ENERCLEAN THOMSON AREA STUCTURE PLAN

(Amended May 2019)

Original Bylaw 1476
Amended Bylaw 19-007

Lot 2 Block 1 Plan 0812940
and
Lot 3 Block 1 Plan 1512847
In
S.W. ¼ Sec. 1-9-21-W4

Prepared for: **JOHANN FEHR**

Prepared by: **MARTIN GEOMATIC CONSULTANTS LTD.**

PROJECT 187846CE

May 2019

LETHBRIDGE COUNTY
IN THE PROVINCE OF ALBERTA

BYLAW NO. 1476

A BYLAW OF LETHBRIDGE COUNTY BEING A BYLAW PURSUANT TO SECTION 633(1) OF THE MUNICIPAL GOVERNMENT ACT, REVISED STATUTES OF ALBERTA 2000, CHAPTER M.26

WHEREAS Hypervac Technologies wishes to develop lands within S.W. 1-9-21-W4;

AND WHEREAS the County's Municipal Development Plan requires that developers prepare an Area Structure Plan to ensure sound development occurs within the County;

AND WHEREAS the total area considered by the Area Structure Plan is 23.31 acres;

AND WHEREAS the landowner/developer have prepared the "Enerclean Thompson Area Structure Plan" which contains engineering, survey, and geotechnical information to support the above conditions.

NOW THEREFORE BE IT RESOLVED, under the Authority and subject to the provisions of the Municipal Government Act, Revised Statutes of Alberta, 2000, Chapter M-26, as amended, the Council of Lethbridge County in the Province of Alberta duly assembled does hereby enact the following:

1. The "Enerclean Thompson Area Structure Plan" Bylaw No.1476, attached as "Appendix A".

GIVEN first reading this 6th day of October, 2016.

Reeve

Chief Administrative Officer

GIVEN second reading this 3rd day of November, 2016.

Reeve

Chief Administrative Officer

GIVEN third reading this 3rd day of November, 2016.

Reeve

Chief Administrative Officer

LETHBRIDGE COUNTY
IN THE PROVINCE OF ALBERTA

BYLAW NO. 19-007

A BYLAW OF LETHBRIDGE COUNTY BEING A BYLAW PURSUANT TO SECTION 633(1) OF THE MUNICIPAL GOVERNMENT ACT, REVISED STATUTES OF ALBERTA 2000, CHAPTER M.26

Bylaw 19-007 of Lethbridge County, being a Bylaw for the purposed of amending the Enerclean Thomson Area Structure Plan Bylaw 1476.

WHEREAS Johann and Susana Fehr (developers) wish to further subdivide Plan 1512847, Block 1, Lot 3, contained within the Enerclean Thomson Area Structure Plan;

AND WHEREAS the County's Municipal Development Plan requires that developers prepare an amendment to the Area Structure Plan to ensure sound development occurs within the County;

AND WHEREAS the landowner/developer have prepared amendments to the "Enerclean Thomson Area Structure Plan" which contains engineering, survey, and geotechnical information to support the above conditions.

NOW THEREFORE BE IT RESOLVED, under the Authority and subject to the provisions of the Municipal Government Act, Revised Statutes of Alberta, 2000, Chapter M-26, as amended, the Council of Lethbridge County in the Province of Alberta duly assembled does hereby enact the following:

1. The "Enerclean Thomson Area Structure Plan" as amended by Bylaw No.19-007, is attached as "Appendix A".

GIVEN first reading this 4th day of April, 2019.

Reeve

CAO

GIVEN second reading this 2nd day of May, 20___.

Reeve

Acting CAO

GIVEN third reading this 2nd day of May, 20___.

Reeve

Acting CAO

1st Reading	April 4, 2019
2nd Reading	May 2, 2019
Public Hearing	
3rd Reading	May 2, 2019

TABLE OF CONTENTS

TABLE OF FIGURES

APPENDICES

Enerclean Thomson Area Structure Plan Amendment 2019

AMENDMENT

The intent of this application is to request consideration and approval for an Area Structure Plan Amendment for the Enerclean Thomson Area Structure Plan, August 2016. The changes include creating one additional lot and rezoning for GCR.

AMENDED SECTIONS OF TEXT

AMENDED FIGURES

Figure 1.0 – General Location Plan
Figure 2.0 – Land Ownership Map
Figure 3.0 – Existing Land Conditions
Figure 4.0 – Proposed Drainage
Figure 5.0 – Land Use Concept

AMENDED APPENDIX

Appendix 2 – Property Ownership (Titles)

1. INTRODUCTION

a. PURPOSE OF THE PLAN

i. The purpose of the EnerClean Thomson Area Structure Plan (ASP) is to provide a comprehensive planning framework for development of the land within portion of S.W. ¼ Sec. 1-9-21-W4. The Plan Area is located in the Lethbridge County and is shown on **Figure 1.** Prior to consideration of subdividing or re-subdividing a property, the Lethbridge County requires preparation of an Area Structure Plan to address all planning issues related thereto. The purpose of this area structure plan is thus to provide all pertinent information to the County and its advisors that will enable re-subdivision of the subject property.

b. BACKGROUND TO THE AREA STRUCTURE PLAN

i. The subject property containing approximately 23.31 acres (9.44 ha) more or less is proposed for re-zoning from Lethbridge Urban Fringe (LUF) to Grouped Country Residential (GCR). This will allow the developer to proceed with subdivision of the plan area into smaller parcels with a minimum lot size of 2 acres (0.8 ha).

c. THE APPROVAL PROCESS

i. The Lethbridge County requires submission of planning documents that are of sufficient detail and clarity to permit comprehensive review by the various agencies, government departments, and utility companies which provide community planning advice to the County.

ii. The plan is submitted for approval according to provincial statutory requirements. This plan will also support a land use reclassification pursuant to Lethbridge County Land Use Bylaw #1404.

d. PLAN PREPARATION

i. PRELIMINARY CONSULTATION

(a) Prior to commencing the preparation of the area structure plan document, Martin Geomatic Consultants Ltd.(MGCL) met with:

(i) the landowner of the proposed plan area,

(ii) Lethbridge County staffs,

(iii) St. Mary River Irrigation District,

(iv) Coaldale Fire Department,

(v) Alberta Environment and Parks staff.

(b) MGCL assessed the "as-built" situation to identify any issues that need to be addressed in undertaking the Country Residential subdivision. Issues that were identified, relating to existing services and access will be discussed under the appropriate headings in the utilities and transportation sections of this plan.

e. LEGISLATIVE FRAMEWORK

i. THE MUNICIPAL GOVERNMENT ACT

(a) The EnerClean Thomson Area Structure Plan has been produced in accordance with Section 633 of the Municipal Government Act. It is the intention of this plan to create a framework for the re-subdivision of portion of S.W. ¼ Sec. 1-9-21-W4 into Grouped Country Residential classified area. In particular, this document will outline:

(i) the sequence of development,

(ii) proposed land uses,

(iii) the proposed population density,

(iv) the access and circulation,

(v) the location of public utilities,

(vi) Other related matters.

ii. COUNTY MUNICIPAL DEVELOPMENT PLAN

(a) Section 6.3.3 of the Lethbridge County Municipal Development Plan (MDP) sets criteria with respect to the development of Grouped Country Residential subdivisions. The plan area is proposed to be re-designated from Lethbridge Urban Fringe to Grouped Country Residential after having met these criteria.

(b) The MDP also outlines specific requirements necessary for the creation of an Area Structure Plan which sets the stage for development within Lethbridge County.

iii. COUNTY LAND USE BYLAW

(a) The Grouped Country Residential Land Use District (GCR) is intended to provide for a high quality clustered residential development in areas where no conflict to agriculture can be anticipated pursuant to the municipal development plan.

(b) The minimum lot size is 2 acres (0.8 ha) to facilitate on-site sewage disposal systems.

(c) Additional requirements of the Land Use Bylaw will be noted in subsequent sections of the plan where necessary.

f. INTERPRETATION

i. This document shall be referred to as "*The EnerClean Thomson Area Structure Plan"*.

ii. All terms referred to in this Bylaw shall have the same meaning as in the Municipal Government Act, the Municipal Development Plan or the Land Use Bylaw unless otherwise indicated.

2. THE PLAN AREA

a. LOCATION AND DEFINITION OF PLAN AREA

i. The plan area is located in the Lethbridge County within S.W. ¼ Sec. 1-9-21-W4. It is bordered on the north by an existing homestead; on the south by an existing homestead/farmland; on the east by a SMRID Northeast Lateral Canal and on the west by Range Road 21-1 *(refer to **Figure 2**)*. The existing GCR Pater subdivision is located adjacent the site, on the east side of the SMRID Northeast Lateral canal. The plan area includes four land parcels:

a) Lot 11 Block 1 Plan 1711410, 4.0 acres (1.62 hectares);

b) Lot 12 Block 1 Plan 1711410, 6.3 acres (2.55 hectares);

c) Lot 13 Block 1 Plan 1711410, 3.0 acres (1.22 hectares);

d) and Lot 3 Block 1 Plan 1512847, 10.01 acres (4.05 ha).

b. GENERAL PHYSICAL DESCRIPTION

I. The site is relatively flat (generally, slopes are on the order of 1%) and drains easterly to the SMRID canal.

3. PLAN GOALS AND OBJECTIVES

a. PLAN GOALS

i. The EnerClean Thomson Area Structure Plan will respond to the needs, issues and requirements identified by the owners, the Lethbridge County as well as those agencies and organizations having an interest in the planning of this area.

ii. When adopted by the County Council, this Area Structure Plan will create the framework for subdividing and developing the subject property.

iii. This document will function as the required plan and as such will outline:

(a) the sequence of development,

(b) proposed land use,

(c) proposed lot layout,

(d) the access and circulation,

(e) the location of public utilities,

(f) other related matters.

b. PLAN OBJECTIVES

i. The EnerClean Thomson Area Structure Plan will adhere to the following objectives:

(a) create lots with a minimum size of 2 acres (0.8 ha),

(b) institute a storm water management system for the planned development,

(c) utilize potable water from the Lethbridge County Rural Water Association Ltd..

4. SITE ANALYSIS

a. SITE CHARACTERISTICS

i. The total plan area is approximately 23.31 acres (9.43 ha), which is comprised of a 10.00 acre (4.05 ha) parcel, a 4.0 ac (1.62 ha) parcel, a 6.3 ac (2.55 ha) parcel, and a 3.0 ac (1.22 ha) parcel. Land ownership Certificate's of Titles are included in attached Appendix.

ii. SMRID's canal runs along the east boundary of the plan area and serves as a buffer that separates the plan area from the Pater subdivision.

iii. Access from Range Road 21-1 is from five existing driveway approaches

connected with direct access to Range Road 21-1.

b. SOILS

i. According to the Alberta Soils Information System, the site's soils are characterized as a "Lethbridge (LET) Series" soil - "…Orthic Dark Brown Chernozem on medium textured ([loam], [silt-loam]) sediments deposited by wind and water".

ii. A Geotechnical Report was prepared by Amec Foster Wheeler and is included in the Appendix as part of the Lethbridge County requirements for new developments.

c. TOPOGRAPHY

i. The site is relatively flat with ground slopes at 0.5 % to 2 %. A slight ridge splits the site into two general drainage areas as shown in **Figure 3**:

(a) North: drains to a natural channel running west to east in the north area of the site. At the west end of the channel there is an existing culvert running under Range Road 21-1, which conveys offsite runoff from the west. The channel is drained to the SMRID canal through a manually controlled sluice gate at the east property line. The high point is located at the existing building site at approximate elevation 901.1 m and the low point is at the east end of the channel at approximate elevation 898.5 m.

Drainage improvements constructed in 2017 includes grass swales which convey runoff water to a shallow depression (Retention Pond 'A') adjacent to the natural channel in the north portion of the site. A 200mm pipe and isolation valve allows water to be drained from Pond 'A' to the natural channel.

(b) South: runoff collects in a depression at the east property line which drains east to the SMRID canal through an uncontrolled culvert. The highpoint of this area is around the existing house at 902.8 m. The low point is located to the east at approximate elevation 899.4 m.

Drainage improvements constructed in 2017 includes grass swales which convey runoff water to a shallow depression (Retention Pond 'B') adjacent to the Northeast Lateral Canal. A 300mm pipe and isolation valve allows

water to be drained from Pond 'A' to the canal.

d. WATER AND HYDROLOGY
   i. There are no natural bodies of water within the plan area,
   ii. The SMRID canal exists along the east side of the site. This canal acts as both a conveyance for irrigation water to SMRID customers and a conveyance for runoff from lands adjacent to the canal,
   iii. The natural channel conveys offsite runoff from the west to the SMRID canal. From Range Road 21-1, the channel extends southwesterly approximately 1.5 km to the lake adjacent to the Lethbridge Correctional Center along Highway 512. The northeast lake shore has a manually operated sluice gate at the outlet which drains into the channel.

e. HABITAT AND VEGETATION
   i. The plan area consists mainly of mixed grasses that produce a hay crop and is also used for grazing purposes. There are mature trees around the existing residential sites within the plan area providing habitat for birds and small animals.

f. ENVIRONMENTAL, HISTORICAL AND ARCHAEOLOGICAL SIGNIFICANCE
   i. The "Environmentally Significant Areas in the Oldman River Region" report prepared for the Lethbridge County indicates:
      (a) no environmentally significant sites within the plan area,
      (b) no hazard lands,
      (c) no archaeologically significant sites.
   ii. The "Phase 1 Environmental Site Assessment Re: Lot 2, Block 1, Plan 0812940, Township Road 211, County of Lethbridge, Alberta" report prepared by WA Environmental Services Ltd., January 2015 (refer to the attached Appendix) indicates:
      (a) The site was undeveloped agricultural land until 1979,
      (b) a hog exchange building was built in 1979 including several hog holding pens and an office,
      (c) a building addition was constructed in 1990,
      (d) no hazardous building materials observed,

(e) no evidence of environmental contamination associated with the site.

g. EXISTING LAND USE

i. The plan area contains two occupied dwellings, two garage/shop buildings, two stormwater retention ponds and a mix of open pasture and landscaped areas. *(refer to **Figure 3**)*;

ii. The surrounding properties directly north, west, and south of the plan area are zoned as Lethbridge Urban Fringe (LUF) while the property on the east side is Grouped Country Residential which is the Pater subdivision *(refer to **Figure 5**)*;

iii. Range Road 21-1 passes along the west side of the site which provides access to the plan area via five existing driveway approaches.

5. CONSTRAINTS & OPPORTUNITIES

a. CONSTRAINT EVALUATION

i. SOIL CAPABILITY FOR RESIDENTIAL DEVELOPMENT

(a) A geotechnical investigation has been completed to provide the necessary information on the ground and/or sub-surface characteristics that are necessary for determining the general suitability of the proposed development.

ii. TOPOGRAPHY

(a) The gentle slope of the site will require careful grading of the lots as well as the swales/ditches to ensure proper drainage is achieved and runoff directed towards the designated discharge points within the storm water management system.

iii. TRAFFIC IMPACT & ACCESS CONSIDERATIONS

(a) The plan area is located on Range Road 21-1 approximately 3.6 km driving distance east of Lethbridge city limits.

(b) Access to the plan area will be via five existing approaches and one proposed approach connecting to Range Road 21-1.

(c) Minimal increase in traffic flow is expected as a result of the development with the creation of one additional lot and therefore a Traffic Impact Analysis (TIA) is not necessary.

iv. AGRICULTURAL CONSIDERATIONS

(a) The proposed development of the plan area is not likely to constrain any existing agricultural land use.

v. NATURAL RESOURCE DEVELOPMENT

(a) There is no natural resource development within the vicinity of the study area which can either restrict or be impacted by the proposed subdivision development.

b. DEVELOPMENT OPPORTUNITIES

i. LOCATION

(a) The proposed development is located within the Lethbirdge Urban Fringe area of Lethbridge County, which offers direct access to the City of Lethbridge where a wide variety of educational, medical, commercial, recreational and community services exist.

ii. HOUSING CHOICE

(a) The proposed development provides for a type of residential land use that would allow families to build and live in a community offering rural lifestyle.

iii. LAND USE RE-CLASSIFICATION

(a) The County Land Use Bylaw Amendment will be required to re-designate the plan area for a grouped country residential development.

iv. EASE OF DEVELOPMENT

(a) All of the basic utilities are at or near the site boundary which will make it generally simple and inexpensive to service and develop the new lots.

6. PROPOSED LAND USE & DESIGN

a. PROPOSED LAND USE

i. A total of five lots with a minimum size of 2 acres (0.8 ha) will be created on the proposed development which is proposed to be re-zoned as a grouped country residential area shown on **Figure 5**,

ii. Existing site contours will be utilized to minimize site grading,

iii. Stormwater within the development will be managed such that runoff will be directed towards the appropriate discharge point adjacent to the development. Post-development runoff is controlled to release per the

Conveyance Agreement between Lethbridge County / SMRID, and per Lethbridge County Engineering Guidelines and Minimum Service Standards.

b. PHASING
   i. The EnerClean Thomson subdivision includes two phases of development. The first phase was done in 2017 which included three lots zoned GCR and one lot zoned LUF. The second phase includes rezoning the LUF lot to GCR and the subdivision of that lot into two lots.

c. DENSITY AND POPULATION
   i. The housing density within the proposed development comprises five lots or 0.2 units per acre (0.5 units per ha.) of net area,
   ii. Based on an average occupancy of 3 persons per household, the population within the plan area is estimated to be approximately 15 persons.

d. RESERVE REQUIREMENTS
   i. MUNICIPAL RESERVE
      (a) There is no land within the proposed area structure plan dedicated for municipal reserve. Municipal Reserve will be dedicated as cash-in-lieu to the Lethbridge County.
   ii. ENVIRONMENTAL
      (a) There is no apparent need for environmental reserve within the plan area.

e. TRANSPORTATION
   i. SITE ACCESS AND CIRCULATION
      (a) Access into the proposed development area will be on Range Road 21-1, via five existing approaches connecting directly to Range Road 21-1.

f. SERVICING
   i. POTABLE WATER SUPPLY AND DISTRIBUTION
      (a) Domestic Water and Fire Protection Requirement for ASP Area:
         (i) The domestic water requirements for the subdivision will be supplied by the Lethbridge County Rural Water Association Ltd. via an existing water distribution pipe running parallel along the west side of Range Road 21-1. The proposed lot services will come east off of the main line and cross under Range Road 21-1 to each proposed lot. This will

be either a metered turnout or a trickle system with individual cisterns. Each cistern will be installed by the homeowners at their expense;

(ii) Cisterns will be installed in accordance with requirements of the Chinook Health Region and Safety Codes Council of Alberta;

(iii) Fire protection will be provided by Lethbridge County municipal forces and may also be provided by the City of Lethbridge forces.

ii. SEWAGE DISPOSAL

(1) Each lot will have its own on-site wastewater treatment and dispersal system,

(2) "Licensed installer" means a contractor who holds a valid "private sewage" installers' license from Alberta Municipal Affairs,

(3) "System designers" must also hold a valid installers license or must be otherwise qualified professionals,

(4) As per Alberta Regulations AR229/97 and AR196/2015, the *Alberta Private Sewage Systems Standard of Practice 2015* (the "SOP") describes the requirements for the design of on-site wastewater treatment and disposal systems,

(5) To assist the County in ensuring these standards are met, building controls registered against the title for the lots will require:

a. Assessment of soil's suitability using methods described by the SOP for sewage effluent dispersal will be done by a licensed installer or system designer for each system (it must be noted that, pursuant to the new SOP, percolation tests are not acceptable for design of on-site wastewater dispersal systems);

b. As per the SOP, the required soil analysis will be provided at two locations on each lot in close proximity to the proposed effluent dispersal location;

c. All homeowners are to obtain a permit from the County's designated inspection agency prior to installation,

d. All homeowners to engage only qualified, licensed installers for installation and commissioning of their on-site wastewater system;

e. All Homeowners to engage in an on-going service and maintenance contract with a licensed installer.

(6) No on-site wastewater management system components shall be installed in areas designated for conveyance or detention of runoff.

iii. STORM WATER MANAGEMENT

(a) EXISTING CONDITION

(i) A detailed description of the site and existing surface drainage is described in the stormwater management plan, which is appended to this document;

(ii) Runoff from the site presently enters the SMRID Northeast Lateral Canal via two piped outlets. The SMRID canal provides both irrigation water conveyance for SMRID customers and stormwater conveyance for a watershed encompassing the surrounding area. The canal drains to an the Northeast Reservoir located in Sections 23 & 24, Township 10, Range 20, West of the 4th Meridian;

(iii) Upland drainage presently runs across the site from the west to east via the natural channel and discharges into the SMRID canal.

(iv) Stormwater management is controlled on site with two dry ponds and a series of swales that have been constructed in 2017.

(v) Within the plan area; runoff in the north portion of the site drains to a dry pond to detain water on site and release at pre-development levels through a valved outlet to the existing natural channel. The channel drains to the SMRID canal through a valved outlet;

(vi) Runoff in the south portion of the site within the plan area drains to a dry pond to detain water on site and release at pre-development levels through a valved outlet to the SMRID canal.

(vii) The drainage areas are protected by easements and right-of-ways.

(b) DRAINAGE CONCEPT

(i) The proposed development outlined in this report amendment will follow the 2016 Stormwater Management Plan (SWMP) which accounts for the area proposed for re-subdivision. No changes to the SWMP are required at this time and the stormwater system will continue to function per the 2016 SWMP.

(ii) The drainage improvements including the two dry ponds, piped outlets and drainage swales have been constructed in 2017. An As-built survey was completed after the construction was complete to confirm that the as-built system meets the design requirements of the stormwater system.

(iii) Additional drainage swales will be required between the two new lots and along the east boundary of the two lots (see Figure 4).

(iv) The new drainage improvement (swale) on the east boundary will be protected by easements and right-of-ways.

(c) SITE GRADING

(i) The subdivision will be graded to be consistent with the overall stormwater management plan. Individual lots will be graded such that all surface runoff will be directed to perimeter swales designed to carry the stormwater runoff into the stormwater detention facilities and towards the designated outfall. The required size and cross section of

these conveyance facilities will be determined during Detailed Design stage.

i. UTILITIES

i. ELECTRICITY

(a) Epcor is the electricity provider for the Lethbridge County and the distributor is Fortis Alberta. All necessary applications for the detailed design and installation of electric utilities will be submitted to Fortis for their approval.

ii. NATURAL GAS

(a) Natural gas is available through ATCO Gas. An existing domestic gas line is located within the plan area running parallel to and along the east side of Range Road 21-1.

iii. TELECOMMUNICATIONS/CABLE SERVICE

(a) Telus and Shaw Communications provides telephone and cable service for the area. Cellular phone service is also available.

iv. SOLID WASTE MANAGEMENT

(a) Individual/Private solid waste will be disposed of at local transfer station for the development unless a municipal fee-for-service is available.

j. PROTECTIVE SERVICES

i. FIRE PROTECTION

(a) The Lethbridge County has emergency services stationed in Coaldale which includes a command unit, a pumper truck, water tanker and wildland unit that can be called upon if needed. The Coaldale fire hall is approximately 9 km from the plan area. Further fire protection may provided by the City of Lethbridge forces. The Lethbridge north fire hall Station #4 is approximately 6 km from the plan area.

ii. POLICE PROTECTION

(a) Policing in the Lethbridge County is provided by the R.C.M.P. which has detachments located in the City of Lethbridge and in Coaldale. The City and Coaldale detachments are both approximately 9 km from the plan area.

7. DEVELOPMENT CONTROL

a. Purchasers must apply for development approval according to the process in effect for the appropriate Land Use District in the Lethbridge County Land Use Bylaw # 1404,

b. No cattle will be allowed on the new development,

c. Notwithstanding any rules and/or bylaws approved by Lethbridge County pertaining to the keeping of animals on a parcel, and subject to approval of the County development authority, residents may be restricted in the number of pets allowed to be kept within the development site. Lot owners will be allowed 1-2 horses per acreage. On the bigger size lot (6 acre), 4-6 horses may be allowed on the property;

d. Houses and wastewater treatment and dispersal shall be located outside runoff conveyances and detention areas.

8. DEVELOPMENT AGREEMENT

a. The Developer will enter into a Development Agreement with the Lethbridge County regarding the following matters:

   i. Easements for runoff conveyance and detention as per the stormwater management plan,

   ii. other services or matters considered necessary by the Lethbridge County.

9. BUILDING CONTROL STANDARDS

a. INDIVIDUAL SITE DEVELOPMENT

   i. Individual site development will utilize a basic level of control to achieve quality within the development site as well as to protect property values.

b. BUILDING CONTROL ELEMENT

   i. HOUSING FORM

      (a) Single detached houses will be the dwelling type allowed within the development,

      (b) Mobile homes, double–wide mobile homes and moved-in homes may be allowed within the development.

   ii. HOUSE SIZE

      (a) Primary dwellings within the subdivision will be required to have a

minimum footprint of 1,000 square feet (92.9 m²) in area.

iii. SITE DESIGN FEATURES

(a) HOUSE DESIGN

(i) Residents will be encouraged to work with a designer in the planning and design of their homes to ensure that a consistent level of development is achieved,

(ii) Proper setbacks are to be maintained per Lethbridge County Land Use Bylaws. The lot owners or its representatives should consult with the County and SMRID if necessary.

(b) ACCESSORY BUILDINGS

(i) Accessory buildings, such as garages may be allowed subject to the appropriate control guidelines and approval by the Lethbridge County development authority.

(c) BUILDING MATERIALS

(i) Residents will be encouraged to co-ordinate the finishing materials for their homes in order to achieve a unified appearance within the development site.

10. IMPLEMENTATION

a. This Amended Area Structure Plan will become a Bylaw of the Lethbridge County.

b. All subsequent subdivision applications must adhere to provisions of this Amended A.S.P. Bylaw and the Land Use Bylaw.

c. Subdivision of land can only occur through established provincial (Municipal Government Act and Subdivision Regulation) in conjunction with the Oldman River Regional Services Commission; and municipal processes that will ensure appropriate municipal and environmental reserves are bestowed and that appropriate fees, levies and service agreements are provided.

d. Development applications, within the boundaries of the plan area, must comply with the requirements of the respective land use districts for which they are proposed.

e. Building permits must be reviewed through a safety codes process approved by

the Lethbridge County.

f. The developer of EnerClean Thomson subdivision will establish a level of architectural standards and development limitations in order to achieve the desired results within the proposed subdivision. These standards and limitations are beyond the normal statutory requirements of the Lethbridge County and will thus be administered by either the Developers or agents acting on their behalf and within their legal authority.

g. The Lethbridge County may utilize other bylaws and policies that will regulate aspects of activity within the boundaries of the Area Structure Plan.

h. Farming on adjacent lands is considered a compatible land use activity in the Lethbridge County and future purchasers will be advised of the types of agricultural activities that take place in the vicinity of EnerClean Thomson subdivision.

FIGURES (MAPS)

(Amended May 2019)

EnerClean/Thomson
AREA STRUCTURE PLAN
Amended December 2018

LEGEND:

AREA STRUCTURE PLAN BOUNDARY

HIGHWAY #3

NE ¼ SEC 2
9–21–4

NW ¼ SEC 1
9–21–4

Lot 11

Area Structure Plan boundary encompasses 9.43 ha (23.31 ac.)

Lot 12

Lot 13

Lot 3

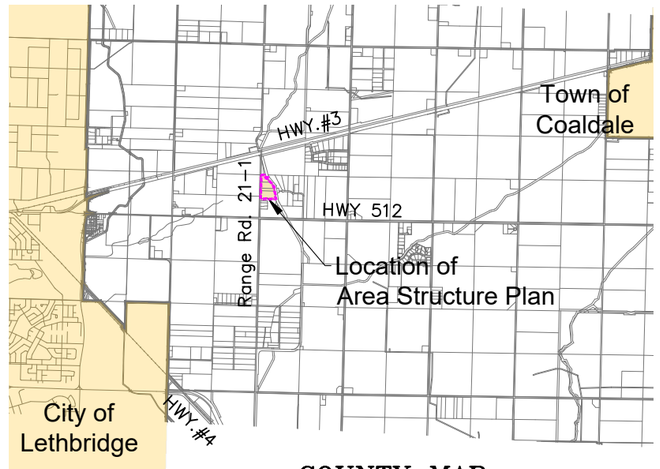
RANGE ROAD 21–1

CANAL R/W

PATER DRIVE

SE ¼ SEC 2
9–21–4

SW ¼ SEC 1
9–21–4



COUNTY MAP
NOT TO SCALE

GENERAL LOCATION PLAN
(Revised 2018)
FIGURE 1.0

MARTIN GEOMATIC CONSULTANTS LTD

SCALE:	1:5000	
DRAWN:	RJM	
DATE:	Jan 16, 2019	December 2018
JOB #:	166543LS	187846CE

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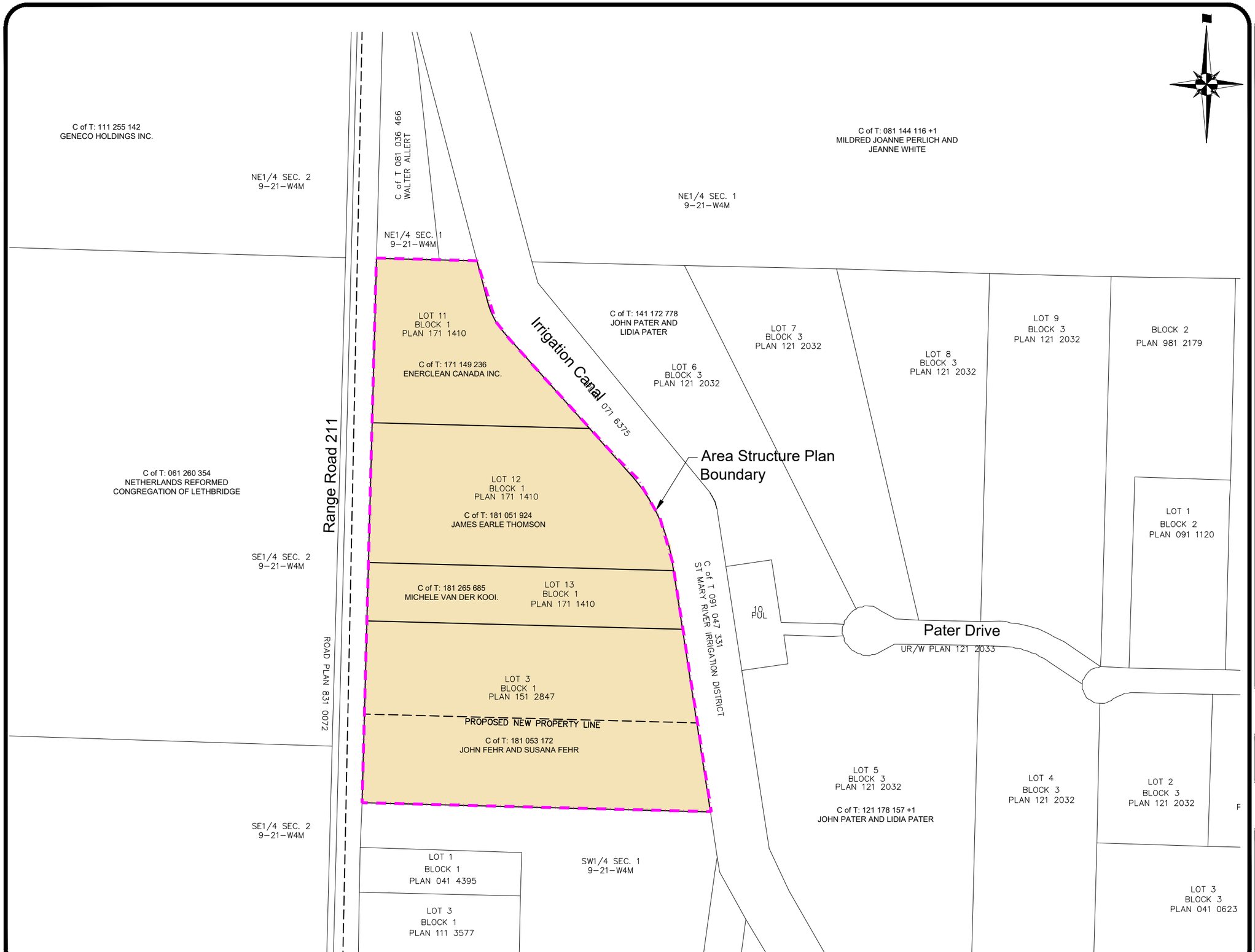

EnerClean/Thomson

AREA STRUCTURE PLAN

Amended December 2018

LEGEND:

AREA STRUCTURE PLAN AREA

171 149 236	–	ENERCLEAN CANADA INC.
181 051 924	–	JAMES EARLE THOMSON
181 265 685	–	MICHELE VAN DER KOOI
181 053 172	–	JOHN AND SUSANA FEHR
081 144 116 +1	–	MILDRED JOANNE PERLICH AND JEANNE WHITE
081 036 466	–	WALTER ALLERT
111 255 142	–	GENECO HOLDINGS INC.
061 260 354	–	NETHERLANDS REFORMED CONGREGATION OF LETHBRIDGE
931 001 349		BOARD OF GOVERNORS OF LETHBRIDGE COLLEGE
171 088 072	–	TWINQUILLITY HOLDINGS LTD.
081 035 250 +1	–	JOHN LEMISKO
121 178 157 +1	–	JOHN PATER AND LIDIA PATER
141 172 778	–	JOHN PATER AND – LIDIA PATER
091 047 331		ST MARY RIVER IRRIGATION DISTRICT

LAND OWNERSHIP MAP

(Revised 2018)

FIGURE 2.0

MARTIN GEOMATIC CONSULTANTS LTD

SCALE:	1:3000	
DRAWN:	RJM	
DATE:	Jan 16, 2019	December 2018
JOB #:	166543LS	187846CE

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EnerClean/Thomson
AREA STRUCTURE PLAN
Amended December 2018

LOT 7
BLOCK 3
PLAN 121 2032

10
PUL

Irrigation Canal

EXISTING 300ø CSP CULVERT
E.INV=899.52
W.INV=899.59

EMERGENCY OVERFLOW NOTCH
ELEV=900.00

LOT 6
BLOCK 3
PLAN 121 2032

POND 'B'
VOL.=1250m³
HWL=900.00
BTM=899.60

PROPOSED LOT LINE

PLAN 071 6375

TOP OF BERM
ELEV= 899.70

EMERGENCY OVERFLOW
NOTCH ELEV=899.60

EX 200ø PVC PIPE
AND GATE VALVE
L= 11.10m S=1.00%
S. INV=898.84
N. INV=898.73

EXISTING RESIDENCE
FLOOR ELEV=901.00

LOT 13
BLOCK 1
PLAN 171 1410

EX 450ø CSP CULVERT & SLUICE
E. INV=898.523
W. INV=898.538

LOT 12
BLOCK 1
PLAN 171 1410

LOT 3
BLOCK 1
PLAN 151 2847

CONCRETE PAD

EXISTING
SHOP

POND 'A'
VOL.=1430m³
HWL=899.60
BTM=898.89

EXISTING RESIDENCE
FLOOR ELEV=903.60±

EXISTING NATURAL SWALE

GRAVEL
AREA

EXISTING SHOP
FLOOR ELEV=901.70

GRAVEL
AREA

NE1/4 SEC. 1
9-21-W4M

LOT 11
BLOCK 1
PLAN 171 1410

EX 500ø CULVERT
L=16.46m @ 0.54%
S.INV.=899.944
N.INV.=899.855

APPROACH
WITH CULVERT

EX 400ø CULVERT
L=14.47m @ 0.48%
S.INV.=899.755
N.INV.=899.684

EX 500ø CULVERT
L=14.11m @ 0.71%
S.INV.=900.077
N.INV.=899.977

EX 450ø
CULVERT

Range Road 211

ROAD PLAN 831 0072

LEGEND:

- AREA STRUCTURE PLAN BOUNDARY
- PP — POWER POLE w/ OH LINE
- EX.HOUSES/STRUCTURES
- EX. C.S.P.
- EX. GAS LINE
- EX. FENCE LINE
- 900.00 — EX. MAJOR CONTOUR LINE
- O/H — EX. OH POWER LINE
- E — EX. ELECTRICAL LINE
- EX. SWALE
- EX. DUGOUT
- EX. WATER LINE

EXISTING LAND CONDITIONS
(Revised 2018)
FIGURE 3.0

MARTIN GEOMATIC CONSULTANTS LTD

SCALE:	1:1500
DRAWN:	RJM
DATE:	Jan 16, 2019 December 2018
JOB #:	166543LS 187846CE

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EnerClean/Thomson
AREA STRUCTURE PLAN
Amended December 2018

LOT 7 BLOCK 3 PLAN 121 2032

LOT 6 BLOCK 3 PLAN 121 2032

10 PUL

Irrigation Canal

EXISTING 300ø CSP CULVERT
E.INV=899.52
W.INV=899.59

EMERGENCY OVERFLOW NOTCH
ELEV=900.00

PROPOSED SWALE

PROPOSED SWALE

12.50

PROPOSED DRAINAGE SWALE EASEMENT

POND 'B'
VOL.=1250m³
HWL=900.00
BTM=899.60

PLAN 071 6375

TOP OF BERM
ELEV= 899.70

EMERGENCY OVERFLOW
NOTCH ELEV=899.60

EX 200ø PVC PIPE
AND GATE VALVE
L= 11.10m S=1.00%
S. INV=898.84
N. INV=898.73

EXISTING RESIDENCE
FLOOR ELEV=901.00

LOT 13 BLOCK 1 PLAN 171 1410

PROPOSED SWALE

PROPOSED NEW PROPERTY LINE

EX 450ø CSP CULVERT & SLUICE
E. INV=898.523
W. INV=898.538

POND 'A'
VOL.=1430m³
HWL=899.60
BTM=898.89

LOT 12 BLOCK 1 PLAN 171 1410

LOT 3 BLOCK 1 PLAN 151 2847

CONCRETE PAD

EXISTING SHOP

EXISTING NATURAL SWALE

EXISTING SHOP
FLOOR ELEV=901.70

GRAVEL AREA

EXISTING RESIDENCE
FLOOR ELEV=903.60±

GRAVEL AREA

NE1/4 SEC. 1 9-21-W4M

LOT 11 BLOCK 1 PLAN 171 1410

EX 500ø CULVERT
L=16.46m @ 0.54%
S.INV.=899.944
N.INV.=899.855

APPROACH WITH CULVERT

EX 400ø CULVERT
L=14.47m @ 0.48%
S.INV.=899.753
N.INV.=899.684

EX 500ø CULVERT
L=14.11m @ 0.71%
S.INV.=900.077
N.INV.=899.977

EX 450ø CULVERT

Range Road 211

ROAD PLAN 831 0072

LEGEND:

- AREA STRUCTURE PLAN BOUNDARY
- PP — POWER POLE w/ OH LINE
- EX.HOUSES/STRUCTURES
- EX. C.S.P.
- EX. GAS LINE
- EX. FENCE LINE
- 900.00 — EX. MAJOR CONTOUR LINE
- O/H — EX. OH POWER LINE
- E — EX. ELECTRICAL LINE
- EX. SWALE
- EX. DUGOUT
- EX. WATER LINE
- PROPOSED SWALE

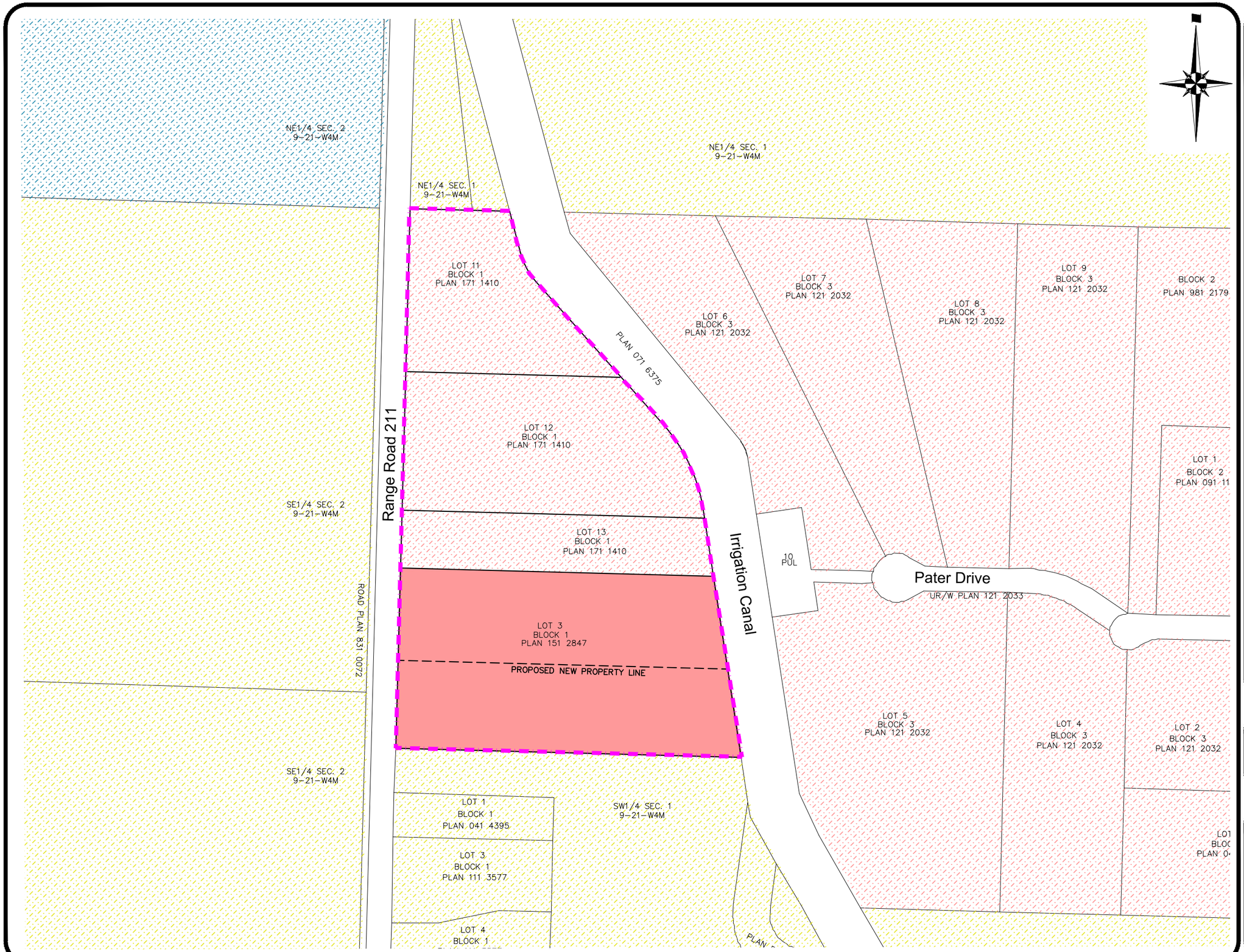
PROPOSED DRAINAGE
(Revised 2018)
FIGURE 4.0

MARTIN GEOMATIC CONSULTANTS LTD

SCALE:	1:1500	
DRAWN:	RJM	
DATE:	Jan 16, 2019	December 2018
JOB #:	166543LS	187846CE

\\seagate-dp4\mgcl-data\data\active projects\187846 fehr sub\cadd\asp\dwg\187846ce-rm-oct30-2018.dwg

EnerClean/Thomson
AREA STRUCTURE PLAN
Amended December 2018



LEGEND:

- AREA STRUCTURE PLAN BOUNDARY
- LETHBRIDGE URBAN FRINGE (LUF)
- GROUP COUNTRY RESIDENTIAL (GCR)
- RURAL GENERAL INDUSTRIAL (RGI)
- FROM: LETHBRIDGE URBAN FRINGE (LUF) TO: GROUP COUNTRY RESIDENTIAL (GCR)

LAND USE CONCEPT
(Revised 2018)
FIGURE 5.0

MARTIN GEOMATIC CONSULTANTS LTD

SCALE:	1:3000
DRAWN:	RJM
DATE:	Jan 16, 2019 December 2018
JOB #:	166543LS 187846CE

\\seagate-dp4\mgcl-data\data\active projects\187846 fehr sub\cadd\asp\dwg\187846ce-rm-oct30-2018.dwg

APPENDIX

APPENDIX 1 ~ STORMWATER MANAGEMENT PLAN

Refer to bound document:
"Site Drainage Analysis, Enerclean Thomson Subdivision, SW-1-9-21-WM4, Lethbridge County, Alberta. Prepared for Hypervac Technologies by Martin Geomatic Consultants Ltd., August, 2016"

MARTIN GEOMATIC CONSULTANTS LTD.

SITE DRAINANGE ANALYSIS
ENERCLEAN THOMSON SUBDIVISION
SW-1-9-21-W4M
LETHBRIDGE COUNTY
ALBERTA

Prepared for: Hypervac Technologies

File Number: 166543CE

Dated: August 2016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX

I. PROJECT BACKGROUND AND DRAINAGE FEATURES

The Enerclean Thomson Subdivision is a proposed group country residential subdivision located 3 km east of Highway#4 (43rd St. S) and 1 km south of Highway #3 in Lethbridge County. The legal property description is Southwest Quarter of Section 1, Township 9, Range 21 West of the 4th Meridian. The property is bound by Range Road 21-1 to the west, the St. Mary River Irrigation District (SMRID) Northeast Lateral Canal to the east, and farmland/ homestead to the north and south. See Figure 1 – Project Location. This drainage report is being submitted in support of The Enerclean Thomson Area Structure Plan (ASP) and rezoning application, for consideration by the Lethbridge County. The plan area is +/- 9.43 ha which includes two lots. The landowner is proposing to subdivide into a total of 4 lots and rezone the land from Lethbridge Urban Fringe (LUF) to Group Country Residential (GCR). The proposed lot layout is shown on Figure 2 – Proposed Subdivision. The purpose of this report is to provide stormwater management strategies to guide the future development of the Enerclean Thomson Subdivision.

A. Existing Features

The area presently includes two parcels (LUF) with one dwelling and one shop. The land is generally flat with ground slopes of 0.5% to 2.0%. The site is presently split in to two catchment areas which define the overland drainage boundaries. The south catchment (4.04 ha) drains to an existing low area along the east property line, which drains through an uncontrolled 300mm culvert to the SMRID Northeast Lateral Canal. The north catchment (5.41 ha) drains to a natural channel which is released through a manually operated sluice gate and 450mm culvert to the SMRID canal. The Northeast Lateral Canal flows northeasterly to the SMRID Northeast Reservoir (approximately 10 km north of Coaldale).

Offsite runoff is directed across the site from west to east along the natural channel. A 450mm culvert under Range Road 21-1 conveys surface water from the west along a grass swale. The swale extends about 1.5km southwest from a lake adjacent to the Lethbridge Correctional Center. The outlet of this lake has a sluice gate which would discharge to the grass swale when opened and ultimately flow across the natural channel at the Enerclean Thomson site and to the SMRID canal.

Existing soil descriptions for the area include loam and silt loam (L, SiL) Orthic Dark Brown Chernozem on medium textured sediments deposited by wind and water (LET), as defined in soil polygon 5865 and 5861[a]. Soil classifications are used to determine infiltration rates for the purpose of this report. Furthermore, four boreholes[b] have been completed on site to determine soil conditions for the purpose geotechnical investigations and general suitability of the proposed development. The four boreholes generally found 100mm topsoil above clay, with groundwater depths ranging from 1.5m to 4.5m. Soil reports are included in Appendix B – Soil Information. A topographical site survey has been completed by Martin Geomatic Consultants Ltd[c] and an existing surface terrain model has been created to define drainage boundaries, storage depressions and flow conveyance routes as shown in Figure 3 – Existing Site Features.

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[a] Alberta Soil Information Viewer, Alberta Agriculture and Forestry, http://www4.agric.gov.ab.ca/agrasidviewer

[b] Geotechnical Investigation, Propsed Rural Subdivision, Part of SW-1-9-21-W4, Range Rd 21-1, near Lethbridge, A, Amec Foster Wheeler, August 2016.

[c] MGCL topographical site survey, May 2016.

Figure 1 – Project Location

Figure 2 – Proposed Subdivision

Figure 3 – Existing Site Features

B. Proposed Development

The proposed development will subdivide the existing parcels into 4 Group Country Residential lots ranging in size from about 1 ha to 4 ha. All of the 4 proposed lots have frontage and direct access on to Range Road 21-1 with approaches. There are no internal access or circulation roads proposed within the development. From a drainage perspective, the runoff discharge rates and volumes will be affected as a result of the development, due to an increase in the amount of impervious areas for the plan area with the addition of hard surfaces including building roofs and driveways. To mitigate this, the development will include detention storage on site with controlled release which is designed to not exceed the pre-development levels. The detention storage areas are located at the low areas of the site and adjacent to the existing drainage outlet locations which release to the SMRID Northeast Lateral Canal. The detention ponds will be built with shallow depressions and berms that are designed to minimize the earthwork efforts and to provide a usable lawn space for residents when the pond is dry. Grass swales will be created to direct runoff away from the buildings and to the designated storage areas. Figure 4 – Proposed Stormwater Upgrades shows the location of proposed detention ponds.

II. METHODOLOGY

Drainage analysis of the proposed development has been completed to determine runoff, storage, and discharge rates for pre and post-development conditions. Existing site analysis (pre-development) has been analyzed to determine a benchmark for allowable release rates at the post development conditions. A stormwater management model[d] has been built to assist with the analysis. The following parameters are included in the modeling:

1. Synthetic Design Storm – Chicago Method: 24-hour duration, 100-year return period, (IDF Parameters A = 1019.20, B = 0, C = 0.731)[e]
2. Rainfall time step = 5 minutes
3. Simulation duration = 24 hrs
4. Routing Method: Dynamic Wave
5. No effect of Evaporation and Groundwater
6. Total Catchment area = 9.45ha
7. Infiltration Method: Green Ampt
8. Manning's N Impervious = 0.015
9. Manning's N Pervious = 0.15 (undeveloped), 0.1 (developed)
10. Depression Storage Pervious = 5mm (undeveloped), 3.8mm (developed)
11. Depression Storage Impervious = $0.77*(S\%)^{-0.49}$

A. Sub-Catchments

The existing (pre-development) and proposed site (post-development) models have been developed to simulate drainage patterns in response to a single event 100yr synthetic design storm. The following tables show the sub catchment parameters assumed in the pre and post-development models:

[d] EPA Storm Water Management Model – Version 5.0 (Build 5.0.22)
[e] 2016 Design Standards, City of Lethbridge.

Table 1 – Pre Development Sub-Catchment Parameters							
Sub-Catchment ID	Area (ha)	Flow Path (m)	Slope (%)	Soil	H.Con (mm/hr)	S.Head (mm)	IMD
Pre-1	5.41	228	0.6	L, SiL	10.0	127.9	0.36
Pre-2	4.04	234	0.5	L, SiL	10.0	127.9	0.36

Table 2 – Post Development Sub-Catchment Parameters							
Sub-Catchment ID	Area (ha)	Flow Path (m)	Slope (%)	Soil	H.Con (mm/hr)	S.Head (mm)	IMD
Post-1a	4.64	90	1.3	L, SiL	10.0	127.9	0.36
Post-1b	0.77	228	0.6	L, SiL	10.0	127.9	0.36
Post-2	4.04	365	0.71	L, SiL	10.0	127.9	0.36

The source information for the above tables includes:

Area (ha) & Flow Path (m): measured

Slope (%): calculated from field survey

Soil Texture: Alberta Soil Viewer & boreholes

Hydraulic Conductivity (mm/hr) & Suction Head (mm): Soil properties[f]

Initial Moisture Deficit: Typical soil characteristics[g]

Pre-development impervious area: 5%[h]

Post-development impervious area: 20% (estimated)

III. RESULTS

The model results are presented in the following tables. Details of the rainfall runoff modeling are included in Appendix B – SWMM Model Results.

[f] Rawls, W.J. et al., (1983). J. Hyd. Engr., 109:1316
[g] XP SWMM Soultions, http://help.xpsolutions.com/display/xps2015/Infiltration
[h] 2016 Design Standards, City of Lethbridge.

A. Pre and Post Development Runoff

Table 3 presents the pre-development model results for the sub-catchment runoff generated from a 24 hour duration 100 year storm. Existing subcatchment areas are shown in the attached Appendix.

Table 3 – Pre-Development Runoff			
Sub Catchment ID	Pre-1	Pre-2	TOTAL
Desc.	North	South	-
Area (ha)	5.41	4.04	9.45
Precipitation (mm)	120.15	120.15	120.15
Infiltration (mm)	92.43	93.15	92.64
Runoff Depth (mm)	27.84	27.09	27.51
Runoff Volume (m^3)	1,510	1,090	2,600
Peak Runoff (m^3/s)	0.39	0.28	-

Table 4 presents the sub-catchment model results for the post-development runoff generated from a 24 hour duration 100 year storm. Proposed subcatchment areas are shown in the attached Appendix.

Table 4 – Post-Development Runoff				
Sub Catchment ID	Post-1a	Post-1b	Post-2	TOTAL
Desc.	Center	North	South	-
Area (ha)	4.64	0.77	4.04	9.45
Precipitation (mm)	120.15	120.15	120.15	120.15
Infiltration (mm)	74.65	70.79	75.15	74.45
Runoff Depth (mm)	45.64	50.05	45.09	45.71
Runoff Volume (m^3)	2,120	380	1,820	4,320
Peak Runoff (m^3/s)	0.92	0.25	0.77	-

Figure 4 – Proposed Stormwater Upgrades

B. Proposed Storage Units

Table 5 displays the proposed detention ponds in response to the 100 year event as shown on Figure 4 – Proposed Stormwater Upgrades.

Table 5 – Proposed Storage Units

Storage Unit	Outlet	Max. Depth (m)	Invert El. NWL (m)	Max. HGL El. (m)	Area bottom (m^2)	Area HWL (m^2)	Max. Volume (m^3)	Min. FF El. (m)
Prop.N	200mm	0.42	899.00	899.42	2,900	3,300	1,292	900.42
Prop.S	200mm	0.56	899.65	900.21	15	3,700	984	901.21
TOTAL	-	-	-	-	-	-	2,276	-

NWL = Normal water level

HWL = High water level

HGL = Hydraulic grade line

Min. FF El. = Minimum finished floor of buildings adjacent to ponds

FF = Finished floor

C. Pre and Post Development Runoff

The pre and post development discharge rates to the SMRID canal are shown below.

Table 6 – Release Rates

Outlet Description	Qpeak (m^3/s)		
	Pre - Development	Post - Development	Net Change
North 450mm Culvert to SMRID Canal	0.264	0.189	-0.075
South 300mm Culvert to SMRID Canal	0.094	0.061	-0.033

IV. RECOMMENDATIONS

It is recommended that the developer(s) provide a combined total of 2,300 m^3 of active stormwater storage to retain the runoff on-site and release at or below the pre-development rates generated from a 1 in 100 year 24 hour storm as outlined in this report. The piped outlets from the ponds will include isolation valves which will be normally open, but can be closed as required by Lethbridge County and SMRID. Detailed designs including detention ponds, outlets, swales and grading plans are recommended prior to construction, which should generally follow the preliminary concepts outlined in this report. The high-water (HWL) level of such detention ponds shall be a minimum of 1.0 m below finished floor (FF) elevations of adjacent buildings. Emergency escape routes shall be provided for a suitable outlet from each pond in the event of flooding.

V. CLOSING

We trust that this report meets the requirements of the Area Structure Plan. Should you require any further information, please contact the undersigned.

Per:

(Original signed and sealed August 25, 2016)

Matt Redgrave, P.Eng.
Project Manager

Reviewed by:

(Original signed and sealed August 25, 2016)

Ray Martin, P.Eng.
Vice-President

MARTIN GEOMATIC CONSULTANTS LTD.
Association of Professional Engineers and Geoscientists of Alberta
Permit to Practice P05852

APPENDIX

APPENDIX 2 ~ PROPERTY OWNERSHIP [TITLES]

(Amended March 2019)

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0037 625 341	1711410;1;11	171 149 236

LEGAL DESCRIPTION
PLAN 1711410
BLOCK 1
LOT 11
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 1.62 HECTARES (4 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;21;9;1;SW

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 151 270 173 +1

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
171 149 236	06/07/2017	SUBDIVISION PLAN		

OWNERS

ENERCLEAN CANADA INC.
OF 1, 2121-36 ST N
LETHBRIDGE
ALBERTA T1H 5L1

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
202FG .		RESTRICTIVE COVENANT " AFFECTS PART OF THIS TITLE "
1485KX .	21/06/1971	IRRIGATION ORDER/NOTICE THIS PROPERTY IS INCLUDED IN THE ST. MARY RIVER IRRIGATION DISTRICT " AFFECTS PART OF THIS TITLE "
4896LO .	20/10/1972	CAVEAT

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. " AFFECTS PART OF THIS TITLE "
991 100 030	15/04/1999	CAVEAT RE : PIPELINE AGREEMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
991 100 031	15/04/1999	CAVEAT RE : SEE INSTRUMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
001 331 237	20/11/2000	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. " AFFECTS PART OF THIS TITLE "
041 079 448	01/03/2004	EASEMENT OVER AND FOR BENEFIT OF: SEE INSTRUMENT " AFFECTS PART OF THIS TITLE "
061 045 120	30/01/2006	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - ST MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278 LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
061 342 353	22/08/2006	UTILITY RIGHT OF WAY GRANTEE - COUNTY OF LETHBRIDGE RURAL WATER ASSOCIATION LIMITED. " AFFECTS PART OF THIS TITLE "
071 231 589	11/05/2007	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1

(CONTINUED)

REGISTRATION
NUMBER DATE (D/M/Y) PARTICULARS

AGENT - KIMBERLY HADDEN
" AFFECTS PART OF THIS TITLE "

171 149 235 06/07/2017 CAVEAT
RE : DEVELOPMENT AGREEMENT PURSUANT TO MUNICIPAL GOVERNMENT ACT
CAVEATOR - LETHBRIDGE COUNTY.
#100, 905 - 4 AVENUE SOUTH
LETHBRIDGE
ALBERTA T1H5L1

171 149 237 06/07/2017 RESTRICTIVE COVENANT

171 149 241 06/07/2017 EASEMENT
AS TO PORTION OR PLAN:1711412

TOTAL INSTRUMENTS: 013

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF DECEMBER, 2018 AT 03:02 P.M.

ORDER NUMBER: 36418249

CUSTOMER FILE NUMBER: 087846

END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER, SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION, APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0037 625 366	1711410;1;12	181 051 924

LEGAL DESCRIPTION
PLAN 1711410
BLOCK 1
LOT 12
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 2.55 HECTARES (6.3 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;21;9;1;SW

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 171 149 236 +2

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
181 051 924	07/03/2018	TRANSFER OF LAND	$730,000	SEE INSTRUMENT

OWNERS

JAMES EARLE THOMSON
OF BOX 1952
90031 RANGE ROAD 211
LETHBRIDGE
ALBERTA T1J 4K5

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
202FG .		RESTRICTIVE COVENANT " AFFECTS PART OF THIS TITLE "
1485KX .	21/06/1971	IRRIGATION ORDER/NOTICE THIS PROPERTY IS INCLUDED IN THE ST. MARY RIVER IRRIGATION DISTRICT " AFFECTS PART OF THIS TITLE "

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
991 100 030	15/04/1999	CAVEAT RE : PIPELINE AGREEMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
991 100 031	15/04/1999	CAVEAT RE : SEE INSTRUMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
001 331 237	20/11/2000	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. " AFFECTS PART OF THIS TITLE "
171 149 235	06/07/2017	CAVEAT RE : DEVELOPMENT AGREEMENT PURSUANT TO MUNICIPAL GOVERNMENT ACT CAVEATOR - LETHBRIDGE COUNTY. #100, 905 - 4 AVENUE SOUTH LETHBRIDGE ALBERTA T1H5L1
171 149 237	06/07/2017	RESTRICTIVE COVENANT
171 149 239	06/07/2017	EASEMENT AS TO PORTION OR PLAN:1711411
171 149 241	06/07/2017	EASEMENT AS TO PORTION OR PLAN:1711412
181 051 925	07/03/2018	MORTGAGE MORTGAGEE - ROYAL BANK OF CANADA. PERSONAL SERVICE CENTRE 180 WELLINGTON STREET WEST, 3RD FLOOR TORONTO ONTARIO M2P0A2 ORIGINAL PRINCIPAL AMOUNT: $1,002,000
181 248 913	20/11/2018	UTILITY RIGHT OF WAY GRANTEE - COUNTY OF LETHBRIDGE RURAL WATER ASSOCIATION LIMITED.

(CONTINUED)

TOTAL INSTRUMENTS: 011

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 13 DAY OF DECEMBER, 2018 AT 03:02 P.M.

ORDER NUMBER: 36418249

CUSTOMER FILE NUMBER: 087846

END OF CERTIFICATE

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LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0036 903 391	1512847;1;3	181 053 172

LEGAL DESCRIPTION
PLAN 1512847
BLOCK 1
LOT 3
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 4.05 HECTARES (10.01 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;21;9;1;SW

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 161 258 786

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
181 053 172	08/03/2018	TRANSFER OF LAND	$700,000	NOMINAL

OWNERS

JOHANN FEHR

AND
SUSANA FEHR
BOTH OF:
BOX 1361
COALDALE
ALBERTA T1M 1N2
AS JOINT TENANTS

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
202FG	.	RESTRICTIVE COVENANT " AFFECTS PART OF THIS TITLE "

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
3495KD .	30/04/1968	CAVEAT CAVEATOR - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. " AFFECTS PART OF THIS TITLE "
1485KX .	21/06/1971	IRRIGATION ORDER/NOTICE THIS PROPERTY IS INCLUDED IN THE ST. MARY RIVER IRRIGATION DISTRICT " AFFECTS PART OF THIS TITLE "
4896LO .	20/10/1972	CAVEAT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. " AFFECTS PART OF THIS TITLE "
741 044 498	13/05/1974	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. "20 FT STRIP"
991 100 030	15/04/1999	CAVEAT RE : PIPELINE AGREEMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
991 100 031	15/04/1999	CAVEAT RE : SEE INSTRUMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
001 331 237	20/11/2000	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. " AFFECTS PART OF THIS TITLE "
041 079 448	01/03/2004	EASEMENT OVER AND FOR BENEFIT OF: SEE INSTRUMENT " AFFECTS PART OF THIS TITLE "
061 045 120	30/01/2006	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - ST MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
061 342 353	22/08/2006	UTILITY RIGHT OF WAY GRANTEE - COUNTY OF LETHBRIDGE RURAL WATER ASSOCIATION LIMITED. " AFFECTS PART OF THIS TITLE "
071 231 589	11/05/2007	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1 AGENT - KIMBERLY HADDEN " AFFECTS PART OF THIS TITLE "
161 277 102	21/11/2016	MORTGAGE MORTGAGEE - BRIDGEWATER BANK. SUITE 150, 926-5TH AVENUE SW CALGARY ALBERTA T2P0N7 ORIGINAL PRINCIPAL AMOUNT: $700,000
171 026 565	30/01/2017	MORTGAGE MORTGAGEE - ALLAN MINCHAU MORTGAGEE - JEAN MINCHAU BOTH OF: P.O. BOX 52 SPRING COULEE ALBERTA T0K2C0 ORIGINAL PRINCIPAL AMOUNT: $300,000
181 053 178	08/03/2018	MORTGAGE MORTGAGEE - ALLAN MINCHAU MORTGAGEE - JEAN MINCHAU BOTH OF: P.O. BOX 52 SPRING COULEE ALBERTA T0K2C0 ORIGINAL PRINCIPAL AMOUNT: $100,000

TOTAL INSTRUMENTS: 015

(CONTINUED)

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ORDER NUMBER: 36418249

CUSTOMER FILE NUMBER: 087846

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LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0037 625 359	1711410;1;13	181 265 685

LEGAL DESCRIPTION
PLAN 1711410
BLOCK 1
LOT 13
EXCEPTING THEREOUT ALL MINES AND MINERALS
AREA: 1.22 HECTARES (3.01 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;21;9;1;SW

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 171 186 115

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
181 265 685	10/12/2018	TRANSFER OF LAND	$130,000	NOMINAL

OWNERS

MICHELE VAN DER KOOI
OF 638 10 STREET NORTH
LETHBRIDGE
ALBERTA T1H 2E2

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
202FG .		RESTRICTIVE COVENANT " AFFECTS PART OF THIS TITLE "
1485KX .	21/06/1971	IRRIGATION ORDER/NOTICE THIS PROPERTY IS INCLUDED IN THE ST. MARY RIVER IRRIGATION DISTRICT " AFFECTS PART OF THIS TITLE "
4896LO .	20/10/1972	CAVEAT

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. " AFFECTS PART OF THIS TITLE "
991 100 030	15/04/1999	CAVEAT RE : PIPELINE AGREEMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
991 100 031	15/04/1999	CAVEAT RE : SEE INSTRUMENT CAVEATOR - THE BOARD OF DIRECTORS OF ST. MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278, LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
001 331 237	20/11/2000	UTILITY RIGHT OF WAY GRANTEE - ATCO GAS AND PIPELINES LTD. " AFFECTS PART OF THIS TITLE "
041 079 448	01/03/2004	EASEMENT OVER AND FOR BENEFIT OF: SEE INSTRUMENT " AFFECTS PART OF THIS TITLE "
061 045 120	30/01/2006	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - ST MARY RIVER IRRIGATION DISTRICT. P.O. BOX 278 LETHBRIDGE ALBERTA T1J3Y7 AGENT - SEAL. " AFFECTS PART OF THIS TITLE "
061 342 353	22/08/2006	UTILITY RIGHT OF WAY GRANTEE - COUNTY OF LETHBRIDGE RURAL WATER ASSOCIATION LIMITED. " AFFECTS PART OF THIS TITLE "
071 231 589	11/05/2007	CAVEAT RE : UTILITY RIGHT OF WAY CAVEATOR - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1

(CONTINUED)

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS
		AGENT - KIMBERLY HADDEN " AFFECTS PART OF THIS TITLE "
171 149 235	06/07/2017	CAVEAT RE : DEVELOPMENT AGREEMENT PURSUANT TO MUNICIPAL GOVERNMENT ACT CAVEATOR - LETHBRIDGE COUNTY. #100, 905 - 4 AVENUE SOUTH LETHBRIDGE ALBERTA T1H5L1
171 149 237	06/07/2017	RESTRICTIVE COVENANT
171 149 239	06/07/2017	EASEMENT AS TO PORTION OR PLAN:1711411
171 149 241	06/07/2017	EASEMENT AS TO PORTION OR PLAN:1711412

TOTAL INSTRUMENTS: 014

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APPENDIX

APPENDIX 3 ~ ENVIRONMENTAL SITE ASSESSMENT

PROJECT NO. WA-15-01924

REPORT TO

WESTERN HOG EXCHANGE

PHASE I
ENVIRONMENTAL SITE ASSESSMENT
RE: LOT 2, BLOCK 1, PLAN 0812940
TOWNSHIP ROAD 211
COUNTY OF LETHBRIDGE, ALBERTA

WA Environmental Services Ltd.
221 Riverpark Blvd.
Lethbridge
Alberta T1K 0P6

Tel: (403) 381-8141
www.waenvironmental.ca

January 30, 2015

PROJECT NO. WA-15-01924

REPORT TO

WESTERN HOG EXCHANGE

PHASE I
ENVIRONMENTAL SITE ASSESSMENT
RE: LOT 2, BLOCK 1, PLAN 0812940
TOWNSHIP ROAD 211
COUNTY OF LETHBRIDGE, ALBERTA

ENVIRONMENTAL SERVICES LTD.

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221 Riverpark Blvd.
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Alberta T1K 0P6

Tel: (403) 381-8141
www.waenvironmental.ca

January 30, 2015

EXECUTIVE SUMMARY

Between January 15 and January 30, 2015 WA Environmental Services Ltd. (WAES) conducted a Phase I Environmental Site Assessment of a building and property located approximately 0.8 km south of the intersection of Highway 3 and Township Road 211, approximately 6 km east of Lethbridge, in the County of Lethbridge, Alberta. The legal description of the site is Lot 2, Block 1, Plan 0812940 in the County of Lethbridge. It is understood that the assessment forms part of a business transaction involving the property.

A summary of environmental concerns identified at the site is presented in Table 1.

The subject site is located in a Rural Agricultural (R-A) zoned area of the County of Lethbridge, Alberta. The site was undeveloped agricultural land until 1979 when the hog exchange building was constructed. The building including several hog holding pens and an office area. An addition was constructed in 1990 that added additional space to the south end of the original building. The land was utilized as a farm prior to it's development in 1979.

Surrounding land use is a combination of residential acreages and agricultural. Township Road 211 runs in a north-south direction along the western boundary of the site. No concerns were identified with current adjacent land use.

No hazardous building materials were observed at the time of the site reconnaissance.

Based on the information gathered and on observations made during this investigation, the Phase I Environmental Site Assessment has revealed no evidence of environmental contamination associated with the site.

No further environmental investigation of the site is recommended at this time.

Table 1 - Summary of Findings and Recommendations			
Potential Source of Contamination	**Level of Environmental Contamination**	**Findings**	**Recommended Action**
Adjacent Properties	None	Surrounding land use is a mix of residential acreages and agricultural. Township Road 211 bounds the site to the west.	None.
Historical Land Use	None	Historically, the site has been used for agricultural purposes since the early 1900s and was developed for commercial land use in 1979s.	None
Underground Fuels and Chemicals	None	None observed or reported at the time of the site reconnaissance.	None.
Aboveground Fuels and Chemicals	None	None observed or reported at the time of the site reconnaissance	None.
Waste Management	None	The site is vacant at this time.	None.
Spill and Stain Areas	None	None observed or reported spills reported; typical staining on parking lot surface from parked vehicles.	None.
Wastewater Discharges	None	Waste water discharges into a septic tank that is emptied as needed.	None.
Air Discharges	None	No concerns.	None.
Polychlorinated Biphenyls (PCBs)	None	None observed or reported.	None.
Asbestos	None	None observed or reported.	None.
UFFI	None	None observed or reported	None.
Ozone Depleting Substances (ODSs)	None	None observed or reported	None.
Lead	None	None observed or reported	None
Electromagnetic Frequencies	None	None observed or reported.	None.
Radon	None	Area not a suspected radon source.	None.
Hydraulic Hoists/Elevators	None	None observed or reported.	None
Mercury	None	No sources of mercury were observed or reported at the site at the time of the site reconnaissance with the exception of thermostats used to regulate the heat supply.	These are typical and do not represent an environmental issue. Should renovation and/or demolition be proposed the thermostats should be removed and disposed according to all regulatory requirements.
Mould	None	None observed or reported.	None
Water Supply	None	The SMRID delivers water to a dugout. It is treated on-site for potable domestic use.	None
Fill Areas	None	Fill areas on site were limited to shallow utility trenches and roadway/parking lot subgrade.	None

High - Evidence of actual contamination, **Moderate** - Evidence of potential contamination (significant), **Low** - Evidence of potential contamination (minor), **None** - No evidence of contamination

TABLE OF CONTENTS

LIST OF APPENDICES, TABLES, AND DRAWINGS

APPENDICES

TABLES

DRAWINGS

1.0 INTRODUCTION

WA Environmental Services Ltd. (WAES) was retained by the Western Hog Exchange to conduct a Phase I Environmental Site Assessment of a building and property located approximately 0.8 km south of the intersection of Highway 3 and Township Road 211, approximately 6 km east of Lethbridge, in the County of Lethbridge, Alberta. The legal description of the site is Lot 2, Block 1, Plan 0812940 in the County of Lethbridge. It is understood that the assessment forms part of a business transaction involving the property. A site location plan and a site plan showing adjacent land use are included in Appendix A of this report.

The purpose of the Phase I ESA was to identify any actual or potential environmental contaminants associated with the site that exist as a result of current or past activities.

This report is presented in nine sections. Sections 1 and 2 present general information about the project, and describe the scope of work and the methodology used. Section 3 provides a summary of applicable legislation that may be referenced during the assessment. Sections 4 to 6 describe the present and historic conditions of the subject and adjacent properties. Section 7 presents the findings of the site visit. Environmental concerns are identified in this section. Significant environmental concerns and related recommendations are summarized in Section 8. Section 9 discusses the limitations of the assessment and its findings. Supporting information is provided in several appendices at the end of this report. Select photographs are included in the text of this report.

2.0 PHASE I SCOPE AND METHODOLOGY

2.1 Scope of Work

The Phase I ESA carried out by WAES on this property is based on the requirements of the Canadian Standards Association (CSA) Phase I Environmental Site Assessment Information Product, Z768-01, April 2003 (CSA protocol) and consists of the following:

- records review;
- interviews with regulatory officials and personnel associated with the site and adjoining properties;
- a site visit; and
- evaluation of information and preparation of the report provided herein.

A Phase I ESA does not include sampling or testing of air, soil, groundwater, surface water or building materials. These activities would be carried out in a Phase II ESA, if required. No enhancements of this assessment were conducted. The professional qualifications of the project team and Insurance Certificates

are provided in Appendix B. The contract between Western Hog Exchange and WAES to conduct the Phase I Environmental Site Assessment is confidential and has not been included in this report.

2.2 Methodology

2.2.1 Records Review

The applicable search distance for the records review included properties immediately adjacent to the sites and other properties (as identified by aerial photographs, insurance records, etc.) where the potential for environmental contamination of the subject sites was apparent (e.g., petroleum products storage in the immediate area).

Previous Environmental Site Assessments and existing title searches were not provided for review. A list of records reviewed is included in **Appendix C.**

2.2.2 Interviews

Interviews were carried out to obtain or confirm information on the environmental characteristics of this property. A summary of interviewees and contact information is presented in Appendix C.

2.2.3 Site Visit

The subject property and readily visible and publicly accessible portions of adjacent sites were examined for the presence of actual or potential environmental contamination. All areas of the property were accessible to WAES during the site visit on January 23, 2015.

3.0 REGULATORY FRAMEWORK

Applicable federal, provincial and municipal regulations were reviewed to identify and assess potential or actual environmental contamination at the sites and to develop appropriate recommendations. It should be noted, however, that this assessment did not include a review or audit of operational environmental compliance issues or of any environmental management system (EMS) that may exist for the property. Where required, the documents listed in Appendix D were used as reference material for the completion of the Phase I Assessment.

4.0 SITE DESCRIPTION

4.1 Property Description

The site is located in a Rural Agricultural zoned (R-A) area in the County of Lethbridge, Alberta. The subject site has a total plan area of approximately 9.4 ha (23.3 acres). The site is presently vacant, but previously served as a holding area and office for the Western Hog Exchange Lethbridge facility. The legal description of the site is Lot 2, Block 1, Plan 0812940 in the County of Lethbridge, (Drawing 2, Appendix A).

Photograph 1: Looking north across parking area at shop and office building constructed in 1982.

4.2 Soil, Topography and Drainage

The site is generally flat, with a gentle slope to the south. Surface water from the site drains towards the ditches on the boundaries of the property. According to published geological information (Shetsen, 1987[1]), site soils are typically silt and clay, overlying clay till up to 20 m thick.

[1]Shetsen, I. 1987. *Surficial Geology of Southern Alberta*. Alberta Research Council.

Based on local topography, shallow groundwater flow is suspected to be towards the east towards the SMRID Canal. The direction of regional (i.e., deep) groundwater flow is predicted to be west towards the Oldman River (Tokarsky, 1974[2]).

It should be noted that topography, geologic materials, development of land and soil disturbances influence localized variances in groundwater movement and pattern. In addition, groundwater levels will fluctuate seasonally and in response to climatic conditions.

No evidence of wells, pits, lagoons, stressed vegetation, or watercourses was observed on the property.

4.3 On-Site Buildings and Structures

There is one building situated on the central portion of the site, surrounded by a gravelled parking area. A summary of the property information is presented in Table 2.

Table 2 - Summary of Lot Information

Property	
Current Zoning	Rural Agricultural R-A
Area	Approximately 800 m^2
Services: Sewer, Water, Electricity	Water is delivered to a dugout by the SMRID. It is treated on-site for potable domestic use. There is a septic tank/field on hand for sanitary sewer disposal. Fortis and Atco gas supply energy to the site.
Building (Office and Shop Building)	
Number of Storeys	One
Exterior Finish	Metal siding, galvanized metal roof.
Interior Finish	Linoleum flooring, concrete floors, drywall, stipple ceiling in office area.
Foundation	Slab on grade
Basement	No
Insulation	Fibreglass insulation; spay on insulation (observed) in barn area.
Roof	Galvanized
Lighting	Fluorescent and incandescent
Heating, Ventilating, Air Conditioning	The office has a natural gas fired forced air furnace to provide heat. There are suspended forced air furnaces and radiant heat in the shop area.

Photograph 2: – View of the spray on insulation and radiant heat in barn area.

5.0 ADJACENT PROPERTIES

Land use of the adjacent properties is identified on Drawing 2 in Appendix A. A summary of this land use is presented in Table 3.

Table 3 - Adjacent Properties - Land Use

Boundary Side of Site	Current Activity	Potential Sources of Contamination
North	Agricultural residence and farm	None identified
South	Agricultural residence and farm	None identified
East	Agricultural residence and farm across SMRID Canal	None identified
West	Agricultural residence and farm across Township Road 211	None identified

No evidence of actual or potential environmental impact from neighbouring properties was observed on the sites during the site reconnaissance.

Photograph 3: – View of residence and farm south of the site.

6.0 REVIEW OF HISTORICAL LAND USE AND REGULATORY HISTORY

6.1 Historical Land Use

Historical information describing the site was obtained from a variety of sources as detailed in Appendix C of this report. Lists of historical land uses for the investigated site and adjacent properties are provided in Table 4 and 5, respectively.

Table 4 - Historical Information for the Site

Period/Date	Land Use	Sources of Information
Prior to 1979	Undeveloped/agricultural land. Irrigation was introduced to the area in the early 1950s.	Air photographs and interviews
From 1979 to present day	The present day office and barn building were constructed and have served as a hog holding area. A small addition was constructed to the south end in 1990.	Air photographs and interviews

Based on information obtained during the historical review, it is unlikely that the presence of the above land use has adversely impacted the site.

Table 5 - Historical Information for Adjacent Properties		
Boundary Side of Site	**Comments**	**Sources of Information**
North, south east and west	The area has been used for agricultural purposes since the early 1900s.	Air photographs and interviews

Based on information obtained during the historical review, it is unlikely that the presence of the above land use has adversely impacted the site.

6.2 Regulatory History

A summary of information obtained from interviews with and/or written requests from regulatory agencies is provided below:

- **Alberta Environment, Regulatory Approvals Centre:** Information received from the Regulatory Approvals Centre indicates that they have no record if any approvals having been issued for the site.

- **Environmental Law Centre:** Information received from the Environmental Law Centre indicates that they have no record of Control Orders, Stop Orders, Prosecutions, or Tickets issued regarding the property owner.

- **Petroleum Tank Management Association of Alberta:** Written information received from the PTMAA states that they have no record of active or abandoned storage tanks registered at the site.

- **Town of Coaldale Fire Department**: Verbal information received indicated that there are no records of violations of the Alberta Fire Code for the site.

7.0 SITE VISIT FINDINGS AND DISCUSSION

The site visit was carried out by Mr. Tim Waters, C.E.T. on January 23, 2015. All areas of the site were made available for observation at the time of the site visit.

7.1 Fuel/Chemical Handling and Storage

No aboveground fuel storage tanks were observed at the site. No evidence of fill or vent pipes indicating the possible presence of underground storage tanks was observed on site. Domestic cleaning chemicals were observed to be stored in an orderly fashion.

7.2 Waste Materials

No waste is presently generated at the site.

7.3 Spill and Stain Areas

No spills reported. Typical staining from parked vehicles was observed on the parking lot surface; however, these are not an environmental concern.

7.4 Wastewater Discharges

No regulated wastewater discharges were identified during the site visit. Sewage generated at the site discharges into a septic tank which is emptied on an "as needed" basis.

7.5 Air Discharges

No sources of air emissions that were suspected to result in residual contamination to the property were observed during the site reconnaissance.

7.6 Polychlorinated Biphenyls (PCBs)

The past use of PCBs in electrical equipment such as transformers, fluorescent lamp ballasts, and apacitors was common. The federal *Environmental Contaminants Act*, 1976, prohibited the use of PCBs in heat transfer and electrical equipment installed after September 1, 1977, and in transformers and capacitors installed after July 1, 1980. In addition, storage and disposal of PCB waste materials is regulated. No evidence of any PCB equipment was observed at the time of the site reconnaissance.

7.7 Asbestos

The common use of potential friable (breakable by hand) asbestos-containing materials (ACMs) (pipe/boiler insulation and fireproofing) in construction generally ceased voluntarily in the mid 1970s. No potential ACMs were observed at the time of the site reconnaissance.

7.8 Urea Formaldehyde Foam Insulation (UFFI)

The sale and installation of UFFI as thermal insulation began in approximately 1970, and continued until December 1980 when it was banned under the federal *Hazardous Products Act*. UFFI was installed in both new and existing buildings during this period. Evidence of UFFI was not observed during the site reconnaissance.

7.9 Lead

In 1976, the lead content in interior paint was limited to 0.5% by weight under the federal *Hazardous Products Act*. Lead is also associated with plumbing solder and old pipes as well as other lead based products such as wall shielding (x-ray rooms). No evidence of lead based products was observed on-site during the site reconnaissance.

7.10 Ozone Depleting Substances (ODSs)

In 1994, the federal government filed the *Ozone-depleting Substances Regulations* to amend controls on production and consumption of (chlorofluorocarbons (CFCs). Halons, carbon, tetrachloride and methyl chloroform. No sources of ozone depleting substances (ODSs) were observed on-site.

7.11 Radon

Radon gas is a product of the decay series that begins with uranium. Radon is produced directly from radium, which can be commonly found in bedrock that contains black shale and/or granite. Radon gas can migrate through the ground and enter buildings through porous concrete or fractures. Radon tends to accumulate in poorly ventilated basements. No testing for radon gas products has reportedly been completed for the site. However, based upon information contained on regional geological maps, radon gas products are not expected to be found.

7.12 Electromagnetic Frequencies (EMFs)

No high-tension transmission lines were observed near the site. Electro-magnetic frequencies are not anticipated to impact the site.

7.13 Noise and Vibration

With the exception of Township Road 211, there were no major sources of noise and vibration identified on or adjacent to the subject property during the site reconnaissance.

7.14 Hydraulic Hoists and Elevators

There were no hydraulic hoists or elevators observed at the subject property during the site reconnaissance.

7.15 Mercury

No sources of mercury were observed or reported at the site at the time of the site reconnaissance with the exception of thermostats used to regulate the heat supply. These are typical and do not represent an

environmental issue. Should renovation and/or demolition be proposed the thermostats should be removed and disposed according to all regulatory requirements.

7.16 Mould

No evidence was observed at the time of the site reconnaissance. Mould can be found anywhere in a building, particularly if a flood or spill/leak has occurred and was not repaired immediately; and mould is usually associated with damp, enclosed areas. A mould assessment was not conducted for the subject site as intrusive observation of building materials is not included within the scope of a Phase I ESA.

7.17 Water Supply

Water is delivered to a dugout by the SMRID; it is then treated on-site for potable domestic use.

7.18 Fill Areas

Fill areas on site are likely isolated to the excavation for the foundation, parking areas and shallow utilities.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The subject site is located in a Rural Agricultural (R-A) zoned area of the County of Lethbridge, Alberta. The site was undeveloped agricultural land until 1979 when the hog exchange building was constructed. The building including several hog holding pens and an office area. An addition was constructed in 1990 that added additional space to the south end of the original building. The land was utilized as a farm prior to it's development in 1979.

Surrounding land use is a combination of residential acreages and agricultural. Township Road 211 runs in a north-south direction along the western boundary of the site. No concerns were identified with current adjacent land use.

No hazardous building materials were observed at the time of the site reconnaissance.

Based on the information gathered and on observations made during this investigation, the Phase I Environmental Site Assessment has revealed no evidence of environmental contamination associated with the site.

No further environmental investigation of the site is recommended at this time.

9.0 CLOSURE

The American Society for Testing and Materials Standard of Practice notes that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in connection with a property. Performance of a standard environmental site assessment protocol is intended to reduce but not eliminate this uncertainty, given reasonable limits of cost and time.

This report has been prepared for the sole benefit of the Western Hog Exchange and their agents. This report may not be relied upon by any third party or entity without the express written consent of WA Environmental Services Ltd. and the Western Hog Exchange.

Any use a third party may make of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. WA Environmental Services Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Some of the information presented in this report was provided through existing documents and interviews. Although attempts were made, whenever possible, to obtain a minimum of two confirmatory sources of information, WA Environmental Services Ltd. in certain instances, has been required to assume that the information provided is accurate.

The conclusions presented represent the best judgement of the assessor based on current environmental standards and on the site conditions observed on January 23, 2015. Due to the nature of the investigation and the limited data available, the assessor cannot warrant against undiscovered environmental liabilities.

Should additional information become available WA Environmental Services Ltd. requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

Respectfully submitted,

WA ENVIRONMENTAL SERVICES LTD.

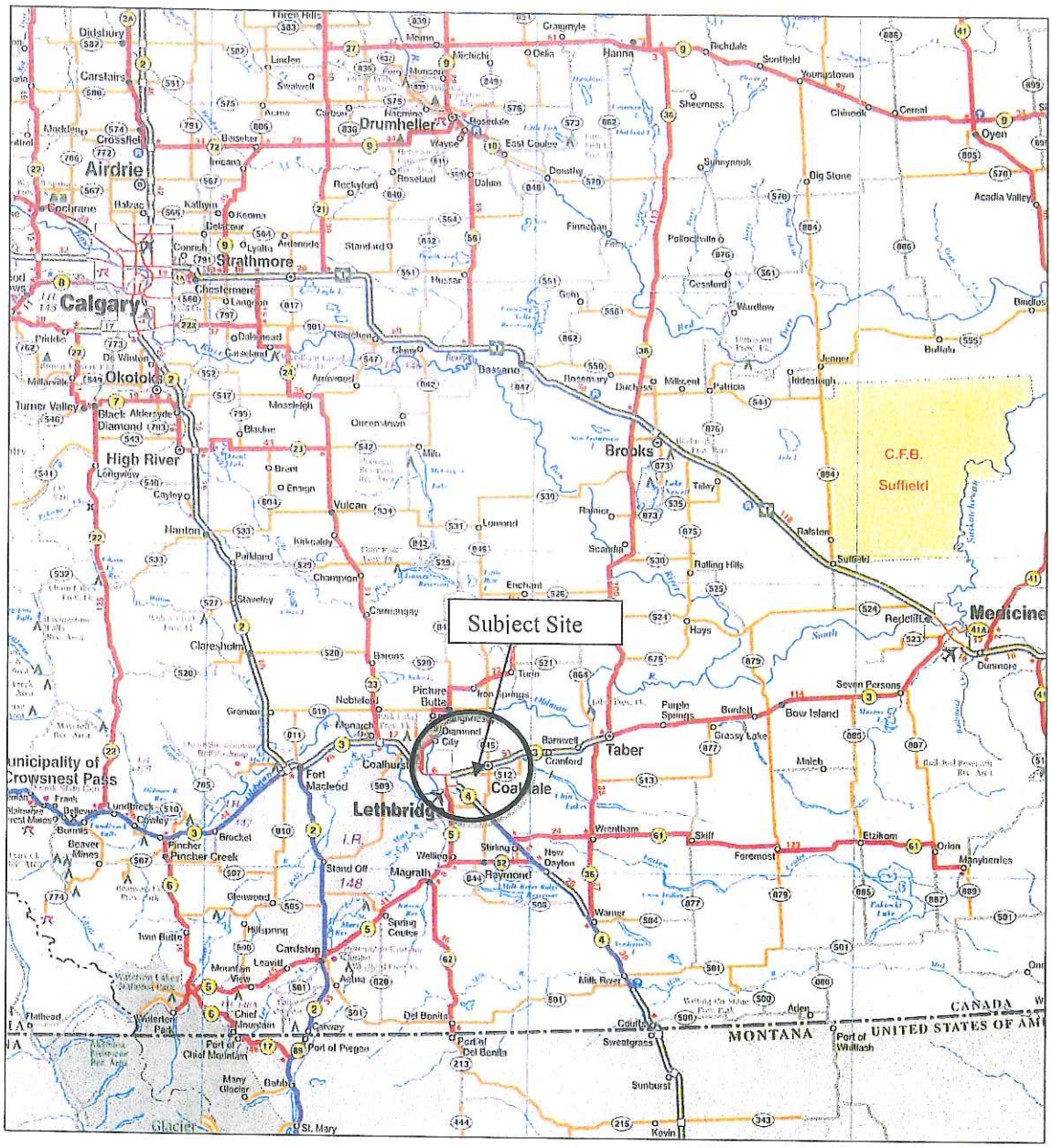
Jan 30, 2015

Tim Waters, C.E.T.
Project Manager

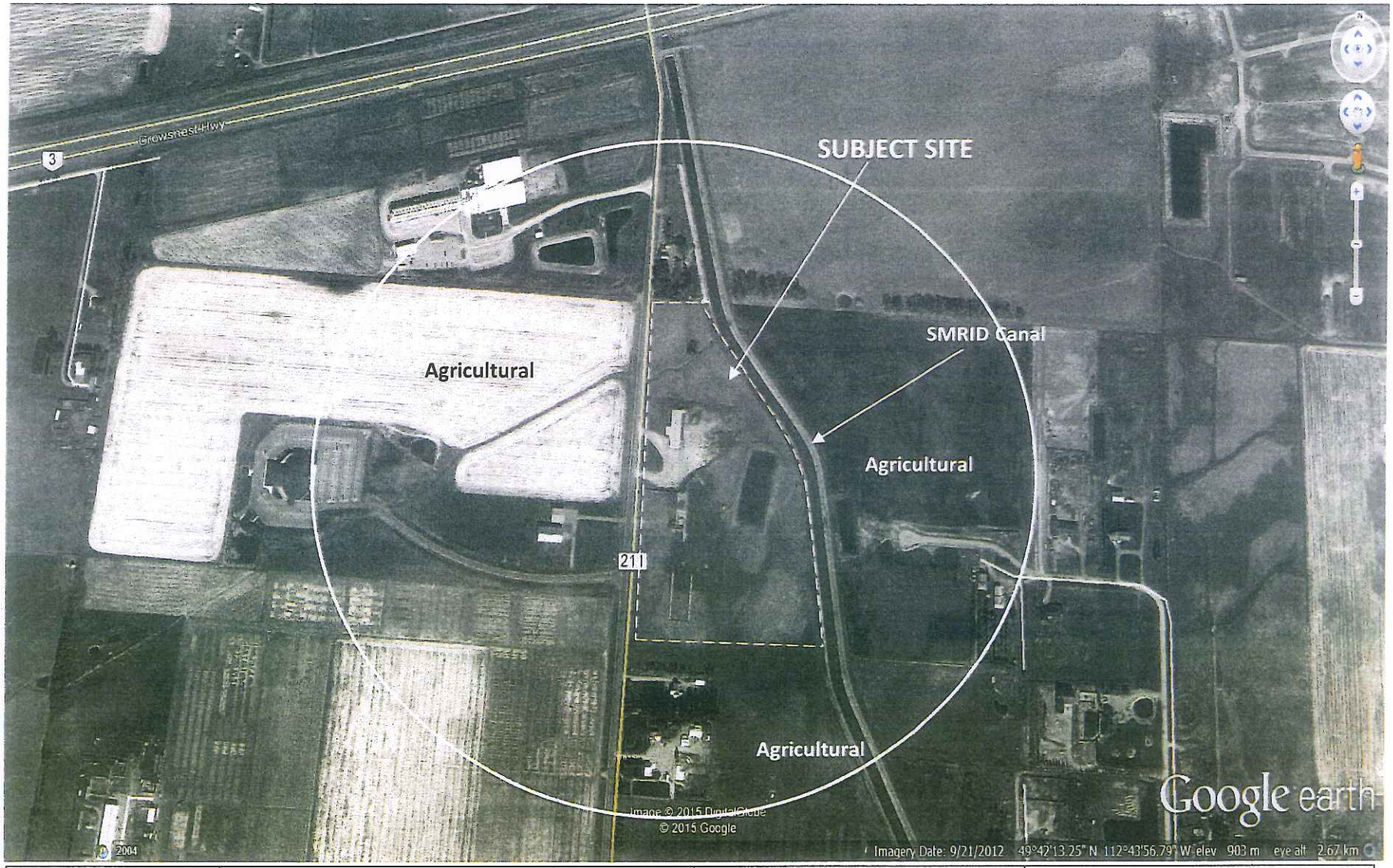
Beverly Waters, C.E.S.A.
Senior Reviewer

APPENDIX A

SITE PLANS



WA ENVIRONMENTAL SERVICES LTD.	**Date: January 26, 2015**	**Project: Phase I Environmental Site Assessment**
	Title: Drawing 1 **Site Location Plan** **Lot 2, Block 1, Plan 0812940** **County of Lethbridge, Alberta**	**Project No.: WA-15-01924** **Client: Western Hog Exchange**



WA ENVIRONMENTAL SERVICES LTD.	Project: Phase I Environmental Site Assessment	Project No. WA-15-01924	Date: January 26, 2015
	Location: Lot 2, Block 1, Plan 0812940 County of Lethbridge, Alberta	Drawn By: TGW	Reviewed By: BFW
	Drawing 2: Site Plan Showing Adjacent Land Use	Client: Western Hog Exchange	

APPENDIX B

ASSESSOR QUALIFICATIONS

INSURANCE CERTIFICATES

Associated Environmental Site Assessors of Canada

AESAC

this is to acknowledge that

Beverly Waters

has been qualified for the Certified Environmental Site Assessment Designation

C.E.S.A.

Certified Environmental Site Assessor - Phase 1
according to AESAC's National Certification Programme

signed and sealed this day of October 7th, 2004

Bruno Lugab, President

LLOYD'S

ARCHITECTS/ENGINEERS PROFESSIONAL LIABILITY INSURANCE

Effected with certain Lloyd's Underwriters ("the Insurer") through
Lloyd's Approved Coverholder ("the Coverholder")
SOUTH WESTERN INSURANCE GROUP LIMITED
703 Evans Avenue, Suite 203, Toronto, Ontario M9C 5E9

DH (10/06/2014) PLAE

DECLARATIONS
THIS IS A CLAIMS-MADE PROFESSIONAL LIABILITY INSURANCE POLICY
PLEASE READ CAREFULLY

RENEWAL POLICY

This declaration, together with the policy wordings and endorsements, if any, issued to form a part thereof, completes this policy.

POLICY NUMBER

LAP 980175
REPLACING POLICY No.:

BROKER

SCHWARTZ RELIANCE INSURANCE
300-10TH STREET SOUTH
LETHBRIDGE, AB T1J 3Y5

1. **NAME OF INSURED**

WA ENVIRONMENTAL SERVICES LTD.

MAILING ADDRESS

221 RIVERPARK BLVD. WEST
LETHBRIDGE
AB T1K 0P6

2. **POLICY PERIOD**

From: June 08, 2014 To: June 08, 2015

12:01 a.m. Standard Time at the Mailing Address of the Named Insured as stated herein

3. **LIMIT OF LIABILITY**

(a) $2,000,000 Each Claim - Includes Claims Expenses

(b) $2,000,000 Annual Aggregate - Includes Claims Expenses

The total Limit of Liability of the Insurer, including Damages and Claims Expenses, for all Claims first made against the Insured and reported in writing to the Insurer during the Policy Period shall not exceed in the Aggregate, the limit stated herein.

4. **SELFINSURED RETENTION**

$ 7,500

The Self-Insured Retention amount shall be separately applicable to each Claim first made during the Policy Period and shall apply to Damages and Claims Expenses.

5. **PREMIUM**

$ 8,500

MINIMUM EARNED PREMIUM

30%

6. **RETROACTIVE DATE**

June 08, 2000 – Primary $1,000,000 Limit
June 08, 2011 - $1,000,000 excess of $1,000,000 Limit

Coverage shall apply only to those Claims or those matters reported pursuant to the terms and conditions of the Policy arising out of Professional Services described in Definitions X and performed subsequent to the date stated herein.

7. **NOTICE OF CLAIM TO:**

Clyde & Co LLP
630 Rene-Levesque Blvd. West, Suite 1700
Montréal, Quebec H3B 1S6
Attention: Robert Emblem
Fax #514.843.6110

Recipient of:
Notice of Claim; Notice of Cancellation; Notice of Insured's intention to purchase; Extended Reporting Period Coverage and premium for Extended Reporting Period Coverage.

8. **NOTICE OF ELECTION TO:**

SOUTH WESTERN INSURANCE GROUP LIMITED
703 Evans Avenue, Suite 203
Toronto, Ontario
M9C 5E9

9. **FORMS AND ENDORSEMENTS ATTACHED HERETO:**

AFB-A&E	Architects/Engineers Professional Liability Insurance
LBA-041B	Rain Screen Exclusion
LSW-559	Retroactive Limitation Clause
LBA-068	Mould Exclusion
LBA-070	Asbestos Exclusion
NMA-1477	Radioactive Contamination Exclusion Clause
NMA-1978	Nuclear Incident Exclusion Clause
NMA-2962	Biological or Chemical Materials Exclusion
NMA-2918	War and Terrorism Exclusion
MIN-EARN1	Minimum Earned Premium Endorsement
AMDEND	Amendatory Endorsement
623AFB0089	Short Rate Cancellation Table
623AFB0097	Warranted No Higher Limits Endorsement
LBA-074	Amended Pollution Exclusion

10. This Policy has been issued based on the information contained in the Application signed and dated May 14, 2014

IDENTIFICATION OF INSURER / ACTION AGAINST INSURER

This insurance has been effected in accordance with the authorization granted to the Coverholder by the Underwriting Members of the Syndicates whose definitive numbers and proportions are shown in the Table attached to Agreement No.B1115 NAPI 13 104497B (Hereinafter referred to as "the Underwriters"). The Underwriters shall be liable hereunder each for his own part and not one for another in proportion to the several sums that each of them has subscribed to the said Agreement.

In any action to enforce the obligations of the Underwriters they can be designated or named as "Lloyd's Underwriters" and such designation shall be binding on the Underwriters liable hereunder as if they had each been individually named as defendant. Service of such proceedings may validly be made upon the Attorney In Fact In Canada for Lloyd's Underwriters, whose address for such service is 1155, rue Metcalfe, Suite 1540, Montreal, Quebec, H3B 2V6.

NOTICE

Any notice to the Underwriters may be validly given to the Coverholder.

In witness whereof this policy has been signed, as authorized by the Underwriters, by **SOUTH WESTERN INSURANCE GROUP LIMITED.**

Per

John A. Barclay, President & CEO

The Insured is requested to read this policy, and if incorrect, return it immediately for alteration.

In the event of an occurrence likely to result in a claim under this insurance, immediate notice should be given to the Coverholder whose name and address appears above. All inquiries and disputes are also to be addressed to this Coverholder.

For purposes of the *Insurance Companies Act* (Canada), this document was issued in the course of insurance business in Canada of the Insurer(s) participating on this policy.

Head Office: 1200, 321 - 6th Avenue S.W., Calgary, Alberta T2P 4W7

[intact]

Business Insurance Policy

Renewal

Policy Number: 5A1276036

Intact Insurance Company hereinafter called the Insurer.

The Policy Declarations together with the Supplementary Declarations, Policy Conditions, forms, riders and endorsements, if any, issued to form a part thereof, completes the Policy.

POLICY DECLARATIONS

Insured Name	WA Environmental Services Ltd
Mailing Address	6 Stoney Place West Lethbridge, AB T1K6V5
Policy Period	**From** June 09, 2014 **To** June 09, 2015 **12:01 a.m. standard time at the postal address of the Named Insured stated herein.**
Insured's Business Operation	Environmental Consultants
Broker	Schwartz Reliance Insurance 220, 300 10 ST S Lethbridge, Alberta T1J3Y5
	Phone No. 403-320-1010
Broker No.	28083 **Branch ID** C
Total Policy Premium	$ 1,666 **Minimum Retained Policy Premium** $ 0
Billing Method	Agency Bill

In witness whereof the Insurer has duly executed this policy, provided however that this policy shall not be valid or binding unless countersigned by a duly Authorized Representative of the Insurer.

Authorized Representative

SCHWARTZ RELIANCE INSURANCE

Per

Authorized Representative

This Policy Contains a Clause(s) That May Limit the Amount Payable

Head Office: 1200, 321 - 6th Avenue S.W., Calgary, Alberta T2P 4W7

intact

Business Insurance Policy

Policy Number: 5A1276036

GENERAL LIABILITY COVERAGES

FORM#	FORM AND COVERAGE(S)	DEDUCTIBLE		LIMIT OF INSURANCE
LR20	Commercial General Liability Max			
	Coverage A - Bodily Injury, Personal Injury and Property Damage Liability		Limit of Liability - each accident or occurrence	$ 2,000,000
	Coverage A - Products-Completed Operations		Limit of Liability - aggregate	$ 2,000,000
	Coverage A - Property Damage Deductible: Per Occurrence	$ 1,000		
	Coverage B - Advertising Injury		Limit of Liability - each accident or occurrence	$ 2,000,000
	Coverage B - Advertising Injury		Limit of Liability - aggregate	$ 2,000,000
	Coverage C - Medical Payments		Limit of Liability - each person	$ 10,000
	Coverage D - Tenants' Legal Liability	$ 1,000	Limit of Liability - any one accident	$ 500,000
L407	Coverage Territory Amendment - Canada only			
L408	Crane and Hoist Operators' Liability Endorsement	$ 1,000		$ 100,000
L410	Employee benefit program liability			
	Aggregate			$ 1,000,000
	Each Employee	$ 1,000		$ 1,000,000
L416OG	Forest and Prairie Fire Fighting Expense Endorsement - Oil and Gas			
	Limit of liability - Aggregate			$ 1,000,000
	Limit of liability - Each accident or "occurrence"	$ 2,500		$ 1,000,000
L429	S.E.F. 94 Legal Liability for Damage to Hired Automobiles			
	Subsection 1 - All Perils	$ 1,000		$ 75,000
L431	S.E.F. No. 99 Excluding Long term Leased Vehicle Endorsement			
L432	S.P.F. No. 6 - Standard Non-Owned Automobile Policy			
	Section A - Third party Liability			$ 2,000,000
L436	Absolute Pollution Exclusion Endorsement			
L440	Concrete Rip & Tear Liability Endorsement			
	Limit of Liability - Annual aggregate			$ 50,000
	Limit of Liability - Each claim			$ 50,000
	Reimbursement			$ 1,000
L442	Employers Liability Exclusion			
L450	Sub-contractor's Warranty Endorsement			
	Minimum Limit of Liability - Aggregate Limit			$ 1,000,000
	Minimum Limit of Liability - Per Accident or Occurrence			$ 2,000,000
L483	Amended Professional Services Exclusion Endorsement			
L508	Oil and Gas Limitation Endorsement			
	Deductible: land	$ 5,000		
	Deductible: pipelines	$ 50,000		
	Deductible: underground	$ 1,000		
	Deductible: water	$ 25,000		

Name: Timothy G. Waters, C.E.T.

Position: Senior Project Manager

Education: General Certificate of Education, Advanced Level (Geography/Geomorphology), University of London, England.

Relevant Experience:

- Lead assessor on 550 Phase I Environmental Site Assessments of residential, commercial, industrial and institutional properties throughout Alberta and B.C.

- Transport Canada, Lethbridge Airport Fire Training Area. Responsible for Phase III drilling program, sample collection and gathering field data.

- Transport Canada, Medicine Hat and Empress Non Directional Beacon Sites. Responsible for Phase II drilling program and subsequent field monitoring and sampling

- Transport Canada, Pincher Creek, Alberta: Responsible for data collection at three facilities at the Pincher Creek Airport and subsequent sampling of groundwater.

- Federal Business Development Bank, Blairmore, Alberta. Responsible for the safe removal of USTs.

- Alberta Transportation and Utilities, Kipp and Burmis, Alberta. Responsible for the safe removal of USTs.

APPENDIX C

RESOURCE INFORMATION

REGULATORY CONTACTS, PERSONS INTERVIEWED, AND HISTORICAL SOURCES

SOURCE	INFORMATION/CONTACT/PHONE NUMBER
Alberta Environmental Protection	Environmental Permits/Approvals Mr. Dennis Eriksen, Regulatory Approvals Centre (403) 427-6311
Aerial Photographs	1949, 1970, 1983, 1990, 2005
Fire Insurance Maps	Not available for this site
Historical City Directories	Not available for this site
Previous Environmental Reports	None available for this site
Other Sources	Ms. Iris Djurfors, Environmental Law Centre, (403) 424-5099 Ms. Connie Jacobsen, PTMAA, (403) 425-9265 County of Lethbridge Planning Dept. (403) 328-5525 Town of Coaldale, Volunteer Fire Dept, (403) 345-1330 Mr. Ron Landry, Western Hog Exchange, (780) 491-3577 St. Mary's River Irrigation District: (403) 328-4401

APPENDIX D

REGULATIONS

Federal

Legislation

Canada Water Act

- Guidelines for Canadian Drinking Water Quality - 6th edition
- Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments

Canadian Environmental Protection Act

- Chlorobiphenyls Regulations (SOR/91-152)
- Federal Aboveground Storage Tank Technical Guidelines
- Federal Underground Storage Tank Technical Guidelines
- Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum
- Federal Lands Regulations
- Storage of PCB Material Regulations (SOR/92-507)

Fisheries Act

Transportation of Dangerous Goods Act/Regulations

Hazardous Products Act

Policies, Guidelines and Codes

Canadian Council of Ministers of the Environment (CCME)

- Environmental Codes of Practice for Underground Storage Tanks Containing Petroleum Products and Allied Petroleum Products, March 1993
- Environmental Code of Practice for Aboveground Storage Tanks Containing Petroleum Products, 1993

Government of Canada Asbestos Abatement Guidelines, 1991-01-04

Code of Good Practice for Handling Solid Wastes at Federal Establishments (Environment Canada)

Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments (EPS-1-EC-76-1)

Provincial

Alberta Fire Code (2011)

Environmental Protection and Enhancement Act (1993)

Ozone-Depleting Substances and Halocarbons Regulation (2000)

Occupational Health and Safety Act (1993)

Transportation of Dangerous Goods Control Act (1986)

Municipal

County of Lethbridge Unsightly/Untidy Premises By-law

County of Lethbridge Refuse By-law

County of Lethbridge Sewer Service By-law

County of Lethbridge Noise Control By-law

APPENDIX

APPENDIX 4 ~ GEOTECHNICAL INVESTIGATION

August 22, 2016

Amec Foster Wheeler File: BX30428

Martin Geomatic Consultants Ltd.
255 – 31 Street North
Lethbridge, AB, T1H 3Z4

Attention: Mr. Ed Martin, P.Eng.

RE: GEOTECHNICAL INVESTIGATION
Proposed Rural Subdivision
Part of SW-1-9-21-W4, Range Rd 21-1, near Lethbridge, AB

1.0 INTRODUCTION

At the request of Martin Geomatic Consultants Ltd., Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) has carried out a geotechnical investigation to support the development of a rural residential subdivision at the above-captioned site.

Based on information provided to Amec Foster Wheeler, it is understood that the subject land area encompasses about 9.3 ha, and is currently made of up two parcels. It is understood that the north parcel (about 5.4 ha) will be subdivided into three rural residential building lots, as illustrated on Figure 1, attached. The three new lots will range in area between about 1.2 ha and 2.6 ha.

It is understood that the current geotechnical investigation will be used to support the proposed subdivision application.

2.0 METHODOLOGY AND RESULTS

2.1 Methodology

In order to assess the subsurface soil and groundwater conditions at the site, Amec Foster Wheeler visited the site on August 3, 2016 and monitored the drilling a series of four boreholes at the locations denoted on Figure 1 as BH16-01 to BH16-04, inclusive.

The boreholes were advanced using a truck-mounted drill equipped with continuous flight solid stem augers, and extended to depths of 4.5 m to 5.0 m below existing grade. During the drilling, disturbed soil samples were collected from the auger flights. In addition, Standard Penetration Tests (SPTs) were also carried out at regular intervals to assess the soil consistency/compactness, and obtain to representative samples for identification.

Upon completion of the drilling, 25 mm diameter hand-slotted standpipes were inserted into three of the boreholes (BH16-01, BH16-02, and BH16-04) to facilitate measurement of the depth

Amec Foster Wheeler Environment & Infrastructure
A division of Amec Foster Wheeler Americas Ltd.
469 – 40th Street South
Lethbridge, AB, CANADA T1J 4M1
Tel +1 (403) 327-7474
Fax +1 (403) 327-7682
www.amecfw.com

to the groundwater table. The annular space was backfilled with the auger cuttings with a bentonite cap at the surface. The remaining boreholes were backfilled with the auger cuttings.

The drilling was carried out under the supervision of an Amec Foster Wheeler technician, who collected the soil samples and logged the subsurface conditions. The recovered soil samples were transported to Amec Foster Wheeler's Lethbridge laboratory for further review by a geotechnical engineer and selected laboratory classification testing. Laboratory testing for this project consisted of routine moisture content determinations and Atterberg Limits testing, with results presented on the appended borehole logs.

Samples remaining will be stored for a period of three months following this report at which time they will be discarded unless we are requested otherwise by the Client.

2.2 Soil and Groundwater Conditions

The subsurface conditions encountered are detailed on the attached borehole logs and summarized in the following paragraphs. It must be noted that boundaries of soil indicated on the borehole logs are inferred from non-contiguous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purposes of geotechnical design, and should not be interpreted as exact planes of geological change.

The boreholes were each surfaced with a 100 mm thick layer of topsoil.

Underlying the topsoil a 0.65 m thick layer of clay fill was observed at borehole BH16-01. The clay fill was described as medium plastic, silty and sandy, mottled, brown, and moist. The consistency of the clay fill was described as firm (based on tactile observations, and observed drill resistance).

The predominant natural mineral soil encountered underlying the topsoil was clay becoming clay till at depth. The clay and clay till was described as medium plastic, silty and sandy with trace gravel, oxide and coal inclusions, and brown. The consistency of the clay and clay till was described as firm to very stiff (based on tactile observations, observed drill resistance, and SPT N-values ranging between 6 and 28 blows per 300 mm of sampler penetration and pocket penetrometer readings ranging between about 2 kg/cm^2 and 2.5 kg/cm^2). In general, the lower N-values (6 to 16) were observed at depths of 1.5 m and 3 m, with higher N-values (16 to 28) recorded beginning at and below the 3 m test depth.).

Based on laboratory testing, the *in situ* water content of the clay and clay till ranged between about 16.5 percent and 24 percent, generally indicative of moist soil conditions.

The results of Atterberg Limits testing carried out on two representative samples of the clay till are provided on the borehole logs, and detailed in the following table. The results of the Atterberg Limits testing indicated that the clay till is of medium plasticity.

Table 1: Atterberg Limits

Borehole / Sample No.	Liquid Limit, w_L	Plasticity Index, I_P	Moisture Content, w
BH16-02/S2	33%	18%	23.4%
BH16-04/S2	38%	22%	23.1%

The boreholes were each terminated in the clay till stratum.

Details of groundwater seepage are provided on the borehole logs. As noted on the logs, slight groundwater seepage was observed in boreholes BH16-01 and BH16-02 from a depth of about 1.5 m to 2.0 m below existing grade while the remaining boreholes were open and dry upon completion of the drilling.

As indicated previously, 25 mm diameter hand-slotted standpipes were installed in three boreholes (BH16-01 BH16-02 and BH16-04) to facilitate measurement of the depth to groundwater. The standpipes were monitored on August 18, 2016, (about two weeks following the drilling) at which time groundwater was measured at depths of about 2.1 m and 4.5 m below grade at boreholes BH16-01 and BH16-04, respectively. While the remaining standpipe was dry.

It is noted that groundwater conditions are expected to fluctuate seasonally in response to spring thaw and periods of heavy precipitation, and may differ at the time of construction.

3.0 GEOTECHNICAL DISCUSSION AND RECOMMENDATIONS

Based on information provided to Amec Foster Wheeler, it is understood that the subject land area encompasses about 9.3 ha, and is currently made of up two parcels. It is understood that the north parcel (about 5.4 ha) will be subdivided into three rural residential building lots, as illustrated on Figure 1, attached. The three new lots will range in area between about 1.2 ha and 2.6 ha.

Based on the results of the current investigation, the subject site is considered generally suitable for the proposed subdivision and rural residential development.

Based on our understanding of the proposed development as discussed above and in conjunction with the results of the current investigation, the following paragraphs provide preliminary geotechnical discussion and recommendations pertaining to residential construction and onsite sanitary sewage disposal.

3.1 Residential Construction – Preliminary Comments

For preliminary design purposes, the following general discussion and recommendations are offered to support the development of single family residential and related ancillary structures within the study area site. Specific, detailed geotechnical investigations are required for non-

residential developments in the subdivision, and may be needed for some residential structures if there are unusual design features associated with the residence.

Conventional Strip and Spread Footing Foundations

Based on AMECs review of the soil conditions within the widely spaced boreholes at the site, the natural occurring clay and clay till encountered within the boreholes is generally considered suitable for the support of conventional strip and spread footings for proposed single family residences. For preliminary design, a Serviceability Limit States (SLS) bearing pressure of 75 kPa is recommended, with a corresponding unfactored Ultimate Limit States (ULS) bearing pressure of 225 kPa. A geotechnical resistance factor of 0.5 should be applied to the ULS bearing pressure, per current building code requirements.

As indicated above, further investigation and/or review of the bearing soils associated with any non-residential structures will be required to support detailed design of the various proposed structures.

For protection against frost action, perimeter footings in heated areas should be extended to provide at least 1.5 m of soil cover. For any unheated buildings or portions of the building, footings should have at least 2.1 m of soil cover. Alternatively, insulation can be used to reduce the thickness of soil cover required.

Damp-Proofing and Drainage

While only minor groundwater was encountered during the current investigation, the installation of weeping tile around residences is still recommended, regardless of groundwater elevation. The requirements for weeping tile installation are outlined in Section 9.14 of the Alberta Building Code. Weeping tiles must discharge to either a gravity outlet, or to a pumped sump, in accordance with local regulatory requirements.

In conjunction with installation of weeping tile, below grade foundation walls around basements require damp proofing, in accordance with the current Alberta Building Code.

Weeping tile flow due to surface water infiltration along foundation walls can be minimized by providing a modest amount of compaction to the exterior foundation wall backfill, thus minimizing future settlement of the backfill. The backfill within two metres of the residence foundation should be graded away from the foundation at approximately a ten percent slope. Downspout roof leaders should discharge onto splash pads at least a metre from the foundation walls.

Construction of Slabs-on-Grade

In general, it is anticipated that engineered fill or the natural clay till at the site will provide adequate support for grade supported basement floors, concrete garage slabs, driveways and parking slabs, provided the subgrade is adequately prepared by stripping topsoil and fill, and reconstruction to achieve design elevations by placement of thin lifts compacted to a minimum of 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

Following preparation of the subgrade surface, a levelling course of 25 mm nominal size well graded crushed gravel at least 150 mm in compacted thickness is recommended directly beneath the slabs. The gravel should also be compacted to at least 98 percent of SPMDD.

For the basement floor slabs, a 150 mm minimum thickness of 25 mm crushed washed rock should be used instead of the well graded crushed gravel.

The excavated subgrade for the slabs on grade should be protected at all times from rain, snow, freezing temperatures, excessive drying and the ingress of free water. To minimize the potential negative effects of settlement or heave in soil below the slabs, it would be preferable to allow slabs to float with no rigid connections to walls or foundation elements except at doorways.

Some relative movement between the slabs-on-grade and adjacent walls or foundations and differential movements within the slabs should be anticipated. Where recommendations outlined in this report are followed, these movements are expected to be within tolerable limits.

3.2 Concrete Mix Considerations

In general, the natural mineral soil deposits in the Lethbridge area contain high levels of water soluble sulphates, indicating severe to very severe potential for sulphate attack on concrete in contact with native mineral soil deposits. Based on the CSA Standard A23.1-09 the Class of Exposure for concrete elements in contact with the clay soils is S-2. Accordingly, sulphate resisting cement (i.e., Type HS, formerly Type 50) should be used in the manufacture of concrete in contact with soil at this site. For durability purposes the concrete must have a maximum water to cementitious materials ratio of 0.45, and a minimum 56 day compressive strength of 32 MPa. Air entrainment and curing should follow CSA A23.1-09 Table 2 requirements.

An air entrainment agent is recommended for concrete exposed to cyclic freeze-thaw action. In addition to the improved durability, the air entraining will provide improved workability of the plastic concrete.

3.3 Onsite Sanitary Sewage Disposal

It is understood that the subject lots will be serviced by private sewage systems which will be developed by the buyer of the individual lots in conjunction the design and construction of proposed residences.

The design and construction of private onsite sanitary sewage disposal systems in Alberta is subject to the requirements of the *Alberta Private Sewage Systems Standard of Practise 2015* (hereafter referred to as the *2015 Standard*).

One of the most significant changes recent changes encompassed in the 2015 Standard compared to prior to the 2009 standard of practice is a shift from a design based on percolation testing to a design based on soil profile and textural classification. Percolation rates can only be used to support a design based on soil profile.

In accordance with *2015 Standard*, a site (i.e., lot) specific evaluation and report is required to support the detailed design and construction of individual private sewage systems. Detailed requirements for the Site Evaluation are provided in Part 7 of the *2015 Standard*.

Using the results of the Site Evaluation, a type of private sewage system best suited for the site is proposed. Selection of the type of system is based on various factors including soil profile, vertical separation between groundwater or impervious layer and point of effluent infiltration, design effluent volume and anticipated effluent strength.

The typical and most cost efficient private sewage system for a single family residential lot generally involves primary treatment of effluent using a septic tank with discharge to a conventional treatment field. The treatment field typically utilizes perforated piping laid in a bed of gravel in trenches which distributes the effluent within a series of trenches to the natural subsurface soils.

Where there are limits imposed by proximity to water table or very low permeable soils, a treatment mound can be considered as an alternative to a conventional treatment field. A treatment mound generally refers to a system where effluent from a septic tank is distributed onto an imported sand layer that is constructed above grade. In this case, the effluent must be discharged into the treatment mound using a pressurized system. Accordingly, the costs associated with importing sand for the treatment mound and operation of a discharge pump make this style of treatment system more costly than the conventional treatment field.

As an alternative, secondary treatment of the effluent can be considered. Secondary treatment of the effluent, as outlined in Part 5 of the *2015 Standard*, can be carried out by means of a sand filter, a re-circulating gravel filter, or a Packaged Sewage Treatment Plant. Where effluent quality meets Level 2 or better (as outlined in Table 5.1.1.1 of the 2015 Standard), the options for disposal of the effluent are less restrictive, and effluent may even be used for sub-surface drip dispersal and irrigation (subject to Section 8.5 of the 2015 Standard).

For the proposed lots, groundwater was measured at depths ranging between about 2.1 m and 4.5 m below existing grades, as detailed in the previous Section 2.2. The groundwater depths observed generally satisfy the vertical separation requirements for soil-based treatment as outlined in Paragraph 8.1.1.4 of the *2015 Standard*.

Based on the current investigation and visual review of samples recovered from boreholes at the site, the soils indicate a textural classification ranging between about SiCL (silty clay loam) to C (clay). Based on the results of the textural classification, the site is considered marginally suitable for effluent discharge using a conventional treatment field, and a treatment mound or secondary treatment of the effluent may be warranted.

It is noted that the detailed design of each proposed discharge field must be based on a soil profile assessment and textural classification of test pits within the footprint of the proposed discharge fields, and that these textural classifications will vary somewhat from the classification indicated above.

4.0 CLOSURE

The recommendations given in the above sections are based upon interpreted conditions found within the four boreholes advanced at this site. Should subsurface conditions other than those presented in this report be encountered during construction, the Client should notify our office so that these recommendations can be reviewed.

Soil conditions, by their nature, can be highly variable across a site. A contingency should be included in the construction budget to allow for the possibility of variations in soil conditions, which may result in modification of the design, and/or changes in the construction procedures.

It is noted that the recommendations outlined herein are considered 'preliminary' relative to the actual design, development and construction of proposed residences within the subject site. Further investigation and analyses may be required to support detailed design and construction of the proposed development.

This report has been prepared for the exclusive use of Martin Geomatic Consultants Ltd. and their designers for the specific application to the development described in this report. Any use that a third party makes of this report, or any reliance or decisions based on this report are the sole responsibility of those parties. This report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

We trust that this report satisfies your present requirements, and we look forward to assisting you in the completion of this project. Should you have any questions, please contact the undersigned at your convenience.

Yours truly,

Amec Foster Wheeler Environment & Infrastructure
A division of Amec Foster Wheeler Americas Ltd.

PROFESSIONAL ENGINEER ALBERTA JOHN LOBBEZOO Aug 22 2016

John Lobbezoo, P.Eng.
Senior Geotechnical Engineer

Co-Authored by:
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Geotechnical EIT

Attachments: Figure 1 Borehole Location Plan
Borehole Logs
Explanation of Symbols and Terms

APEGA PERMIT P04546

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amec foster wheeler

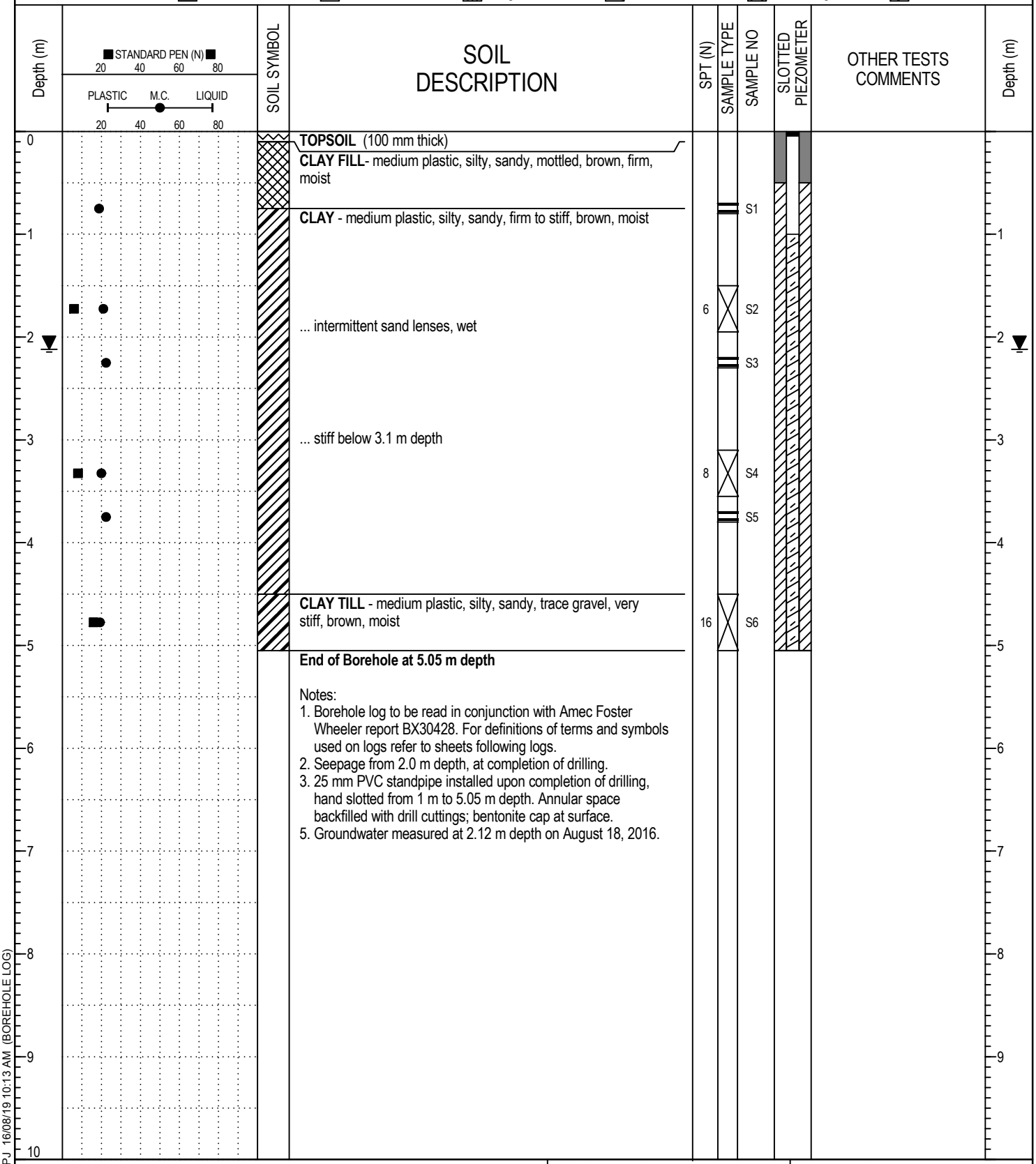
Martin Geomatics Consultants Ltd.

TITLE: BOREHOLE LOCATION PLAN	DWN BY: BJ	DATUM: NA	DATE: AUGUST 2016	
PROJECT: Proposed Rural Residential Subdivision SW1-9-21-W4M near Lethbridge, Alberta	CHK'D BY: JS	PROJECT NO: BX30428	FIGURE 1	
	SCALE: NTS			

PROJECT: Proposed Rural Residential Subdivision	DRILLER: Chilako Drilling Services Ltd.	BOREHOLE NO: **BH16-01**
CLIENT: Martin Geomatic Consultants Ltd.	DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA	PROJECT NO: BX30428
LOCATION: South of the proposed development area. Refer to Figure 1		ELEVATION: --

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

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



Notes:
1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30428. For definitions of terms and symbols used on logs refer to sheets following logs.
2. Seepage from 2.0 m depth, at completion of drilling.
3. 25 mm PVC standpipe installed upon completion of drilling, hand slotted from 1 m to 5.05 m depth. Annular space backfilled with drill cuttings; bentonite cap at surface.
5. Groundwater measured at 2.12 m depth on August 18, 2016.

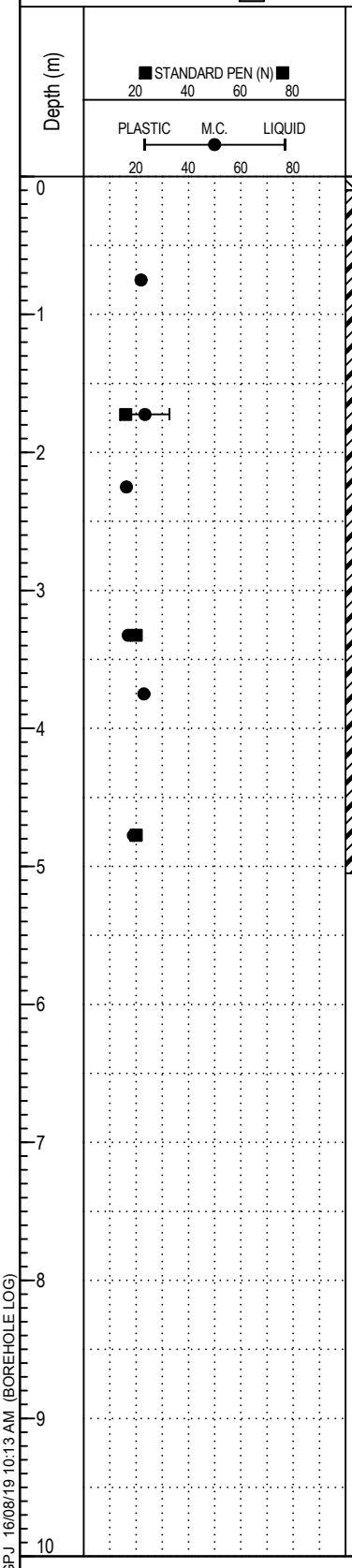
Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: SR	COMPLETION DEPTH: 5.05 m
	REVIEWED BY: JL	COMPLETION DATE: 3/8/16
		Page 1 of 1

BX30428.GPJ 16/08/19 10:13 AM (BOREHOLE LOG)

PROJECT: Proposed Rural Residential Subdivision	DRILLER: Chilako Drilling Services Ltd.	BOREHOLE NO: **BH16-02**
CLIENT: Martin Geomatic Consultants Ltd.	DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA	PROJECT NO: BX30428
LOCATION: Centre of the proposed development area. Refer to Figure 1		ELEVATION: --

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

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



Notes:
1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30428. For definitions of terms and symbols used on logs refer to sheets following logs.
2. Seepage from 1.5 m depth, at completion of drilling.
3. 25 mm PVC standpipe installed upon completion of drilling, hand slotted from 1 m to 5.05 m depth. Annular space backfilled with drill cuttings; bentonite cap at surface.
5. Standpipe was dry on August 18, 2016.

Amec Foster Wheeler Environment & Infrastructure	LOGGED BY: SR	COMPLETION DEPTH: 5.05 m
	REVIEWED BY: JL	COMPLETION DATE: 3/8/16
		Page 1 of 1

BX30428.GPJ 16/08/19 10:13 AM (BOREHOLE LOG)

PROJECT: Proposed Rural Residential Subdivision	DRILLER: Chilako Drilling Services Ltd.	BOREHOLE NO: **BH16-03**
CLIENT: Martin Geomatic Consultants Ltd.	DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA	PROJECT NO: BX30428
LOCATION: Proposed dugout/berm area. Refer to Figure 1		ELEVATION: --

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

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

Depth (m)	STANDARD PEN (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SPT (N)	SAMPLE TYPE	SAMPLE NO	OTHER TESTS COMMENTS	Depth (m)
0			**TOPSOIL** (100 mm thick)					0
			CLAY - medium plastic, silty, sandy, stiff, brown, moist to very moist					
1	■ ●			11		S1		1
			CLAY TILL - medium plastic, silty, sandy, trace gravel, coal & oxide inclusions, very stiff, brown, moist					
2	●					S2	PP = 2.0 kg/cm².	2
3								3
	●					S3	PP = 2.5 kg/cm².	
4								4
			End of Borehole at 4.5 m depth					
5			Notes: 1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30428. For definitions of terms and symbols used on logs refer to sheets following logs. 2. Borehole open and dry at completion of drilling. 3. Borehole backfilled with drill cuttings.					5
6								6
7								7
8								8
9								9
10								

BX30428.GPJ 16/08/19 10:13 AM (BOREHOLE LOG)

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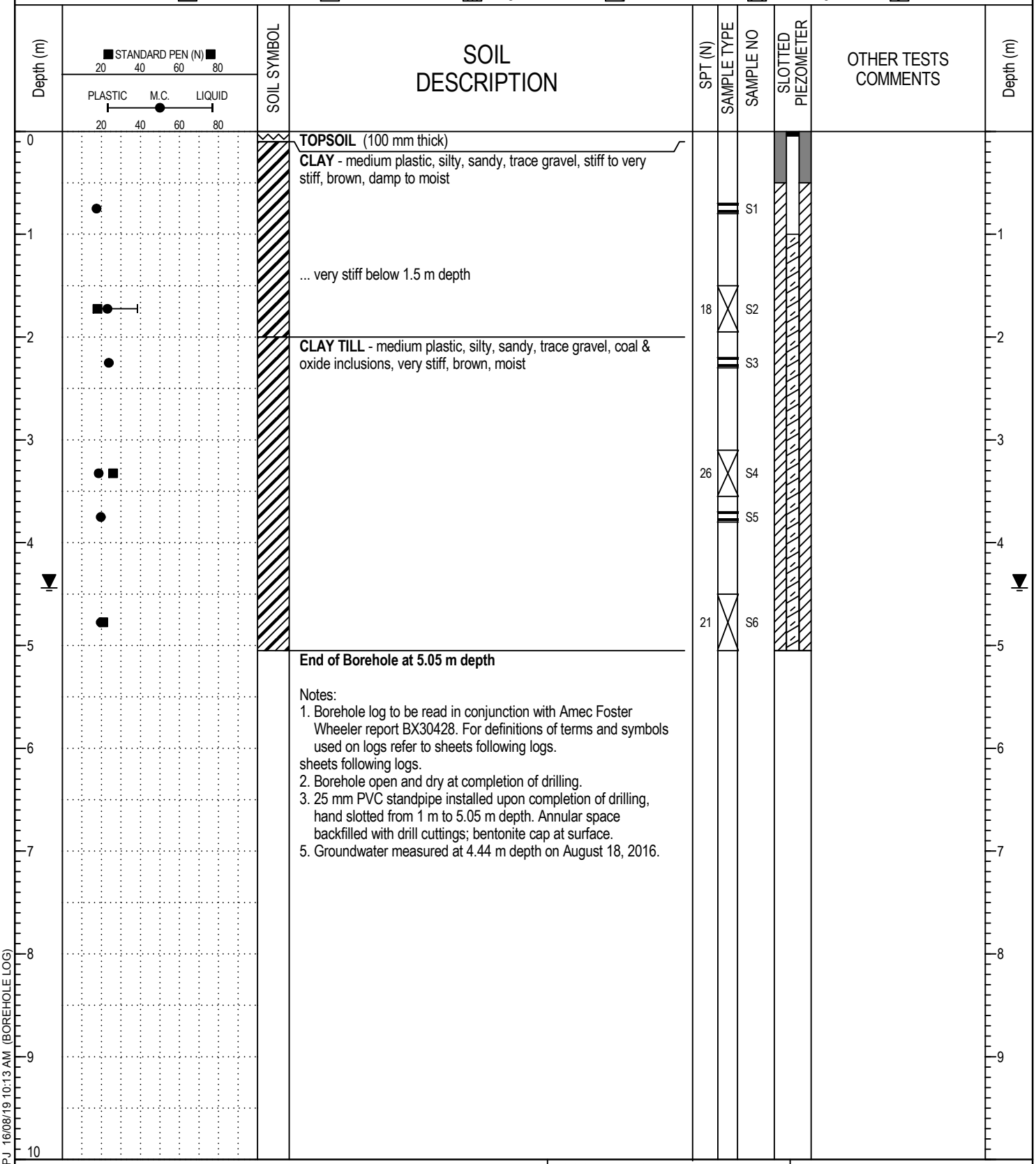
LOGGED BY: SR	COMPLETION DEPTH: 4.50 m
REVIEWED BY: JL	COMPLETION DATE: 3/8/16
	Page 1 of 1

PROJECT: Proposed Rural Residential Subdivision	DRILLER: Chilako Drilling Services Ltd.	BOREHOLE NO: **BH16-04**
CLIENT: Martin Geomatic Consultants Ltd.	DRILL/METHOD: Truck Mounted C-1150 Drill/ SSA	PROJECT NO: BX30428
LOCATION: North of the proposed development area. Refer to Figure 1		ELEVATION: --

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

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



TOPSOIL (100 mm thick)

CLAY - medium plastic, silty, sandy, trace gravel, stiff to very stiff, brown, damp to moist

... very stiff below 1.5 m depth

CLAY TILL - medium plastic, silty, sandy, trace gravel, coal & oxide inclusions, very stiff, brown, moist

End of Borehole at 5.05 m depth

Notes:
1. Borehole log to be read in conjunction with Amec Foster Wheeler report BX30428. For definitions of terms and symbols used on logs refer to sheets following logs.
sheets following logs.
2. Borehole open and dry at completion of drilling.
3. 25 mm PVC standpipe installed upon completion of drilling, hand slotted from 1 m to 5.05 m depth. Annular space backfilled with drill cuttings; bentonite cap at surface.
5. Groundwater measured at 4.44 m depth on August 18, 2016.

BX30428.GPJ 16/08/19 10:13 AM (BOREHOLE LOG)

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LOGGED BY: SR	COMPLETION DEPTH: 5.05 m
REVIEWED BY: JL	COMPLETION DATE: 3/8/16

EXPLANATION OF TERMS AND SYMBOLS

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

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

TEST DATA

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

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

*C	Consolidation test	*ST	Swelling test
D_R	Relative density	TV	Torvane shear strength
*k	Permeability coefficient	VS	Vane shear strength
*MA	Mechanical grain size analysis	w	Natural Moisture Content (ASTM D2216)
	and hydrometer test	w_l	Liquid limit (ASTM D 423)
N	Standard Penetration Test (CSA A119.1-60)	w_p	Plastic Limit (ASTM D 424)
N_d	Dynamic cone penetration test	E_f	Unit strain at failure
NP	Non plastic soil	γ	Unit weight of soil or rock
pp	Pocket penetrometer strength (kg/cm²)	γ_d	Dry unit weight of soil or rock
*q	Triaxial compression test	ρ	Density of soil or rock
q_u	Unconfined compressive strength	ρ_d	Dry Density of soil or rock
*SB	Shearbox test	C_u	Undrained shear strength
SO_4	Concentration of water-soluble sulphate	→	Seepage
		▼	Observed water level

* The results of these tests are usually reported separately

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

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

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

Relative Density and Consistency:

Cohesionless Soils		Cohesive Soils		
Relative Density	SPT (N) Value	Consistency	Undrained Shear Strength c_u (kPa)	Approximate SPT (N) Value
Very Loose	0-4	Very Soft	0-12	0-2
Loose	4-10	Soft	12-25	2-4
Compact	10-30	Firm	25-50	4-8
Dense	30-50	Stiff	50-100	8-15
Very Dense	>50	Very Stiff	100-200	15-30
		Hard	>200	>30

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

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

2 ”Canadian Foundation Engineering Manual”, 4th Edition, Canadian Geotechnical Society, 2006.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	COLOUR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			GP		RED	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{60})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
			SP		RED	POORLY GRADED SANDS, GRAVELLY 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 %	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L< 50%	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)	
		W_L< 50%	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDS OR SILTY SOILS		
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L< 30%	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS		
		30% <W_L< 50%	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		W_L> 50%	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS BELOW "A" LINE	W_L< 50%	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY	
		W_L> 50%	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBEROUS TEXTURE	

SPECIAL SYMBOLS

LIMESTONE		OILSAND	
SANDSTONE		SHALE	
SILTSTONE		FILL (UNDIFFERENTIATED)	

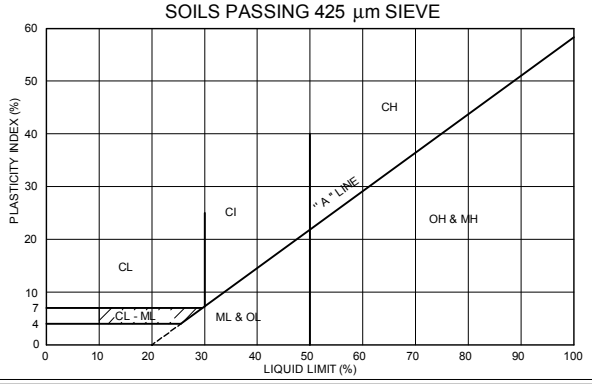
SOIL COMPONENTS

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

OVERSIZED MATERIAL

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

PLASTICITY CHART FOR SOILS PASSING 425 µm SIEVE



NOTES:

1. ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD A.S.T.M. E.11
2. COARSE GRAIN SOILS WITH 5 TO 12% FINES GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5 AND 12% FINES.

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