of contaminants and/or environmental concerns on the subject property.

SITE HISTORY

The subject property is vacant (no buildings) and used for pasture land and agricultural cultivation (hay). The subject property is located in an area of agricultural, residential (farmyards), industrial and commercial development. Corman Industrial Park is located across Range Road 3052, directly to the east of the site. A landfill is located approximately 800 metres to the east.

ENVIRONMENTAL HAZARD POTENTIAL

Based on the information reviewed, and the observations made during the visual site review, the subject property is considered to have a low environmental hazard potential and no further investigation (i.e., Phase II ESA) is warranted at this time.

File searches (i.e., Land Titles) are still outstanding. Once completed, the outstanding information will be reviewed and, if warranted, forwarded in a follow-up letter.

P. MACHIBRODA ENGINEERING LTD.
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S10-7471.1-2  Site Plan

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1.0 INTRODUCTION

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- A Portion of the Southeast Quarter, Section 15, Township 38, Range 5, West of the Third Meridian.

The subject property is located at the northwest intersection of Lutheran Road (Township Road 382) and Range Road 3052, approximately 2 km southeast of the Town of Martensville and immediately west of the Corman Industrial Park, in the Rural Municipality of Corman Park No. 344, Saskatchewan.

In accordance with CSA Z788-01 (R2006), the Phase I ESA consisted of a review of available background and historical information, a visual site review and a report of our findings. The purpose of the Phase I ESA was to determine the potential existence of contaminants and/or environmental concerns on the subject property.

The Terms of Reference for this investigation were presented in PMEL Proposal No. 0819-6259, dated September 10, 2008. Written authorization to perform this Phase I ESA was provided by Mr. Glen Reimer on September 2, 2010.

2.0 REVIEW OF BACKGROUND AND HISTORICAL INFORMATION

Historical information available for the subject property was reviewed to identify potential environmental concerns, which may not be evident, based on current site conditions. Information sources available and reviewed for the subject property included: aerial (stereo pair) photographs; Land Titles records; zoning records, fire department records; and an environmental file search performed by Saskatchewan Environment.

In addition to the above, a review of general background information for the site and area was conducted. Items collected and reviewed included topographic and geologic maps and hydrogeological studies.

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2.1 Site Description

The location of the subject property is shown on the Key Plan and Surrounding Land Use Drawing, Drawing No. S10-7471.1-1, while details of the site are shown on the Site Plan, Drawing No. S10-7471.1-2. The subject property is vacant (no buildings) and used for pasture land and agricultural cultivation (hay). Surrounding land use to the site is comprised of agricultural, residential (farmyards), industrial and commercial development. Corman Industrial Park is located across Range Road 3052 to the east of the site. A landfill is located approximately 800 metres to the east.

2.2 Background Information

2.2.1 Physiography and Regional Geology

The subject property lies in the physiographic region known as the Saskatchewan Rivers Plain. The Saskatchewan Rivers Plain is characterized as gently undulating to rolling glacial lacustrine-alluvial (glacial lake) plains, aeolian plains (dunes) and till plains. The surficial soil deposits consist of variable textured lacustrine and alluvial sands, silts and clays, aeolian sands, glacial till and local bedrock exposures in the South Saskatchewan River (Acton et. al., 1960). The bedrock deposits at this site consisted of approximately 75 m of glacial till and stratified drift (sand, silt and clay) underlain by the noncalcareous silt and clay of the Lea-Park Formation-Upper Colorado.

The land surface elevation at the site was approximately 505 m (Geodetic) and slopes gradually downward to approximate elevation 470 metres at the South Saskatchewan River, located approximately 5 km to the southeast.
2.2.2 Hydrogeology

An examination of hydrogeological data, (Christiansen, 1967), for this region revealed the following observations:

1. The primary source of water in this region is drift aquifers above or between glacial till strata and the Empress Group, (Tyner Valley Aquifer), between the base of the glacial till and the surface of the bedrock.

2. The Tyner Valley Aquifer system (Empress Group) is the most extensive and potentially productive aquifer in the Saskatoon region. The Tyner Valley Aquifer is utilized for dairy and stock raising operations outside the area where the Dalmeny Aquifer is present.

3. The South Saskatchewan River is a discharge receptor for many of the aquifer systems in the Saskatoon area. The inferred regional groundwater flow would be southeast towards the South Saskatchewan River.

4. The closest surface water body to the site is the South Saskatchewan River, located approximately 5 km southeast of the subject property at its nearest point.

5. The subject property is located in a region of groundwater recharge.

2.2.3 Water and Sewer

The subject property is vacant, undeveloped (i.e., no buildings) land. As such, no water is consumed and no wastewater is generated at the subject property.
2.3 Aerial Photograph Review

Historical aerial photographs dated 1966, 1978, 1985 and 2004 were examined to identify site specific land-use which may have resulted in environmental concerns on and/or adjacent to the subject property. A summary of observations made has been presented below. Copies of the air photographs reviewed have been provided in Appendix A.

1966: The subject property is vacant (no buildings) and appears to be in use as agricultural (pasture and cultivation). A dugout is located on the northwest portion of the subject property. The surrounding land use consists predominantly of agricultural cultivation and/or pasture.

1978: Relatively consistent with 1966 observations. Development (aggregate mining) has occurred on the Department of Highways property.

1985: Relatively consistent with 1978 observations. Corman Industrial park is beginning to develop along Range Road 3502 and the road (Unger Street/Wurtz Road) in the industrial park has been constructed.

2004: Relatively consistent with the current level of development.

2.4 Street Directories

No Henderson Directories for the Rural Municipality of Corman Park were available for viewing.

2.5 Zoning

The subject property is zoned for agricultural use.
2.6 Land Titles Search

A land titles search for the subject property is currently underway. Once completed, the outstanding information will be reviewed and, if warranted, forwarded in a follow-up letter.

2.7 Tax Assessment Records-Field Sheets

Tax Assessment Records (field sheets) for the subject property were obtained from the Saskatchewan Assessment Management Agency (SAMA) during this investigation. Review of the Tax Assessment Records revealed the following:

1. The subject property was last inspected by SAMA on October 14, 1998.

2. The total area of the subject property is 131 acres. Approximately 29 acres of the quarter section is owned by the Department of Highways.

3. No buildings are listed on the field sheet for the subject property.

4. The main property use code for the site is non-arable land. Other land uses listed include: field crop production (60 acres); native rangeland (1 acre); and reverting pasture (70 acres).

Copies of the field sheets have been presented in Appendix B.

2.8 Rural Municipality of Corman Park

A file search was requested from the Rural Municipality of Corman Park for the subject property. Review of the information provided revealed:

1. No storage, handling, spills, leaks or release of hazardous substances or waste dangerous goods at or in the immediate vicinity of the subject property;

2. No outstanding orders on the subject property.
2.9 **Fire Insurance Maps**

No Fire Insurance Maps were available for the subject property.

2.10 **Saskatchewan Environment File Search**

A search of Saskatchewan Environment records for the subject property revealed the following:

1. The subject property is not registered pursuant to the Hazardous Substances and Waste Dangerous Goods Regulations; and

2. There have been no reported spills pursuant to Environmental Spill Control Regulations.

3. Saskatoon Used Truck parts, located in Corman Industrial Park, across the road from the subject site, is registered as a Hazardous Material Storage site. Based on the separation distance (25 m from property line to property line) this site is considered to represent a low likelihood of impact towards the subject property.

2.11 **ERIS ECOLOG Database Report**

An ERIS ECOLOG database report was completed for the subject property. The database report provides the search results of various Federal, Provincial and Private source databases for a 250 m radius surrounding the subject property. A copy of the search is presented in Appendix C. Review of the information revealed that the items contained within the ERIS ECOLOG search represent a low likelihood of impact towards the subject property.
2.12 Water Wells

A file search of the SaskWater Database for water wells located on the subject property (i.e., SE-15-38-05-W3M) revealed the following two wells:

1. A domestic use well (37 metres deep) is located approximately 425 metres from the south boundary and 549 metres from the west boundary of the quarter section.

2. A domestic use well (40 metres deep) is located approximately 183 metres from the south boundary and 244 metres from the west boundary of the quarter section.

2.13 Interview

No interviews were conducted as part of this Phase I ESA.

2.14 Geotechnical Investigation

A geotechnical investigation was conducted at the site by PMEL in September, 2010. Although the scope of the geotechnical investigation did not include environmental considerations, no staining and/or adverse odours were apparent in the soil samples collected during drilling.
3.0 **VISUAL SITE REVIEW**

A visual site review was conducted by PMEL personnel on October 13, 2010. Select photographs taken of the subject property have been included in Appendix D, while brief summaries of the observations made during the review are presented in the following sub-sections.

3.1 **Property**

1. The subject property is located at the northwest intersection of Range Road 3502 and Luther Road (Township Road 382).

2. The subject property is vacant (no buildings).

3. The north and east portions of the subject property are fenced (barbed wire). Several water filled depressions and sloughs are located within the fenced area.

4. Overhead utility lines are located along the east and south property lines.

5. An underground natural gas line runs east-west through the centre of the subject site. Underground telephone lines run north-south proximate the east property line.
3.2 Surrounding Land Use

As shown on Drawing No. S10-7471.1-1, surrounding land use in the vicinity of the site, includes:

North: Land under agricultural development with sparse residential (i.e., farmyard) development.

South: Overhead utility lines followed by Saskatchewan Department of Highways land, Lutheran Road, agricultural development and sparse residential development (i.e., farmyard), respectively.

East: Overhead utility lines followed by Range Road 3502 and Corman Industrial Park. Businesses located adjacent the road include: Saskatoon Truck Parts; Supreme Steel Ltd.; Commercial Sand Blasting and Painting Ltd.; and Westeel.

West: Barbed wire fence followed by a horse riding and boarding stable (including a residence) and a landfill, respectively.

3.3 Waste Management

3.3.1 Liquid Waste

No wastewater is reportedly generated at the subject property.

3.3.2 Solid Waste

No solid waste is generated at the subject property.

3.3.3 Hazardous Substances and Waste Dangerous Goods

No hazardous substances or waste dangerous goods are reportedly stored and/or handled at the subject property.

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3.4 Storage Tanks

No Aboveground Storage Tanks (AST's) and/or visible evidence of Underground Storage Tanks (UST's) (i.e., pump islands, vent pipes, etc.) were apparent at the site during the visual site review.

3.5 Surface Staining/Stressed Vegetation and Soil Fill

No surface staining or stressed vegetation or soil fill was apparent.

3.6 Polychlorinated Biphenyls (PCBs)

No sources of PCBs were apparent at the time of the visual site review.

3.7 Radon Potential

Radon is a naturally occurring radioactive gas originating from degradation of naturally occurring uranium in the soil. Radon gas can enter buildings by seeping through cracks in the foundation walls and floors. Since there are no buildings on the subject property, the potential for radon gas accumulation appears low.

3.8 Building Materials and Air Quality

No buildings currently exist on the subject property and no adverse odours were apparent at the time of the visual site review.

3.9 Noise and Vibration

With the exception of vehicle traffic no sources of adverse noise and/or vibration were apparent at the time of the visual site review.
3.10 **Electromagnetic Fields (EMFs)**

No high-tension transmission lines with the potential to generate significant Electromagnetic Fields (EMFs) were located on the subject property.

3.11 **Radioactive Materials/Radiation Sources**

No radioactive sources requiring special licensing were apparent during the visual site review.

3.12 **Neighboring Properties**

A land fill is located approximately 800 metres east of the subject property. Based on the separation distance, releases (if any) from the land fill are considered to represent a low likelihood of impact towards the subject property.

Based on historical information and observations made at the time of the visual site review, the risks associated with the remaining properties surrounding the subject property appear low. It should be recognized that the precise nature of the activities carried out on the surrounding sites and their potential impacts to the subject site are outside the scope of this report. Potential contamination associated with surrounding land use cannot be confirmed without further investigation including detailed inspections of the surrounding properties.

4.0 **ENVIRONMENTAL HAZARD POTENTIAL**

Based on the information reviewed, and the observations made during the visual site review, the subject property is considered to have a low environmental hazard potential and no further investigation (i.e., Phase II ESA) is warranted at this time.

File searches (i.e., Land Titles) are still outstanding. Once completed, the outstanding information will be reviewed, and if warranted, forwarded in a follow-up letter.
5.0 CLOSURE

A Phase I Environmental Site Assessment (ESA) was conducted for the property legally described as:

- A Portion of the Southeast Quarter, Section 15, Township 38, Range 5, West of the Third Meridian.

The subject property is located at the northwest intersection of Lutheran Road (Township Road 382) and Range Road 3052, approximately 2 km southeast of the Town of Martensville and immediately west of the Corman Industrial Park, in the Rural Municipality of Corman Park No. 344, Saskatchewan.

The ESA consisted of a review of sequential aerial photographs, historical records, Provincial Land Titles, a visual site review and interviews. If additional information becomes available regarding the environmental hazard potential of this site, our report and recommendations should be reviewed in the light of any new information. File searches (i.e., Land Titles) are still outstanding. Once completed, the outstanding information will be reviewed, and if warranted, forwarded in a follow-up letter.

The Phase I ESA report has been prepared for the exclusive use of Mr. Glen Reimer and his agents for specific application to the above referenced property. It has been prepared in accordance with generally accepted geoenvironmental engineering practices and no other warranty, express or implied, is made.

Any uses which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. P. Machibroda Engineering Ltd. and/or its employees, servants and agents accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

P. MACHIBRODA ENGINEERING LTD.
If this report has been transmitted electronically, it has been digitally signed and secured with personal passwords to lock the document. Due to the possibility of digital modification, only originally signed reports and those reports sent directly by PMEL can be relied upon without fault.

We trust that this report fulfills your requirements for this project. Should you require additional information, please contact us.

P. MACHIBRODA ENGINEERING LTD.

Lorry Reynish, P.Eng.

Ray Machibroda, P. Eng., M.Sc.

LR:RM:zz
6.0 REFERENCES


Christiansen, E. A. 1967. Geology and Groundwater Resources of the Saskatoon Area (73 – B), Saskatchewan Research Council, Geology Division, Saskatoon, Canada, Map No. 7.

7.0 QUALIFICATIONS OF ASSESSORS

Lorry Reynish, B.A.Sc. has a degree in Environmental Systems Engineering from the University of Regina. He has completed several Phase I ESAs at a variety of sites including: industrial; commercial; and residential properties. His experience also includes assessment and remediation of petroleum hydrocarbon and heavy metal impacted sites.

Ray Machibroda, P. Eng, M.Sc. is a senior geoenvironmental engineer with over 20 years of experience. He has conducted hundreds of Environmental Site Assessments and is experienced in both assessment and remediation of sites including industrial, commercial, and residential properties. His experience also includes assessment of landfills and sewage lagoons, risk assessments, and Brownfield redevelopment.
Summary of Property Servicing

Development Name: WEST CORMAN INDUSTRIAL PARK- PHASE 1
Developer Name: PREMIUM PORTABLE WASHROOMS LTD.
Legal Land Location: SE-15-38-5-W3M

The purpose of these worksheets is twofold. Firstly, the worksheets are intended to provide the Municipality with a summary of the various services which are being constructed, including any technical specifications. The second reason for these worksheets is to aid the developer in itemizing the various costs of servicing the development for the purpose of calculating the amount of financial security to be provided to the Municipality.
Summary of Property Servicing
Worksheet 1: Roadways

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security. **Complete a separate worksheet for each type of roadway being constructed or upgraded for the development.**

1. **Type of roadway:**
   - [ ] Residential internal subdivision road
   - [ ] Municipal road – main farm access
   - [ ] Primary haul road
   - [X] Industrial/Commercial internal subdivision road

2. **Specifications:**
   a. length of road to be constructed or upgraded: ___________ metres
   b. right of way width: ___________ metres
   c. road sub-grade width: ___________ metres
   d. road top width: ___________ metres
   e. back slope: ___________
   f. side slope: ___________
   g. ditch width: ___________ metres
   h. method of erosion control: _______________________________
   i. anticipated design speed: ___________ km/hr
   j. estimated road lifespan: ___________ years
   k. culvert locations (attach site plan) and sizes:
      - number: _____ type: ___________ size: _____ mm
      - number: _____ type: ___________ size: _____ mm
      - number: _____ type: ___________ size: _____ mm
      - number: _____ type: ___________ size: _____ mm
      - number: _____ type: ___________ size: _____ mm
   
   Comments: To be confirmed as a function of detailed design

   _____________________________________________________________

   l. road surfacing:
      - [ ] Gravel
      - [ ] Chip seal
      - [ ] Asphalt
      - [ ] Other

      surface thickness: _______ m³/km
3. **Cost estimates**: Provide cost estimate for each component of construction attaching quotes and contracts where necessary to verify estimates.

   a. land acquisition $__________
   b. Design and engineering ____________
   c. preliminary earthwork & sub grade construction ____________
   d. road construction ____________
   e. surfacing ____________
   f. culverts ____________
   g. signage ____________
   h. line painting, curbing etc... ____________
   i. re-vegetation and erosion controls ____________

   TOTAL ESTIMATED COST $__________

**For Office Use Only:**
- Date of receipt of preliminary construction plans: _______/______/______ (d/m/y)
- Date of approval of preliminary construction plans: _______/______/______ (d/m/y)
- Date of receipt of as-built drawings: _______/______/______ (d/m/y)
- Date of final inspection: _______/______/______ (d/m/y)
Summary of Property Servicing
Worksheet 2: Water Supply Lines

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security. *Complete a separate worksheet for each type of waterline being constructed or upgraded for the development.*

4. Type of waterline:
   - [X] Potable
   - ____________________________
   - [ ] Non potable
   - ____________________________
   - [ ] Fire suppression

5. Specifications:
   a. length of water supply line constructed: ____________________________
      metres
   b. water supply line diameter: ____________________________
      mm
   c. depth of line: ____________________________
      metres
   d. water supply line material: ____________________________
   e. # fire hydrants: ____________________________
   f. # curb stops: ____________________________
   g. minimum water supply line depth: ____________________________
      metres

6. Cost estimates: Provide cost estimate for each component of construction attaching quotes and contracts where necessary to verify estimates.

   a. land acquisition and/or easements $ ____________________________
   b. Design and engineering ____________________________
   c. materials & labour ____________________________
   d. trenching and/or drilling ____________________________
   e. installation Included in Trenching
   f. backfill and re-vegetation Included in Trenching
   g. hydrants and pump stations ____________________________
   TOTAL ESTIMATED COST $ ____________________________

For Office Use Only:
Date of receipt of preliminary construction plans: ___________/__________/_________ (d/m/y)
Date of approval of preliminary construction plans: ___________/__________/_________ (d/m/y)
Date of receipt of as-built drawings: ___________/__________/_________ (d/m/y)
Date of final inspection: ___________/__________/_________ (d/m/y)
Summary of Property Servicing  
Worksheet 3: Shallow Utilities & Public Amenities

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security.

7. **Shallow Utilities:** Provide cost estimate for each utility attaching quotes and contracts where necessary to verify estimates.  
   
   a. Natural Gas  
   b. Electricity  
   c. Telephone  
   d. Other:  
   
   Estimate Supplied  
   
   $75,000  
   $15,000  
   $60,000  
   $150,000

8. **Public Amenities:** List and provide a cost estimate for each public facility as well as the costs of developing public lands within the development.

   a. Engineering and design  
   b. Site Grading and Landscaping  
   c. Lighting  
   d. Recreational Facilities  
   e. Fencing  
   f. Other:

   TOTAL ESTIMATED COST PUBLIC AMENITIES $______________

9. **Other:** Include relevant statement and contracts to verify estimates  
   a. Legal  
   b. Survey  
   c. Storm water retention system  
   d. ________________  
   e. ________________

   TOTAL ESTIMATED COST OTHER $______________
Summary of Property Servicing
Worksheet 4: Drainage Works

To be submitted by an applicant for the purposes of summarizing the design standards for a development and calculation of financial security.

10. Drainage Works: Provide a cost estimate for the construction of drainage works for the development attaching quotes and contracts where necessary to verify estimates.

   a. Design and Engineering        $ 20,000
   b. Site grading and excavation  1,280,000
   c. Culverts and drainage channels/swales
   d. Re-vegetation                60,000
   e. Pump                         ---
   f. Other control structures
      i. Retention Canal            10,000
      ii. Retention Pond            10,000
      iii. ___________________________

TOTAL ESTIMATED COST DRAINAGE WORKS     $ 1,380,000

11. Storm Pond Design Specifications:

   a. Pond Type:  ☒ Wet pond  ☐Dry Pond
   b. Pond depth:   1.0 m
   c. Water holding capacity  39,900 m³
## Summary of Estimated Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadways</td>
<td>$</td>
</tr>
<tr>
<td>Waterlines</td>
<td>122,500</td>
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<tr>
<td>Shallow Utilities</td>
<td>150,000</td>
</tr>
<tr>
<td>Drainage Works/Lot Preparation</td>
<td>1,380,000</td>
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<tr>
<td>Other</td>
<td>40,000</td>
</tr>
<tr>
<td><strong>Total Estimated Costs</strong></td>
<td>$ 1,692,500</td>
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</tbody>
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