Proposed Country Residential Subdivision - Phase I
Portion of NE 24-42-17-W3M & NW 19-42-16-W3M
RM of Battle River No. 438, Saskatchewan

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SABATINI EARTH TECHNOLOGIES INC.

GEOTECHNICAL SITE INVESTIGATION

PROPOSED COUNTRY RESIDENTIAL SUBDIVISION – PHASE I
PORTION OF NE 24-42-17-W3M & NW 19-42-16-W3M
R.M OF BATTLE RIVER NO. 438, SASKATCHEWAN

E0908-2177 **SEPTEMBER 2009**

Prepared For:

Kropf Holdings Ltd.
Spruce Grove, Alberta

Prepared By:

Sabatini Earth Technologies Inc.
Edmonton, Alberta

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Kropf Holdings Ltd.
#15, 53223 Range Road 264
Spruce Grove, Alberta
T7X 3H5

September 30, 2009
Our File: E0908-2177

Attention: **Mr. Fred Kropf, President**

Dear Sir:

Re: **Geotechnical Site Investigation & Shallow Water Table/ Soil Permeability Testing**
Proposed Country Residential Subdivision – Phase I
Portion of NE 24-42-17-W3M & NW 19-42-16-W3M
R.M. of Battle River No. 438, Saskatchewan

1.0 INTRODUCTION

As requested, a geotechnical site investigation and shallow water table with soil permeability testing was carried out by Sabatini Earth Technologies Inc. (hereinafter referred to as SETI) at the above-referenced site. The scope of work consisted of drilling thirteen boreholes, soil sampling, laboratory testing, and evaluation of the results. The field drilling was carried out on August 11 & 12, 2009. Our findings and recommendations for the construction of a new subdivision are provided herein.

2.0 SITE AND PROJECT DESCRIPTION

The site is located within a portion of the northeast quarter of Section 24, Township 42, Range 17 and the northwest quarter of Section 19, Township 42, Range 16, west of the Third Meridian within the Rural Municipality of Battle River No. 438, Saskatchewan (refer to Figure 1, following). The site is comprised of approximately 67.2 acres (27.8 hectares) and is bounded on the south by a reclaimed railway right-of-way, on the north by a Government Road Allowance and bisected by a 20 metres north/south road allowance. The topography of the property can be generally classified as moderately to strong rolling with an approximate maximum elevation difference of 38 metres. Two above ground and/or underground springs run throughout the property and generally correlate with the surface drainage identified by LWS Group and can be referred to on Plate 16, Appendix A.

The sloping and treed portion of the site is largely populated by maple, poplar and birch trees, silverberry, Saskatoon berry and pin cherry bushes, Fescue & wheat grass and prickly rose bushes. The southern portion of the property has been cultivated with a barley field and interspersed with sage grass. The identified foliage is consistent with the conditions described within the Central Parkland Natural Subregion extending into

Saskatchewan which suggests a moderate to dry site and loamy soil conditions which is supported by our drilling and laboratory program as well as supplemental water table readings obtained several days following drilling completion.

It is understood that the proposed country residential subdivision is to be subdivided into approximately 6 lots ranging in size from approximately 7.6 to 15.1 acres.

3.0 PRELIMINARY SLOPE STABILITY ASSESSMENT

A preliminary assessment conducted on site of the slope stability conditions within the property indicated no outward warning of issues associated with stability such as fallen/severely stressed foliage, soil slumping or excessive surface soil erosion. A desktop assessment was also conducted using satellite contours as provided by LWS Group (Drawing 3485.10-02). Calculated slopes were determined in approximate terms and revealed an eight to fourteen percent slope with one slope hitting the fifteen percent mark. Given this information, it was determined by SETI that the necessity of a slope analysis will be left up to the Rural Municipality of Battle River No. 438 authorities; however, it would be the recommendation of the SETI to have individual lots assessed upon purchase as dictated by the R.M. once specific building locations have been identified.

4.0 INVESTIGATION PROCEDURE

A total of thirteen boreholes (Boreholes 09-1 to 09-13) were drilled at the site on August 11 & 12, 2009 to a depth of approximately 6.0 meters below ground surface using a bobcat-mounted drill rig equipped with continuous flyte, 100-millimeter diameter and solid-stem augers.

The soils encountered during drilling were described in accordance with the Modified Unified Soil Classification System, and are presented on Plates 1 and 2, Appendix A. The soil and groundwater conditions encountered during field drilling are presented on the borehole logs (Plates 3 to 15, Appendix A). A site plan showing approximate borehole locations is presented on Plate 16, Appendix A.

Soil sampling for laboratory analyses generally consisted of disturbed auger soil samples at 0.75-meter intervals obtained from the boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75-meter intervals from each borehole in order to obtain an indication of the unconfined compressive strength (Q_u) of the soil.

The groundwater conditions in the boreholes were monitored during drilling, at drilling completion and 14 & 15 days later. The groundwater observations from each borehole location are presented on the borehole logs in Appendix A.

In addition to the routine moisture content analyses, the laboratory analyses program included thirteen particle size analyses, three soluble sulphates and three Atterberg Limit analyses on selected soil samples. The laboratory analyses results are presented on the borehole logs in Appendix A.

5.0 SUBSOIL AND GROUNDWATER CONDITIONS

The soil profile in the borehole locations generally consists of a layer of topsoil followed by clay till that extended beyond the termination depth of the boreholes. Occasionally sand was encountered above or within the clay till layer. Borehole 09-4 encountered a gravel layer beneath the topsoil. The soil strata are shown on the borehole logs in Appendix A and are further described in the following paragraphs.

5.1 TOPSOIL

Topsoil was encountered at the ground surface in all boreholes and extended to depths ranging from 0.12 to 0.20 metres below ground surface. The topsoil was generally noted to be sandy, damp to moist and black in colour.

5.2 GRAVEL

Gravel was encountered within beneath the topsoil within Borehole 09-4 at an approximate depth of 0.13 and extended to an approximate depth of 0.90 metres below ground surface. The gravel was generally noted to be sandy, damp and medium in relative density with occasional cobble size rocks. An in-situ moisture content conducted on a gravel sample was approximately 9 percent.

5.3 SAND

Sand was encountered in varying layers within Boreholes 09-4, 09-6, 09-7, 09-10 and 09-12 at depths ranging from 0.15 to 1.6 metres and extended to depths ranging from 1.1 to 3.5 metres below ground surface. The sand was generally described as medium grained, gravely, dry, medium dense to dense in relative density and rusty brown in colour. In-situ moisture contents in the sand ranged from approximately 4 to 22 percent with a more typical range of 5 to 10 percent.

5.4 CLAY TILL

Clay till was encountered in all boreholes at depths ranging from 0.12 to 3.5 metres and extended to beyond the termination depth of the boreholes. The clay till was generally described as silty to very sandy, moist, medium to high plasticity, stiff to hard in consistency with occasional rust staining, white mottling, coal and gravel chips and dark brown to grey in colour. In-situ moisture contents in the clay till ranged from 7 to 26 percent with a more typical range of 11 to 18 percent. Pocket penetrometer readings taken on intact auger samples of clay till revealed approximate unconfined compressive strengths, Q_u, ranging from 50 to more than 450 kPa with a more typical range of 150 to 250 kPa. Two Atterberg limit tests conducted on selected samples of clay till from a depth of 1.50 meters below ground surface yielded Liquid Limits of 39 to 58 percent and Plastic Limits of 17 to 22 percent, indicative of medium to high plastic clay. The clay till is generally at or near optimum moisture content. The clay till has a moderate to high swelling potential given access to free water. The clay till is a competent material and exhibits low compressibility under moderate to heavy loads.

5.5 GROUNDWATER CONDITIONS

Groundwater levels in each borehole location were monitored during drilling, at drilling completion and 14 and 15 days later. During drilling, evidence of groundwater seepage/free water was encountered within one of the boreholes. The groundwater conditions observed in all the boreholes are summarized on the borehole logs, Appendix A and presented in Table 1, following.

TABLE 1
SUMMARY OF GROUNDWATER OBSERVATIONS

Borehole Number	Depth of Groundwater Seepage (m)	Depth of Water (m) t = 13 days later
09-1	Dry	3.51
09-2	Dry	3.52
09-3	Dry	3.20
09-4	4.30	3.46
09-5	Dry	5.70
09-6	Dry	4.81
09-7	Dry	5.80 (dry)
09-8	Dry	5.75 (dry)
09-9	Dry	5.25 (dry)
09-10	Dry	5.50 (dry)
09-11	Dry	6.0 (dry)
09-12	Dry	5.50 (dry)
09-13	Dry	6.0 (dry)

It should be recognized that the level of the groundwater table is dependent on meteorological cycles and surface drainage on a regional scale. Higher groundwater levels than those observed in this investigation may be encountered following spring thaw and periods of prolonged precipitation. Seasonal fluctuations under normal conditions are expected to be ±1.0 meter and for design purposes, the water table should be assumed at approximately 2.5 meters below ground surface within the majority of the property.

Saskatchewan Environment and Resource Management (SERM) requires that each proposed lot have adequate natural area for the development of a residence. In addition, the developer is required to conduct field tests to determine the near-surface water table. A high water table is defined by SERM as any area where the water table is within 1.5 meters (5.0 feet) of the ground surface. Generally, groundwater levels can be expected to be at the

highest level during the spring snowmelt or after periods of prolonged rainfall and can be inconsistent due to these fluctuations. The water levels will typically decrease until late fall when the lowest levels are maintained throughout the winter months. In addition, the water table may drop 30 to 50 centimetres during a dry growing season. For this site, it is appropriate to use a groundwater level criterion of 1.5 meters (5 feet) below ground surface, which is the criterion established by the Rural Municipality of Battle River No. 438, Saskatchewan. The high and dry areas are shown on Plate 16, Appendix A, and based on these results, approximately 100 percent of the proposed subdivision can be classified as high and dry. A detailed design for the proposed country residential subdivision should be conducted to ensure that each proposed lot has sufficient area of high and dry developable land.

5.6 FROST PENETRATION

The expected maximum depth of frost penetration for various soil types is given in Table 2. The penetration is based on a freezing index for a 25-year return period of 1877 degrees-days Celsius. The depth of frost penetration assumes a uniform soil type without topsoil or snow cover.

TABLE 2
ESTIMATED DEPTH OF FROST PENETRATION

Soil Type		Depth of Frost Penetration (m)
In-situ	Clay and Clay Till	2.3
	Silt and Sand	2.6
	Weathered Bedrock	2.7
	Gravel	3.1
Compacted Backfill (95 % SPMDD*)	Clay and Clay Till	2.0
	Silt and Sand	2.5
	Weathered Bedrock	2.7
	Gravel	3.0

*SPMDD- Standard Proctor Maximum Dry Density

The clay till encountered within the boreholes are considered to be frost susceptible, and with an adequate supply of moisture near the ground surface, significant frost heave may occur.

6.0 SOIL PERMEABILITY RESULTS

A sieve analyses was performed on soil samples collected from Boreholes 09-1 to 09-13 at a standard depth of 3.0 feet (0.91 metres) below ground surface. This analysis was performed to determine if the soil is suitable for septic fields. The sieve analysis indicates that the soil is comprised of various percentages of sand, silt and clay. Using the Soil Texture Classification Triangle provided on page 49 of Appendix A in Saskatchewan Ministry of Health's *Saskatchewan Onsite Wastewater Disposal Guide (2009)* the above soils are classified as outlined in the following table, Table 3.

The maximum effluent soil loading rate per day for the soils is identified above (Table A.15 on page 47 of the Saskatchewan Ministry of Health's *Saskatchewan Onsite Wastewater Disposal Guide (2009)*). This rate is used

to calculate the total effluent volume per day along with its equivalent septic field size.

TABLE 3
SOIL CLASSIFICATION BY BOREHOLE

Borehole Number	Soil Classification	Loading Rate (Litres/Square Metre)
09-1	Sandy Clay Loam	13.72
09-2	Clay Loam	10.78
09-3	Sandy Loam	22.05
09-4	Loamy Sand	30.87
09-5	Clay Loam	10.78
09-6	Loam	17.15
09-7	Sandy Clay Loam	13.72
09-8	Clay Loam	10.78
09-9	Clay Loam	10.78
09-10	Sandy loam	22.05
09-11	Clay Loam	10.78
09-12	Sandy Loam	22.05
09-13	Clay Loam	10.78

The following tables (Tables 4 to 8) summarize the total effluent volume per day along with its equivalent septic field size based on the number of bedrooms within the proposed development.

TABLE 4

SANDY CLAY LOAM

No. of Bedrooms	Effluent Volume		Septic Field Area	
	L/day	Gal/day	M^2	Ft^2
2	1380	300	101	1071
3	1530	338	112	1207
4	2040	450	149	1607
5	2550	563	186	2000
6	3060	675	223	2411
7	3570	788	260	2814
8	4080	900	297	3214
9	4590	1013	335	3618
10	5100	1121	372	1004

TABLE 5

CLAY LOAM

No. of Bedrooms	Effluent Volume		Septic Field Area	
	L/day	Gal/day	M^2	Ft^2
2	1380	300	128	1364
3	1530	338	142	1536
4	2040	450	189	2046
5	2550	563	237	2559
6	3060	675	284	3068
7	3570	788	331	3582
8	4080	900	378	4091
9	4590	1013	426	4605
10	5100	1121	473	5095

TABLE 6

SANDY LOAM

No. of Bedrooms	Effluent Volume		Septic Field Area	
	L/day	Gal/day	M^2	Ft^2
2	1380	300	63	667
3	1530	338	69	751
4	2040	450	93	1000
5	2550	563	116	1251
6	3060	675	139	1500
7	3570	788	162	1751
8	4080	900	185	2000
9	4590	1013	208	2251
10	5100	1121	231	2491

TABLE 7

LOAM

No. of Bedrooms	Effluent Volume		Septic Field Area	
	L/day	Gal/day	M^2	Ft^2
2	1380	300	80	857
3	1530	338	89	966
4	2040	450	119	1286
5	2550	563	149	1609
6	3060	675	178	1929
7	3570	788	208	2251
8	4080	900	238	2571
9	4590	1013	268	2894
10	5100	1121	297	3203

TABLE 8

LOAMY SAND

No. of Bedrooms	Effluent Volume		Septic Field Area	
	L/day	Gal/day	M^2	Ft^2
2	1380	300	45	476
3	1530	338	50	537
4	2040	450	66	714
5	2550	563	83	894
6	3060	675	99	1071
7	3570	788	116	1251
8	4080	900	132	1429
9	4590	1013	149	1608
10	5100	1121	165	1779

The above calculations are based on a single family dwelling for a straight septic field with no infiltrators. The results for the grain size analyses were based on the above information. All of the thirteen locations tested met the Saskatchewan Ministry of Health guidelines, as stated above. Based on these results, the majority of the soils outside of any low and wet areas are suitable for the development of conventional sewage disposal septic fields.

It should be noted that the above results obtained during this study are only preliminary. Plumbing Inspection Services require a total of 3 percolation tests be performed at any lot chosen for sewage field system prior to the installation of a sewage field.

6.1 HYDROGEOLOGICAL SENSITVITY

Based on the Prairie North Health Region, a hydrogeological sensitive area is an area known to be susceptible to contamination based on existing soils and groundwater conditions. The site appears to be underlain by thick unconsolidated glacial till and sand units as indicated in the borehole logs and a water well record in NE-14-42-17-W3 where tills and sands were found above the shale bedrock at 200 feet. The majority of the area has a vertical separation to the water table of greater than 1.5 metres and an otherwise confining layer of bedrock was not found above aquifer units.

All installations of septic systems will be greater than 1 kilometre from the boundary of the any city, town, village or known subdivision containing at least 2 parcels. The density of the subdivision is "medium" consisting of

approximately six lots.

Therefore, the majority of this site can be classified as a "good location" per the Matrix of Development Requirements and according to the matrix, no Impact Assessment is required.

7.0 GEOTECHNICAL EVALUATION & RECOMMENDATIONS

7.1 OVERVIEW

It is understood that that the land development will be for a country residential subdivision consisting of approximately 6 lots. Based on the information obtained in this investigation, the soil conditions at the site are considered generally favourable for foundation support for the proposed structures. Shallow footings bearing in native, undisturbed soil or engineered fill should be suitable as a foundation system for single-family residences. Alternatively, cast-in-place concrete caisson piles that are straight shaft are considered suitable for this project. Should other foundation types be desired, SETI could provide design parameters, upon request.

7.2 SITE PREPARATION

All topsoil should be removed from building and roadway areas. If the homes will have a basement, the excavation should be carefully inspected to ensure that any fill and poor quality compressible material have been removed from the site.

Estimates of topsoil thickness may be obtained from the borehole logs. However, it should be expected that the thicknesses might vary between the borehole locations.

The native mineral soil is expected to be suitable for general site grading. Uniformity and compactive effort of the engineered fill are important in minimizing the potential for differential settlement. The engineered fill should be compacted to the following standards.

(1) All site-raising fill under building areas should be placed in 150 mm maximum lifts compacted to at least 98% of standard Proctor maximum dry density within ±2% of its optimum moisture content.

(2) Site raising fill under the roadway area should be placed in 150 mm maximum lifts compacted thickness and compacted to at least 95% of standard Proctor maximum dry density within ±2% of its optimum moisture content.

(3) General site grading fills outside the building footprints should also be placed in 150 mm lifts compacted thickness and compacted to at least 95% of standard Proctor maximum dry density within ±2% of its optimum moisture content.

7.3 BUILDING FOUNDATIONS

Strip and spread footings are considered feasible foundation types for the home and garage after the existing topsoil and deleterious material have been removed and replaced with engineered fill.

7.3.1 Spread Footings

Spread footings should be designed and constructed according to the following recommendations.

Footings supporting heated structures should have a minimum soil cover of 1.5 meters below finished ground level to provide adequate protection against frost. For unheated structures, exterior and interior footings should be founded at a minimum depth of 2.5 meters below the floor slab level.

In case of basements, footings may be founded immediately below basement level provided the minimum depth of 1.5 meters below grade is maintained.

All footings should be founded on engineered fill or native mineral soils. Footings should not be supported on non-engineered fill or topsoil. Where local soft zones are encountered in the footing excavations, it may be necessary to increase the size of the footings or to remove the soft material and replace with lean concrete. Disturbed soil should not be allowed to remain in the footing excavations.

Strip and spread footings may be designed using allowable bearing capacities of 105 and 120 kPa, respectively for footings founded in the recommended materials at the above depths.

Footings should be inspected by qualified geotechnical personnel in order to ensure that the footings are located in suitable native mineral soils or compacted engineered fill.

7.4 SOIL SWELLING POTENTIAL

An undesirable characteristic of the high plastic clay and clay till, such as that encountered at this site, is the potential to develop swelling pressures with increased moisture content or contact with water. Since a majority of the moisture contents in the soil samples obtained from this site are at or above the plastic limit, the in-situ clays at this site possess a moderate potential for swelling. Swelling clays are an issue in the design of slab-on-grade floors and lightly loaded footing foundations bearing on the clay soils.

7.4.1 Cast-in-Place Concrete Friction Piles

Foundation loads may be carried on cast-in-place concrete friction piles. This may be an economical foundation type for any at-grade building development including attached garages to avoid construction of footing excavations. An advantage in friction piles is that the bases need not be thoroughly cleaned or inspected, as they do not rely on soil end bearing resistance. The piles should be designed and installed according to the recommendations given below.

(1) An allowable shaft adhesion of 20 kPa may be used for the design of concrete friction piles in the existing native mineral soil. Due to shrinkage effects that would otherwise provide intimate contact between the soil and concrete pile, the skin friction for that portion of the pile shaft within the upper 1.5 metres should be discounted as zero. A minimum pile length of 5.5 meters below finished site grade for exterior piles is recommended to resist potential frost heave forces. Interior piles should also be 6.0 meters deep if installation will be carried out during the winter season. It is imperative that the pile design is carried out by a structural engineer to ensure that the piles are deep enough and have sufficient steel reinforcement.

(2) End bearing resistance should not be included in calculating the allowable design load of a friction pile.

(3) A minimum pile shaft diameter of 300 millimeters is recommended to prevent voids from forming during pouring of the concrete.

(4) As a minimum and not including structural requirements, a nominal percentage of longitudinal reinforcement (0.5 percent of the sectional area of the pile shaft should be provided) is required throughout the length of the pile shaft to resist potential uplift forces on the pile due to frost action and seasonal moisture variations. If piles are designed as tension elements, the pile reinforcing should be designed to resist the anticipated uplift stresses.

(5) Concrete should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing soil. As groundwater was encountered during drilling in most boreholes, it is probable that seepage and sloughing may occur during pile installation.

7.4.2 Concrete Grade Beams

If piles are used to support attached garage structures, etc., a concrete grade beam is required along the top of the piles. Precautions should be taken to prevent heaving of the grade beams, due to frost penetration, where the grade beams will lie less than 1.5 meters below the ground surface.

The recommended construction procedure for preventing heave under the grade beam is to use a crushable, non-degradable void filter that is incorporated at the base of the grade beam. In this method, the grade beam must be designed in accordance with the crushing strength of the void filler used and the piles must be constructed to take the resulting uplift.

7.4.3 Concrete Floor Slabs

If the home and attached garage is to contain a grade supported floor slab, all deleterious material as well as native organic soils must be excavated to expose the underlying, inorganic native clay soil. In order to provide uniform and stable support for a slab-on-grade, it is recommended to backfill the building area to design grade using low to medium plastic clay fill. This will also help to reduce the risk of long-term swelling. The imported general engineered clay fill within the building and attached garage should be moisture conditioned to between 0 and 2 percent above optimum moisture content (OMC). This fill should be compacted to at least 98 percent of standard Proctor maximum dry density (SPMDD) in lifts that do not exceed 150 mm in compacted thickness. Full-time inspection including soil compaction tests will be required in order to ensure acceptable fill material placement and compaction.

A minimum of 150 millimeters of clean, well-graded sand or gravel is recommended beneath the interior floor slabs. Coarse material greater than 50 millimeters in diameter should be avoided directly beneath the floor slab to prevent stress concentrations within the slab. The granular levelling course should be compacted to a uniform dry density of at least 100 percent of its SPMDD. A recommended typical gradation is provided in Table 9, following.

TABLE 9
TYPICAL GRADATION FOR GRANULAR FILL BELOW SLAB-ON-GRADE FLOORS

SIEVE		% PASSING
1½	38 000 µm	100
3/8	10 000 µm	65-100
No. 4	5 000 µm	50-90
No. 10	2 000 µm	35-75
No. 40	400 µm	10-45
No. 100	150 µm	0-20
No. 200	75 µm	0-5

Other appropriate materials, which fall outside the above recommended gradation limits might be suitable. Alternate materials should, however, be evaluated by a geotechnical engineer prior to use.

The concrete floor slab for slab on-grade construction should be designed to tolerate some movement and should be separated from the building structure.

7.4.4 Excavation and Backfilling of Basement

Temporary excavation slopes for basement construction should be cut at 1 horizontal to 1 vertical though the native mineral soils. Occupational Health and Safety regulations for excavations must be followed at all times.

Perimeter drains should be provided on the outside of the footings or bottom of basement walls to prevent building up of hydrostatic pressure below the floor slab and against the basement walls. The drains should be surrounded with at least 200 millimeters of free draining gravel.

The native mineral soils may be used for backfilling around the basement walls, provided it is free of organic soils. The soils should be carefully placed and hand tamped in lifts of 300 millimeters or less to obtain uniform compaction. If compacted backfill is used, the foundation walls should be designed using an equivalent fluid pressure of 10 kN/m^3.

7.4.5 Exterior Concrete Aprons

It is recommended that exterior concrete aprons and sidewalks be supported on engineered fill that is compacted in 150 mm thick lifts to at least 98 percent of SPMDD. It is recommended that the concrete aprons be sloped at

least 1.5 to 2.0 percent for proper surface drainage. It is also recommended that front driveways be covered with gravel and not hot mix asphalt or concrete, if they are constructed on the existing fill.

7.5 CONCRETE

Soluble sulphate analyses were conducted on two selected soil samples obtained from the six borehole locations drilled at the site. The results of the analyses revealed sulphate concentrations of approximately 0.07 to 0.28 percent water-soluble sulphates by dry weight of soil. These results indicate a "negligible" to "severe" potential for sulphate attack on concrete in contact with the native soils at this site. Therefore, all concrete in contact with the native soils at this site should be made with CSA Type 50 normal Sulphate Resistant cement possessing a minimum 28-day compressive strength of 32 MPa. The maximum water cement ratio should be 0.54. An air entrainment agent of 5 to 7 percent is recommended for improved workability and freeze-thaw durability.

Any new fill brought to the site should be tested for sulphate concentrations.

7.6 FLEXIBLE PAVEMENT DESIGN

7.6.1 Subgrade Preparation

It is understood that the pavement structure will be classified as Main Farm Access Road adjusted to fit the ROW. This system of roads is constructed to an all weather standard, moderately travelled less than 150 vehicles per day. All loose, soft, or organic soils should be removed from beneath the proposed pavement areas. The final subgrade surface should be compacted to 100 percent of SPMDD at moisture content at or slightly in excess of the optimum moisture content. The RM of Battle River No. 438 has requested a minimum finished road top of 8.0 metres and the surfacing structure they expect is as outlined in the following section. Prior to placement of the pavement structure, the entire surface should be proof rolled with a fully loaded tandem axle or single axle dump truck to detect any soft area. Stabilization of the subgrade with Portland cement may be required in areas where the clay subgrade is too wet or soft.

7.6.2 Flexible Pavement Sections

The pavement sections given in the following tables are the minimum requirements to accommodate the assumed traffic loading conditions and frequencies for the project site. These sections are designed based on an assumed California Bearing Ratio (CBR) value of 3, a design period of 20 years, a DTN of 5, and a maximum axle load of 80 kN (18 kips).

TABLE 10
PAVEMENT SECTION THICKNESS

Structure	Minimum Thickness (mm)
Light Duty Hot Mix Asphalt	75 mm asphalt concrete
	250 mm crushed gravel (20 mm)
	150 mm of compacted subgrade to 100 % SPMDD
Heavy Duty Hot Mix Asphalt	100 mm asphalt concrete
	300 mm crushed gravel (20 mm)
	150 mm of compacted subgrade to 100 % SPMDD

The granular base material should be hard, clean, well graded, crushed aggregate, free of organics, coal clay lumps, and other deleterious material. The minimum sand equivalent should be 35 and the maximum percent passing the 80-micrometer screen should be 7 percent. Each mat of hot-mix asphalt should be compacted to at least 98 percent of maximum Marshall density.

The gravel pavement section given in Table 11 below may be used, or a structural equivalent.

TABLE 11
GRAVEL PAVEMENT DESIGN

Layer	Minimum Thickness (mm)
Crushed Gravel (25 mm)	150 mm
Crushed Gravel (100 mm)	400 mm
Subgrade	Stabilized, as necessary

In all cases, the minimum designs as established by the Rural Municipality of Battle River No. 438, Saskatchewan or surrounding authority should supersede the above design.

8.0 CLOSURE

This preliminary report is based on the findings at thirteen borehole locations. Should different subsoil and/or groundwater conditions be encountered during construction, Sabatini Earth Technologies Inc. must be notified

immediately and the recommendations provided herein will be reviewed and revised, as necessary. The design of concrete piles foundations should be carried out by a structural engineer that is registered in the Province of Saskatchewan.

Should you have any questions or require additional information, do not hesitate to contact our office at (780) 438-0844.

Yours very truly,
Sabatini Earth Technologies Inc.

MWojvodic

for Kerry Yeremiy, C.E.T.
Edmonton Office

Distribution: (3) addressee

Attachments: Appendix A

Gurpreet Gill, M. Eng., P. Eng.
E0908-2177

Ken Hugo, P. Geol.
E0908-2177

Hydrogeology C1653 KHugo

PLAN OF PROPOSED SUBDIVISION SHOWING
SUBDIVISION & CONSOLIDATION OF ALL OF
REG'D PLAN No. AF 2083 AND ALL OF
NW ¼ SEC. 24 – 42 – 17 – W3MER. AND
SUBDIVISION & CONSOLIDATION OF ALL OF
REG'D PLANS No. AF 2083 AND AH2033 AND
NE ¼ SEC. 24 – 42 – 17 – W3MER. AND
SUBDIVISION & CONSOLIDATION OF ALL OF
REG'D PLANS No. AF 2083 AND AR596 AND
NW ¼ SEC. 19 – 42 – 16 – W3MER.
R.M. OF BATTLE RIVER, No. 438, SASK.

LEGEND:
1. ALL DISTANCES SHOWN IN METRES AND DECIMALS THEREOF, WITH AN ACCURACY OF ±10 METRES.
2. ARC DISTANCES ARE SHOWN ALONG CURVED BOUNDARIES.
3. ALL CORNER CUT OFFS ARE 6.0 METRES BY 6.0 METRES.
4. CONTOURS ARE SHOWN AT 1.0 METRE INTERV
SUPPLIED BY LAND DATA TECHNOLOGIES INC.
5. CONTOURS FORM PART OF THE DIGITAL FILE AND ARE SHOWN ON PAGE TWO OF THE PROPOSED SUBDIVISION.
6. AREA BEING SUBDIVIDED CONTAINS ±193.20 HECTARES, AND IS BOUNDED BY A BOLD DASHED LINE.
7. SCALE: 1:7,000

MINISTRY OF MUNICIPAL AFFAIRS, COMMUNITY PLANNING BRANCH:

PRELIMINARY PLAN COMPLETED
ON NOVEMBER 2ND, A.D. 2009,

BY: _____, S.L.S.

Prepared by:

MERIDIAN SURVEYS LTD.
P.O. BOX 548,
NORTH BATTLEFORD, SASK.
S9A 2Y7 OUR FILE: W09240
DRAWN BY: *B. Gristwood*
PH: 445-8148 FAX: 445-1545

OWNERS APPROVAL:

KROPF HOLDINGS LTD.

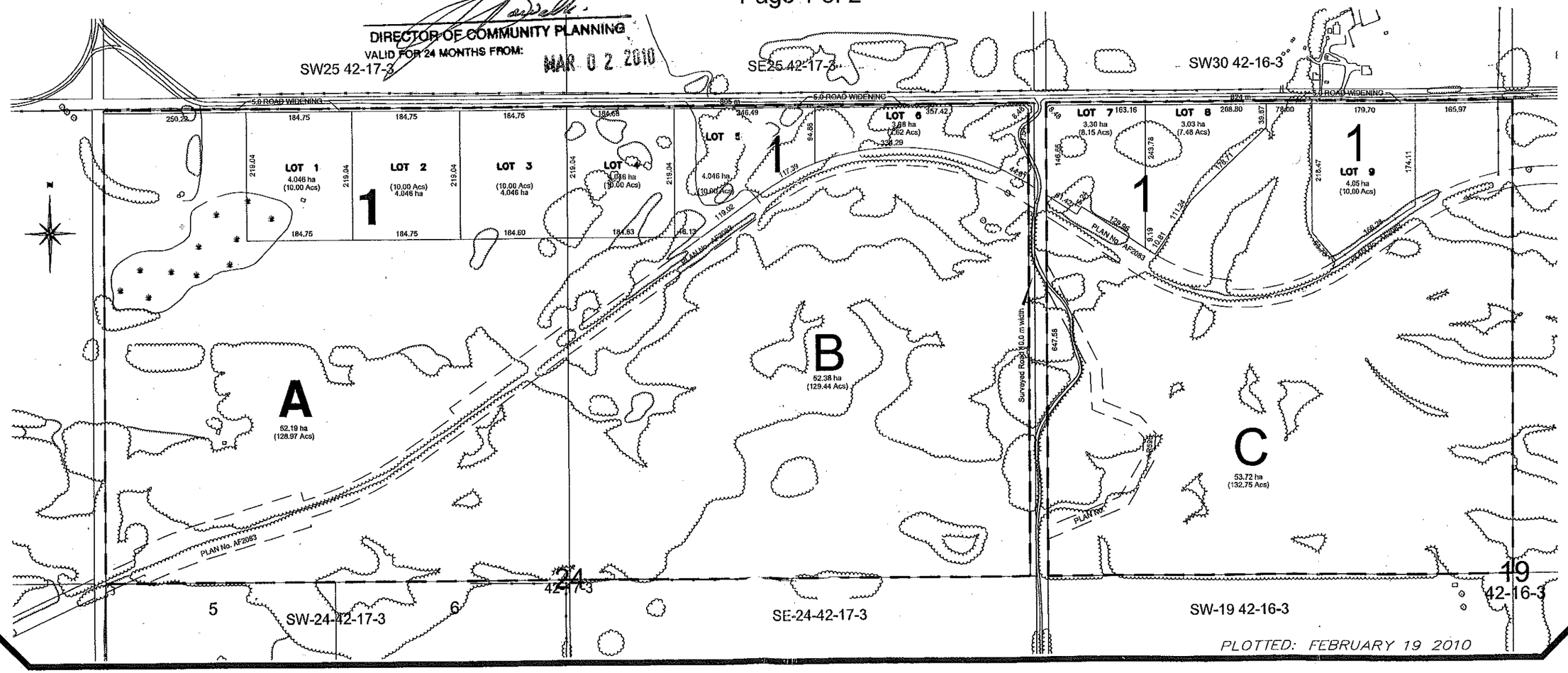
REVISED: NOVEMBER 18, 2009
AMENDED LOT 9, BLOCK 1,
ADDED PARCEL 'D', ROADWAY
WITHIN PARCEL 'C', AND ROAD
WIDENING WITHIN PARCEL 'B'

REVISED: FEBRUARY 19, 2010
REMOVED PARCEL 'D' AND
ROADWAY WITHIN PARCEL 'C'

THE SUBDIVISION SHOWN WITHIN THE BOLD DASHED LINE IS HEREBY APPROVED AS PER THE ATTACHED NOTICE OF DECISION

DIRECTOR OF COMMUNITY PLANNING

VALID FOR 24 MONTHS FROM: MAR 02 2010



PLOTTED: FEBRUARY 19 2010

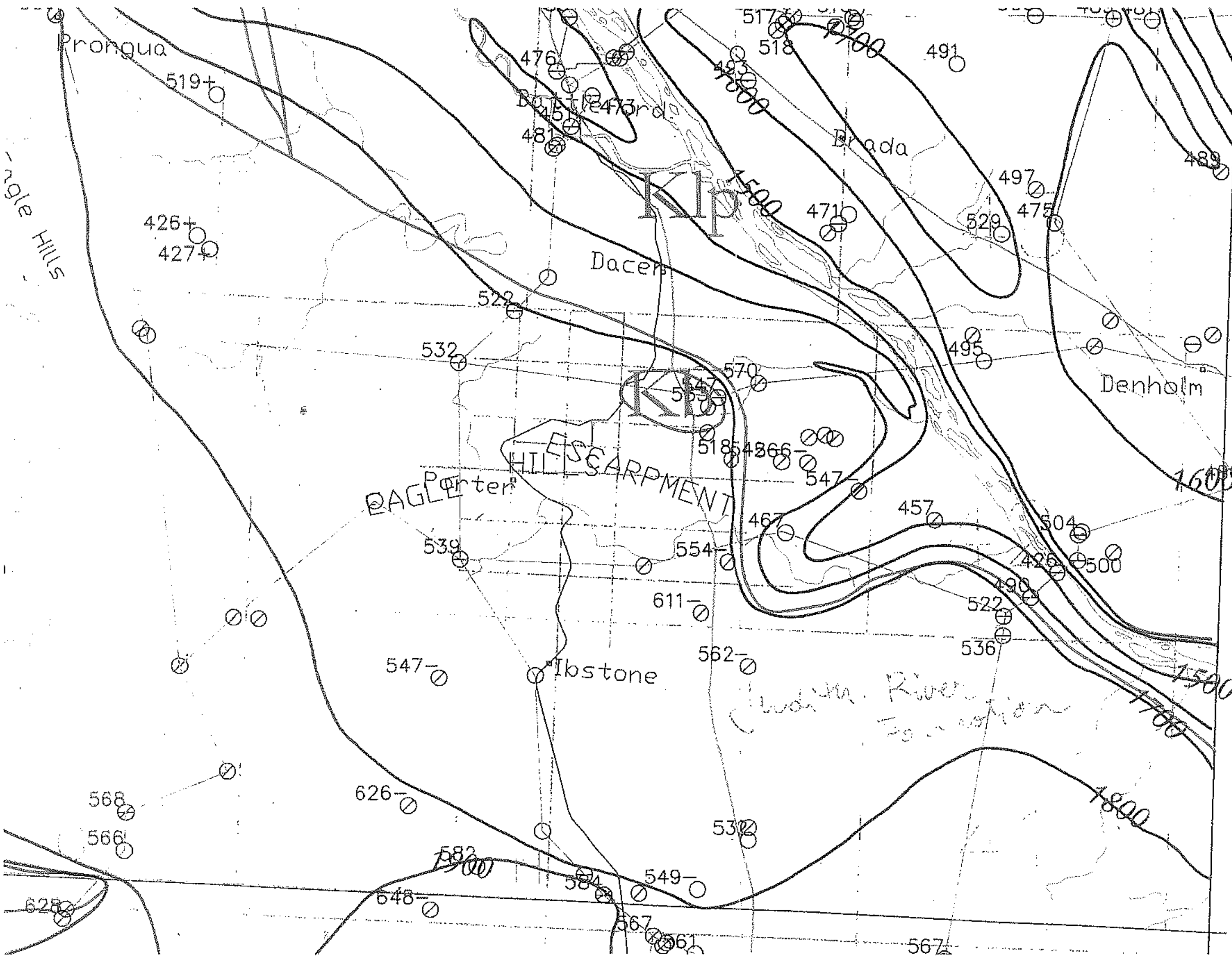
SABATINI EARTH TECHNOLOGIES INC.

12323 - 67 street, Edmonton, Alberta T5B 1N1
Phone: (780) 438-0844
Fax: (780) 435-1812

KROPF HOLDINGS LTD.

Proposed Country Residential Subdivision
Portion of N ½ 24 - 42 - 17 - W3M
R.M. of Battle River No. 438, Saskatchewan
Survey Map Showing Site Boundary & Approximate Borehole Locations

Job No.: E0908 - 2177	Date: September 25, 2009	Plate: 16



Pronqua
Battleford
Brada
Dacers
Denholm
Porter
Ibstone
Klp
Klp
EAGLE HILL ESCARPMENT
1500
1600
1700
1800
1900

APPENDIX A

Explanation of Terms and Symbols Used on Borehole Logs
Borehole Logs
Survey Map Showing Site Boundary, Approximate Borehole Locations

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm	SAND - 0.08 mm to 5 mm
COBBLES - 75 mm to 200 mm	SILT - 0.002 mm to 0.08 mm
GRAVEL - 5 mm to 75 mm	CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage

water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

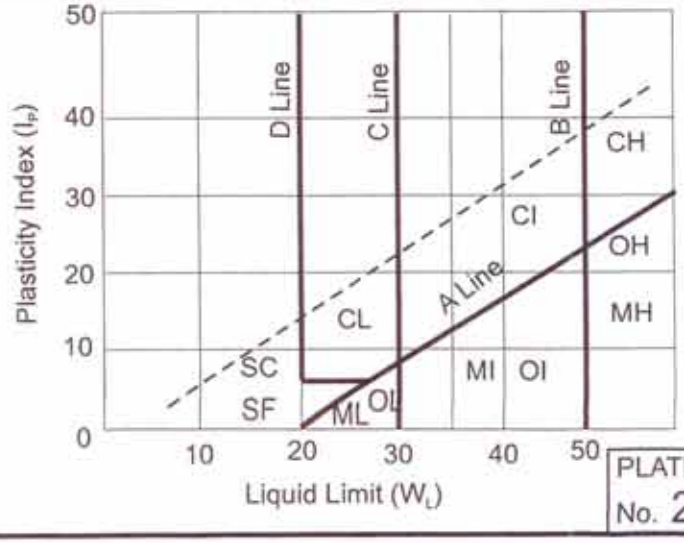
HVR	Hydrocarbon Vapour Readings, ppm or % LEL
* MA	Mechanical grain size analysis
G	Specific gravity
k	Coefficient of permeability
PP	Pocket penetrometer strength kg/cm2
* q	Triaxial compression test
* C	Consolidation test
Qu	Unconfined compressive strength kg/cm2
SO_4	Soluble sulphate concentration
γ	Bulk unit weight
γd	Dry unit weigh

* Tests normally summarized on separate data sheets

Modified Unified Classification System For Soils

Major Division			Group Symbol	Graph Symbol	Color Code	Typical Description	Laboratory Classification Criteria	
Coarse-Grained Soils (more than half by weight larger than 200 sieve)	Gravels more than half coarse grains larger than No. 4 sieve	Clean Gravels (little or no fines)	GW		Red	Well graded gravels, little or no fines	$C_U = (D_{60}/D_{10}) > 6$ $C_C = D_{30}^2/(D_{10}*D_{60}) = 1$ to 3	
			GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting above requirements	
		Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines exceeds 12%	Below "A" line P.I. less than 4
			GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures		Above "A" line P.I. more than 7
	Sands more than half fine grains smaller than No. 4 sieve	Clean Sands (little or no fines)	SW		Red	Well graded sands, gravely sands, little or no fines	$C_U = (D_{60}/D_{10}) > 4$ $C_C = D_{30}^2/(D_{10}*D_{60}) = 1$ to 3	
			SP		Red	Poorly graded sands, little or no fines	Not meeting above requirements	
		Dirty Sands (with some fines)	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines exceeds 12%	Below "A" line P.I. less than 4
			SC		Yellow	Clayey sands, sand-(silt) clay mixtures		Above "A" line P.I. more than 7
Fine-Grained Soils (more than half by weight passes 200 sieve)	Silts below "A" line negligible organic content	$W_L < 50\%$	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification is based upon plasticity chart	
		$W_L > 50\%$	MH		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
	Clays above "A" line negligible organic content	$W_L < 30\%$	CL		Green	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays		
		$30\% < W_L < 50\%$	CI		Green-Blue	Inorganic clays of medium plasticity, silty clays		
		$W_L > 50\%$	CH		Blue	Inorganic clays of high plasticity		
	Organic Silts & Clays bellow "A" line on chart	$W_L < 50\%$	OL		Green	Organic silts and organic silty clays of low plasticity	Whenever the nature of the fine content has not been determined it is designated by the letter "F". E.G. SF is a mixture of sand with silt or clay	
		$W_L > 50\%$	OH		Blue	Organic clays of high plasticity		
Highly Organic Soils			PI		Orange	Peat and other highly organic soils	Strong color or odor, and often fibrous texture	

Bedrock Symbols



SABATINI EARTH TECHNOLOGIES INC.

PLATE No. 2

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 11, 2009
TECH: DJ

TEST BORING P1/09-1

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT - N	MISCELLANEOUS TESTS
		TOPSOIL, sandy, dry, black				
		CLAY TILL, sandy, some silt, moist, stiff, medium plastic, brown, pebbles, occasional gravel pieces, trace salts and rust specks				PP = 175 kPa
3	1					
		– stiff to very stiff, dark brown, occasional coal bits				PP = 225 kPa SO_4 = 0.00 %
6	2					
		– greyish brown				PP = 250 kPa
10	3					PP = 250 kPa
						▼ 15 days later PP = 250 kPa
	4					
15						PP = 250 kPa
	5					PP = 250 kPa
						PP = 250 kPa
20	6	End of Borehole = 6.0 m Slough = 5.7 m, 0 hours Water level = 5.7 m (dry), 0 hours Water level = 3.51 m, 15 days later Standpipe Piezometer Installed at 5.7 m				
	7					
25						
	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
▨ UNDISTURBED SAMPLE (SHELBY)
▣ BAG SAMPLE

PLATE No. 3

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 11, 2009
TECH: DJ

TEST BORING P1/09-2

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, sandy, dry, black				
		CLAY TILL, sandy, some silt, moist, very stiff, medium plastic, brown, pebbles, occasional gravel pieces, trace salts and rust specks, occasional coal bits				
3	1					PP = 275 kPa
6	2					PP = 250 kPa
						PP = 150 kPa
10	3					PP = 150 kPa
						▼ 15 days later
	4					PP = 175 kPa
15						PP = 175 kPa
	5					PP = 150 kPa
	6					PP = 150 kPa
20		End of Borehole = 6.0 m Slough = 5.7 m, 0 hours Water level = 5.7 m (dry), 0 hours Water level = 3.52 m, 15 days later Standpipe Piezometer Installed at 5.7 m				
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 4

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009 TECH: DJ

TEST BORING **P1/09-3**

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, sandy, damp, black				
		CLAY TILL, sandy, silty, moist, stiff, medium plastic, light brown, trace salts, pebbles				PP = 150 kPa
3	1	– trace rust, and coal specks				PP = 175 kPa
6	2	– brown, trace gravel pieces				PP = 150 kPa
						PP = 150 kPa
10	3					▼ 14 days later
						PP = 150 kPa
	4	– dark greyish brown				
15						PP = 150 kPa
	5					PP = 150 kPa
	6					PP = 150 kPa
20		End of Borehole = 6.0 m Slough = 5.7 m, 0 hours Water level = 5.7 m (dry), 0 hours Water level = 3.2 m, 14 days later Standpipe Piezometer Installed at 5.7 m				
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 5

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009 TECH: DJ

TEST BORING P1/09-4

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

DRILL TYPE Solid Stem Auger

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, gravelly, damp black				
		GRAVEL, sandy, damp, medium dense, occasional cobbles				
3	1	**SAND**, fine to medium grained, damp, medium dense				
6	2	– wet, water				
		CLAY TILL, sandy, silty, moist, soft to firm, grey, medium plastic, pebbles, occasional gravel pieces coal bits				⧗ 14 days later
10	3					PP = 75 kPa
	4					
15						PP = 75 kPa
	5	– soft, increased sand, low plastic				PP = 50 kPa
	6					PP = 50 kPa
20		End of Borehole = 6.0 m Slough = 4.3 m, 0 hours Water level = 4.3 m, 0 hours Water level = 3.46 m, 14 days later Standpipe Piezometer Installed at 6.0 m				
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
⧗ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 6

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009 TECH: DJ

TEST BORING P1/09-5

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT - N	MISCELLANEOUS TESTS
		TOPSOIL, sandy, damp, black				
		CLAY TILL, sandy, silty, moist, stiff, medium plastic, dark brown, trace salts, occasional gravel/pebble & coal chips				PP = 375 kPa
3	1					PP = 350 kPa
		– rusty brown, stiff				
6	2					PP = 200 kPa
						PP = 175 kPa
10	3	– turning dark brown				
						PP = 150 kPa
	4					PP = 200 kPa
15						
	5					PP = 175 kPa
						▼ 14 days later
	6					PP = 200 kPa
20		End of Borehole = 6.0 m Slough = 5.7 m, 0 hours Water level = 5.7 m (dry), 0 hours Water level = 5.7 m, 14 days later Standpipe Piezometer Installed at 5.7 m				
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 7

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009 TECH: DJ

TEST BORING P1/09-6

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT - N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
3	1	**CLAY TILL**, sandy, silty, moist, firm to stiff, grey, medium plastic, pebbles, occasional gravel pieces coal bits, dark brown				PP = 250 kPa PP = 400 kPa SO_4 = 0.01 %
6	2	**SAND**, gravelly, medium dense, damp, light brown				
10	3	**CLAY TILL**, sandy, silty, moist, firm to stiff, grey, medium plastic, pebbles, occasional gravel pieces coal bits, turning grey				PP = 175 kPa PP = 200 kPa ▼ 14 days later PP = 250 kPa
15	4					
20	5					
	6	End of Borehole = 6.0 m Slough = 5.3 m, 0 hours Water level = 5.3 m (dry), 0 hours Water level = 4.81m, 14 days later Standpipe Piezometer Installed at 5.3 m				PP = 250 kPa
25	7					
30	8					
	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 8

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-7

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
		SAND, silty, occasional pebbles, medium dense,				
3	1					
		CLAY TILL, sandy, silty, damp, stiff to very stiff, medium plastic, pebbles, trace salts & rust staining occasional coal bits, dark brown				PP = 300 kPa
6	2					PP = 250 kPa
10	3					PP = 300 kPa
		– turning grey, very stiff				PP = 400 kPa
15	4					PP = 275 kPa
	5	– grey				PP = 350 kPa
	6					PP = 350 kPa
20		End of Borehole = 6.0 m Slough = 5.8 m, 0 hours Water level = 5.8 m (dry), 0 hours Water level = 5.8 m (dry), 14 days later Standpipe Piezometer Installed at 5.8 m				
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 9

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-8

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
3	1	**CLAY TILL**, sandy, silty, dry to damp, medium plastic, stiff to very stiff, trace salts, rust specks, pebbles, occasional gravel pieces, brown				PP = 450 kPa
						PP = 450 kPa
6	2	–dark brown, moist, very stiff				
						PP = 200 kPa
10	3					PP = 275 kPa
						PP = 350 kPa
	4	–some rust, stiff, greyish brown				
15						PP = 300 kPa
	5					
						PP = 250 kPa
	6					PP = 200 kPa
20		End of Borehole = 6.0 m Slough = 5.75 m, 0 hours Water level = 5.75 m (dry), 0 hours Water level = 5.75 m (dry), 14 days later Standpipe Piezometer Installed at 5.75 m				
	7					
25						
	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 10

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009 TECH: DJ

TEST BORING P1/09-9

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
		CLAY TILL, sandy, silty, dry, medium plastic, very stiff to hard, some salts, light brown				
3	1					PP = 450 kPa
						PP = 450 kPa
6	2	–moist, very stiff, brown,				
		–dark brown				PP = 250 kPa
10	3					PP = 200 kPa
						PP = 175 kPa
	4					
15						PP = 200 kPa
	5	–Auger refusal due to large boulder				PP = 220 kPa
		End of Borehole = 5.25 m Slough = 5.25 m, 0 hours Water level = 5.25 m (dry), 0 hours Water level = 5.25 m (dry), 14 days later Standpipe Piezometer Installed at 5.25 m				
20	6					
	7					
25						
	8					
	9					
30						
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 11

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-10

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS ATTERBERG LIMITS

MOISTURE CONTENT %

10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
		SAND, gravelly, medium dense, damp,				
3	1					
6	2					
10	3					
		CLAY TILL, sandy, silty, moist, firm to stiff, grey, medium plastic, pebbles, occasional gravel pieces coal bits, dark brown				PP = 250 kPa
15	4	– gravelly, very stiff, low to medium plastic				PP = 300 kPa
	5					PP = 350 kPa
	6					PP = 325 kPa
20		End of Borehole = 6.0 m Slough = 5.5 m, 0 hours Water level = 5.5 m (dry), 0 hours Water level = 5.5m (dry), 14 days later Standpipe Piezometer Installed at 5.5 m				
25	7					
	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▽ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☒ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 12

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-11

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
		CLAY TILL, sandy, silty, dry to damp, medium plastic, stiff to very stiff, trace salts, rust specks, pebbles, occasional gravel pieces, dark brown				
3	1					PP = 450 kPa
						PP = 450 kPa
6	2	– moist, very stiff				
						PP = 300 kPa
10	3					
						PP = 250 kPa
		– increased rust, turning grey				
	4					PP = 250 kPa
15		– grey				
	5					PP = 300 kPa
						PP = 350 kPa
	6					
20		End of Borehole = 6.0 m Slough = 6.0 m, 0 hours Water level = 6.0 m (dry), 0 hours Water level = 6.0 m (dry), 14 days later Standpipe Piezometer Installed at 6.0 m				PP = 250 kPa
	7					
25						
	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
☐ UNDISTURBED SAMPLE (SHELBY)
☒ BAG SAMPLE

PLATE No. 13

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-12

DRILL TYPE: Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT-N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
3	1	**SAND**, silty, occasional pebbles, medium dense,				
		CLAY TILL, sandy, silty, damp, stiff to very stiff, medium plastic, pebbles, trace salts & rust staining occasional coal bits, dark brown				PP = 300 kPa
6	2	– gravelly, dark brown, very stiff, moist				PP = 250 kPa
10	3	– less gravel				PP = 300 kPa
		– greyish brown				PP = 400 kPa
15	5					PP = 2750 kPa
						PP = 350 kPa
20	6	End of Borehole = 6.0 m Slough = 5.5 m, 0 hours Water level = 5.5 m (dry), 0 hours Water level = 5.5 m (dry), 14 days later Standpipe Piezometer Installed at 5.5 m				PP = 350 kPa
25	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
▨ UNDISTURBED SAMPLE (SHELBY)
▣ BAG SAMPLE

PLATE No. 14

SABATINI EARTH TECHNOLOGIES INC.

CLIENT: Kropf Holdings Ltd.
PROJECT: Proposed Country Residential Subdivision
LOCATION: NH 24-42-17-W3M & NW 19-42-16-W3M, RM of Battle River No.438, SK
JOB No.: E0908 - 2177
DATE: August 12, 2009
TECH: DJ

TEST BORING P1/09-13

DRILL TYPE Solid Stem Auger

MOISTURE CONDITIONS
ATTERBERG LIMITS

MOISTURE CONTENT %
10 20 30 40 50 60

SOIL PROFILE & DESCRIPTION

TEST RESULTS

DEPTH IN FEET	DEPTH (m)	DATUM: / SURFACE ELEVATION:	SOIL SYMBOL	SAMPLE TYPE	BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL, damp, black				
3	1	**CLAY TILL**, sandy, silty, dry to damp, medium plastic, stiff to very stiff, trace salts, rust specks, pebbles, occasional gravel pieces, dark brown				SO_4 = 0.04 %
6	2					PP = 400 kPa
10	3					PP = 350 kPa
		– dark brown, moist, stiff to very stiff, occasional gravel chips				
15	4					PP = 325 kPa
	5					PP = 300 kPa
20	6					PP = 300 kPa
		End of Borehole = 6.0 m Slough = 6.0 m, 0 hours Water level = 6.0 m (dry), 0 hours Water level = 6.0 m (dry), 14 days later Standpipe Piezometer Installed at 6.0 m				PP = 250 kPa
25	7					
	8					
30	9					
	10					
35						

⊙ MOISTURE CONTENT
⊡ LIQUID LIMIT
△ PLASTIC LIMIT

Q_u UNCONFINED COMPRESSION
γ_d DRY UNIT WEIGHT

SO_4 SULPHATE CONTENT
▼ WATER TABLE
N PENETRATION RESISTANCE

☒ STANDARD PENETRATION SAMPLE
▨ UNDISTURBED SAMPLE (SHELBY)
▣ BAG SAMPLE

PLATE No. 15

MAR 1 0 2010

Saskatchewan

Ministry of Municipal Affairs

Community Planning

Room 978, 122-3rd Avenue North
Saskatoon, Saskatchewan S7K 2H6
Phone: (306) 933-5729
Fax: (306) 933-7720

Notice of Decision

CERTIFICATE OF APPROVAL

Under *The Planning and Development Act, 2007*

Number: R1210-09S

REGISTERED

Your file: W09240
March 2, 2010

Phase I Approved

Regan Rayner, S.L.S.
Meridian Surveys Ltd.
Box 548
NORTH BATTLEFORD SK S9A 2Y7

Re: RM of Battle River No. 438
Proposed Residential Subdivision
N ½ Section 24-42-17-W3M - Lots 1-6, Block 1; Parcels A and B
NW ¼ Section 19-42-16-W3M - Lots 7-9, Block 1; Parcel C

Under Section 128(4)(c)ii) of *The Planning and Development Act, 2008* (PDA), the proposed subdivision shown within the bold dashed line on the attached plan is hereby **APPROVED subject to compliance with the following directives for development standards issued under Section 130 of the PDA.**

Development Standards

Development on the lands shown on the attached plan is to be undertaken pursuant to the issuance of development permits by the Rural Municipality of Battle River No. 438 in conformance with all guidelines and recommendations contained in the following: geotechnical reports and letter prepared by Sabatini Earth Technologies Inc. (SETI):

1. *Geotechnical Site Investigation, Proposed Country Residential Subdivision - Phase I Portion of NE ½ 24-42-17-W3M & NW ¼ 19-42-16-W3M, RM of Battle River No. 438, Saskatchewan,* File E0908-2177 dated September 2009;
2. *Geotechnical Site Investigation, Proposed Country Residential Subdivision - Phase II Portion of NW ¼ 19-42-16-W3M, RM of Battle River No. 438, Saskatchewan,* File E0908-2177 dated September 2009; and
3. Supplemental letter to Kropf Holdings Ltd. dated February 16, 2010.

This approval is issued on the understanding that the developer will advise potential parcel purchasers of the engineering requirements and development constraints on the proposed lots. It is also understood that the developer will make copies of the geotechnical report and supplemental letter available to all purchasers in order for the purchasers to be aware of the report recommendations for development.

. . . 2

Appeal

Within 30 days of receipt of this Notice, this decision may be appealed under Section 228 of the PDA. To file an appeal, send a written notice of appeal and a $50.00 filing fee to the: Saskatchewan Municipal Board, Planning Appeals Committee, 2151 Scarth Street Room 480, REGINA SK S4P 2H8. Please send us a copy for our file.

Interest Registration

Per Section 130(2) of the PDA we have registered an interest on the title to the land being subdivided. The interest informs landowners of the need to comply with the above development standards. The interest will remain registered until we are supplied with new information proving the development standards are no longer required or the Planning Appeals Committee directs the interest be discharged.

Municipal Reserve

Section 181 of the PDA requires a landowner subdividing land to provide, without compensation, part of the land, or money in lieu of that part of the land, as municipal reserve for public use. Since neither dedicating such a parcel nor deferring the requirement is desirable, and since the applicant has paid an appropriate amount to the municipality's Dedicated Lands Account, I hereby waive the requirement for dedicating land under Section 187 of the PDA.

Legal

This Certificate is subject to the following legal limitations and qualifications:

a) It does not establish the method of registration prescribed under *The Land Titles Act, 2000.* To register the approved subdivision in the Saskatchewan Land Registry, this Certificate must be submitted with other documents to the Controller of Surveys.

b) It is valid for 24 months from the date of issue. If requested before the expiry date, it may be re-issued for a fee of $25.00. After the expiry date, such a request must be considered a new application subject to the full examination fees.

c) It does not eliminate the need to comply with the requirements of other government agencies, or with the municipality's building, zoning or other bylaws.

. . . 3

General Comments

People planning construction or excavations must contact each utility company for service connections and line locations before starting work. Some utility and pipe lines can be located by phoning SASK 1st CALL at 1-866-828-4888 or via the internet at www.sask1stcall.com.

Health Region permits are required to construct or modify water supply or wastewater systems. For applications, contact the Health Region listed below.

People who use private water and sewer systems are responsible for having their water tested to ensure it is safe for drinking or domestic use and for making certain their onsite sewage disposal system does not contaminate water sources. Private domestic wells are not licensed, monitored or regulated. Ground water supply can be affected by other wells, sewer systems, contamination and climate change. If a ground or surface water supply is unsuitable, residents must have water hauled from other sources. The Saskatchewan Watershed Authority and the Ministry of Health publish guides for maintaining water sources on-line at: www.swa.ca and at www.saskh2o.ca.

The **Saskatchewan Watershed Authority** (SWA) advises that the subdivision may have a minor flood risk due to the nature of the land and the proximity to Eagle Hills. The proponent is cautioned to select appropriate building sites to mitigate any risk of flooding especially on Lot 1 which has a substantial sized slough which may expand during wet years. An estimated peak water level has not been formally calculated by SWA, however, if any landowner intends to build any new structures closer to the water, a development permit is required from the municipality which will apply its hazard land provisions in the municipal zoning bylaw.

Also, a permit must be obtained from SWA before any work is done to alter a water course. Under Sections 38 and 39 of *The Saskatchewan Watershed Authority Act, 2005* the property in and the right to the use of ground water and surface water is deemed vested in the Crown. No person has any exclusive or other property or interest in, or any exclusive right or privilege with respect to any river, stream, watercourse, lake, creek, spring, ravine, canyon, lagoon, swamp, marsh or other water body, or any exclusive or perpetual property, interest or privilege in the land forming the bed or shore of any water body or water course.

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Fees

Thank you for your client's cheque's No. 0336 and 0375 covering our examination and approval fees as well as the fees for Interest registration.

Len Kowalko, P.P.S., M.C.I.P.
Director of Community Planning

Enclosure:

cc: SaskPower, Land Department **27884**
SaskEnergy/TransGas, Land Services (R. Aldag) **09-13659**
SaskTel, Lands and Easements (B. Schmidt) **277 NBFD**
Prairie North Health Region (R. Koroluk)
Watershed Authority, North Battleford (Judy Szuch) **B7-1-5-1** 306-446-7450
Heritage Resources Branch, TPCS (Jennifer Thompson) **09-1119**
RM of Battle River No. 438
Kropf Holdings Ltd., 15-53223 Range Road 264, Spruce Grove, AB T7X 3H5

SABATINI EARTH TECHNOLOGIES INC.

203, 6919 - 32nd AVENUE N.W.
CALGARY, ALBERTA T3B 0K6
TEL: (403) 247-1813
FAX: (403) 247-1814

12323 - 67th STREET
EDMONTON, ALBERTA T5B 1N1
TEL: (780) 438-0844
FAX: (780) 435-1812

Kropf Holding Ltd.
15, 53223 Range Road 264
Spruce Grove, Alberta
T7X 3H5

File No: E0908-2177
August, 2009

Attention: Mr. Fred Kropf

RE: **Aquifer Evaluation - Proposed Country Residential Subdivision**
NH 24-42-17-W3M & NW 19-42-16-W3M,
RM of Battle River No. 438, Saskatchewan

An aquifer evaluation was undertaken to determine whether the aquifers underlying the above mentioned site could support additional water demands associated with the proposed 45 lot country residential subdivision. Water well data was examined to determine the likely aquifer potential in the area.

Aquifers in the area consist of sands deposited within an east – west trending buried valley system and are generally found within depths of less than 100 feet.

A pump test was undertaken on well within a lot on the proposed subdivision (Lot 5). This well is 82 feet deep and obtains water from sand layers within the buried valley deposits. Results of a relatively short (5 hour) pump test show a transmissivity of 3.3 m^2/day, indicating a moderately productive aquifer. Estimated long term continuous yields from this well are on the order of 21.7 m^3/day (3.3 gallons per minute).

It is recommended that water supply for this project be provided by individual wells on each lot, and the aquifer, if it extends across the site in a similar way as observed in the well on Lot 5, should be able to accommodate the water requirements for the subdivision.

Unconfined aquifers such as these may be susceptible to contamination from surface sources and water quality testing is recommended prior to utilizing the groundwater as a drinking water source.

Yours truly,
Sabatini Earth Technologies Inc.

Mira Vojvodic

SABATINI EARTH TECHNOLOGIES INC.

203, 6919 - 32nd AVENUE N.W.
CALGARY, ALBERTA T3B 0K6
TEL: (403) 247-1813
FAX: (403) 247-1814

12323 - 67th STREET
EDMONTON, ALBERTA T5B 1N1
TEL: (780) 438-0844
FAX: (780) 435-1812

File: E0908-2177

February 16, 2010

Kropf Holdings Ltd.
#15, 53223 Range Road 264
Spruce Grove, Alberta
T7X 3H5

Attention: Mr. Fred Kropf, President

Dear Sir:

Re: Slope Stability
Proposed Country Residential Subdivision
Lots 1 to 9, Block 1
Portions of N½ 24-42-17-W3M and NW¼ 19-42-16-W3M
R.M. of Battle River No. 438, Saskatchewan

INTRODUCTION

A slope stability analysis was undertaken for the above noted development. The analysis was concerned solely with the stability of the slopes on and adjacent to the project lands. It is understood that the proposed initial phase of the development will include only 9 lots located north of the existing rail right-of-way. Slope stability for future developments proposed to the south will be addressed at the appropriate time.

A geotechnical investigation for the site was undertaken by Sabatini Earth Technologies Inc., the results of which are included in our report dated September 30, 2009. This addendum letter is intended to address slope stability issues for the Phase 1 (Lots 1 to 9) development in response to comments received from Sherman Hendsbee.

SUBSURFACE CONDITIONS

The soil profile at the test hole locations in the Phase 1 portion of the development consists generally of either clay till or sand.

The sand deposit where present is described as fine to medium grained, medium dense and damp

to wet.

The clay till is generally described as sandy and silty, brown, medium plastic, firm and moist.

Groundwater was encountered during drilling at depths of 3.2m to 5.7 metres when monitored approximately two weeks after drilling. It should be noted that groundwater levels can vary from season to season and year to year and are dependent on many factors including surface drainage, precipitation and regional hydrogeology. For slope analysis purposes, it was assumed that the water level would rise to a depth of 2 metres below the ground surface.

Topography

The ground surface slopes downward generally from south to north. The rail right-of-way which forms the southern boundary of the present analysis is at approximately elevation 575 to 580 metres. The road allowance which forms the northern boundary of the site is at approximately 545 to 555 metres. Slope gradients range from relatively flat, less than 5% to moderately steep at approximately 25%.

SLOPE STABILITY ANALYSIS

Based on the information obtained from the drilling program, site inspection and laboratory testing, soil properties were estimated for the sand and clay till strata. The sand and clay till were characterized as cohesionless soils with angles of shearing resistance of 30° and no cohesion. The clay till is characterized as cohesive with an effective friction angle of 28° and an effective cohesion of 3 kPa. These values are considered conservative for slope stability analysis purposes.

For analysis purposes, it was assumed that the worst possible groundwater conditions which could develop on the site would be a water table at a depth of 2 metres.

A slope stability analysis was conducted using GSLOPE software program. The approach taken was to use the steepest slope and the most probable worst soil profile. The location for the critical slope section analyzed is shown on attached Plate 1. The results of the slope stability analysis, as shown on Plate 2, under the worst anticipated groundwater conditions indicate that the minimum factor-of-safety is approximately 1.7 for overall slope failure.

For most purposes, a slope is considered stable if it has a factor-of-safety of 1.5.

COMMENTS AND RECOMMENDATIONS

1. The slopes of the subject site appear safe with no signs of instability. The slope stability analysis confirms the stable conditions with a factor-of-safety of 1.7 under the worst

anticipated groundwater conditions which is more than the minimum acceptable of 1.5.

2. The proposed subdivision is thus considered acceptable from a slope stability perspective.

3. To maintain a factor-of-safety of 1.5 for the slope, no grading, re-grading or permanent excavations should be undertaken on the proposed building lots which increases the gradient steeper than 25% (4 horizontal: 1 vertical).

4. Temporary slopes, for example, for basement excavations can be steeper than 25%, provided that all health and safety regulations related to worker's safety are complied with. For preliminary purposes, all temporary slopes should be sloped at no steeper than 1 horizontal to 1 vertical.

5. Control of surface water is imperative to ensure that erosion does not occur. Surface erosion can result in local steepening of slopes and progressive slope deterioration.

6. Final development plans should be reviewed by Sabatini Earth Technologies Inc. to ensure that our comments and recommendations regarding slope stability have been properly interpreted and implemented.

Should you have any questions or require further information, please contact the undersigned.

Yours very truly;
SABATINI EARTH TECHNOLOGIES INC.
APEGGA PermitP5778

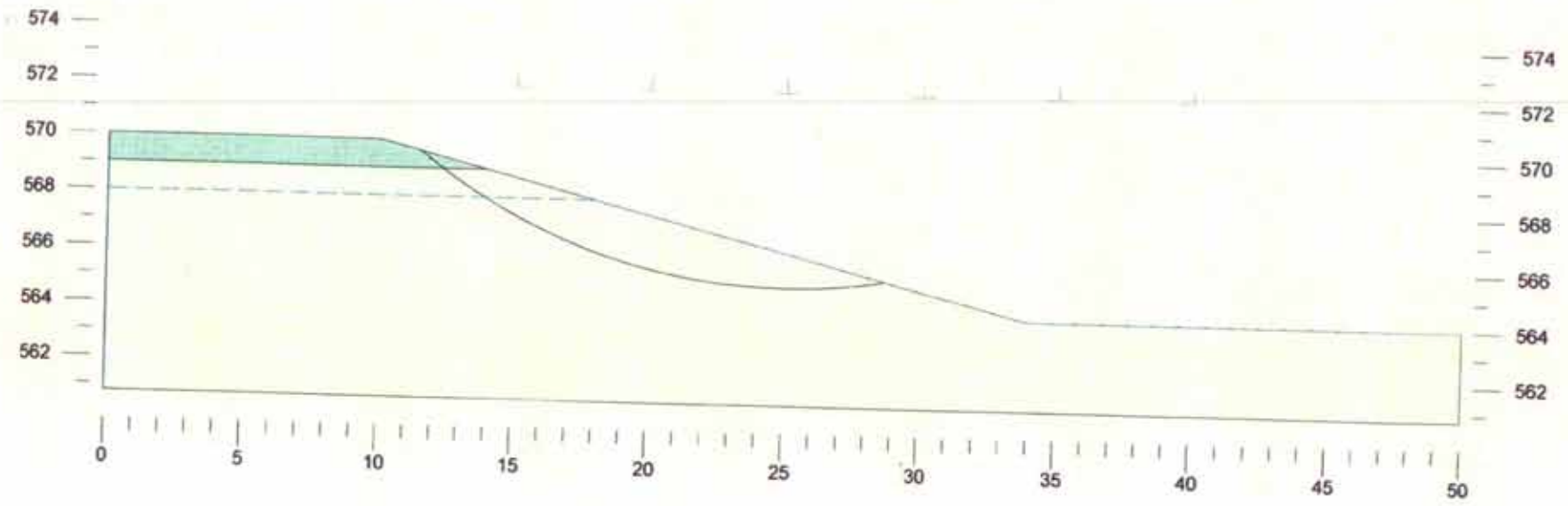
Paul Sabatini, P.Eng.

	Gamma	C	Phi	Piezo
	kN/m3	kPa	deg	Surf.
Sand	18	0	30	1
Clay till	20	3	28	1

Sabatini Earth Technologies Inc. - Calgary, AB

Kropf development
February, 2010
Critical Slope Section

F = 1.798



2/17/2010 10:56:02 AM Z:\A-JOBF~1\REPORTS\EDMONT~1\KROPF.GSL Sabatini Earth Technologies Inc. - Calgary, AB F = 1.798

EAGLE HILLS ESTATES

Building Guidelines

Lot Use:
Lots shall not be developed or used other than for single family residential purposes. The single family residential homes shall be built with a double or triple attached Garage on the side of the house, as designated by the developer .

House size:
Each private home constructed shall have a minimum main floor area as follows, not including garage:

Bungalow.....1400 sq. ft.
Bi-Level..... 1400 sq. ft.
One & one half story.....1600 sq. ft
Two Story .....1600 sq.ft.

R.T.M.homes are allowed providing main floor area is 1400 sq. ft. with a double or Triple attached garage.
Log house permited.
Mobile homes, weather single or double wide are not permitted.

Exterior Finishing:
Stucco
Brick
Stone
Vinyl or Wood Siding
Garage is to be finished in the same fashion as the house.
No Metal walls or roofs.

Roofing:
Cedar Shakes
Asphalt shingles, earth tones, blacks, grays (no reds, or bright colors)
No flat roofs

Any other development will have to meet R.M. of Battleford Land Use Bylaws.