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CHIN GROUPED COUNTRY RESIDENTIAL AREA STRUCTURE PLAN

MARCH 2024

DOUGLAS J. BERGEN & ASSOCIATES LTD.
ARCHITECTURAL TECHNOLOGY

CHIN GROUPED COUNTRY RESIDENTIAL AREA STRUCTURE PLAN

March 2024

Prepared for
Mr. Peter Klassen
Chin, Alberta

Prepared by
Douglas J. Bergen & Associates Ltd.
HV Consulting Ltd.
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1. INTRODUCTION

1.1. PURPOSE OF THE PLAN

The purpose of the Chin Meadows Area Structure Plan (ASP) is to set out a concept for planning and proposed guidelines for the future subdivision and development of the lands described in this document. The plan has been prepared to compliment the proposed amendment to the Lethbridge County Land Use Bylaw No. 1404 to change the zoning of the subject lands from Rural Urban Fringe (RUF) to Grouped Country Residential (GCR) and Rural General Industrial (RGI).

1.2 LOCATION AND BACKGROUND

(an excerpt from the Lethbridge County – Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission)

The subject property is located immediately north of the Hamlet of Chin. It is legally described as Blocks A, B & E on Plan 899AA. See **Figure 1.0 County Map and Figure 2.0 Land Use Districts**.

The Hamlet of Chin is located approximately 17 miles (27 km) east of the City of Lethbridge, ½ mile (0.8 km) north of Highway 3, situated between the Towns of Coaldale and Taber. Chin is located on the very eastern border of Lethbridge County with the Municipal District of Taber western boundary beginning immediately east of the hamlet. Chin currently encompasses approximately 19.7 acres (7.0 ha) of land within its designated boundary. The hamlet basically functions as a small urban residential area for the surrounding agricultural area. Chin is also located adjacent to the McCain Foods Ltd. potato processing plant, which is one of the larger industrial processing developments in Lethbridge County.

Chin was initially founded as a settlement area in the early 1900s due to both agriculture and the Canadian Pacific Railway (CPR) line being established in close proximity. The name Chin was derived from the native Blackfoot language of the Blackfoot First Nations who historically held a significant presence in southern Alberta. The CPR and the Alberta Railway and Irrigation Company registered the original subdivision site plan in 1910 (Plan 899AA) for lands north of the rail line. The CPR appeared to have grand expectations for the community to grow, as the original plan covered an area twice as large as what exists today. The north half of the original Chin subdivision plan was never developed for hamlet use, and in 1964 was consolidated into one larger block (Block E) and amalgamated with adjacent Blocks A and B into a single title. **Figure 3.0** illustrates the current hamlet layout and lot/block configuration in respect of the 1964 consolidated plan.

LETHBRIDGE COUNTY – SUBJECT LOCATION MAP

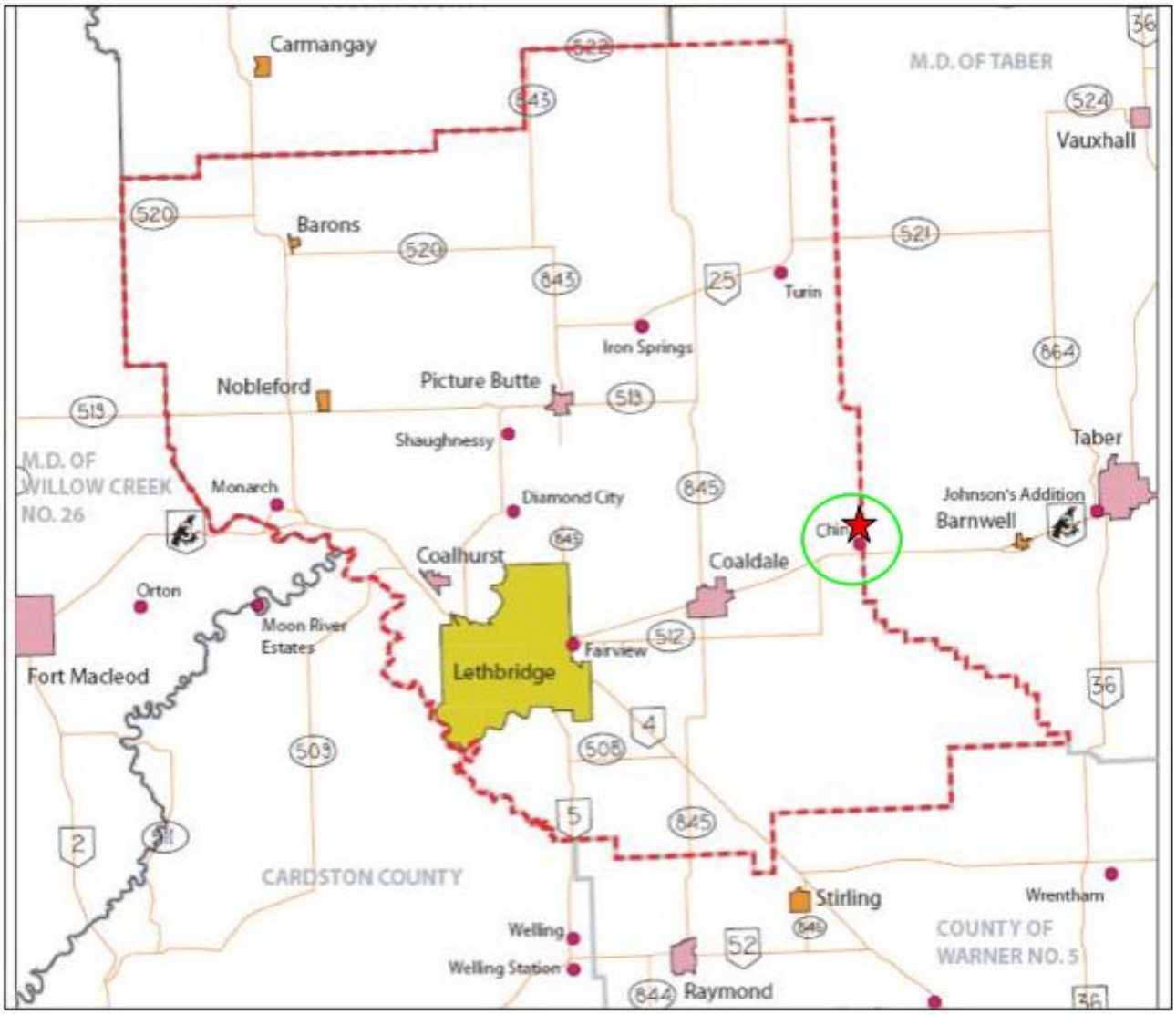


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 1.0 – County Map

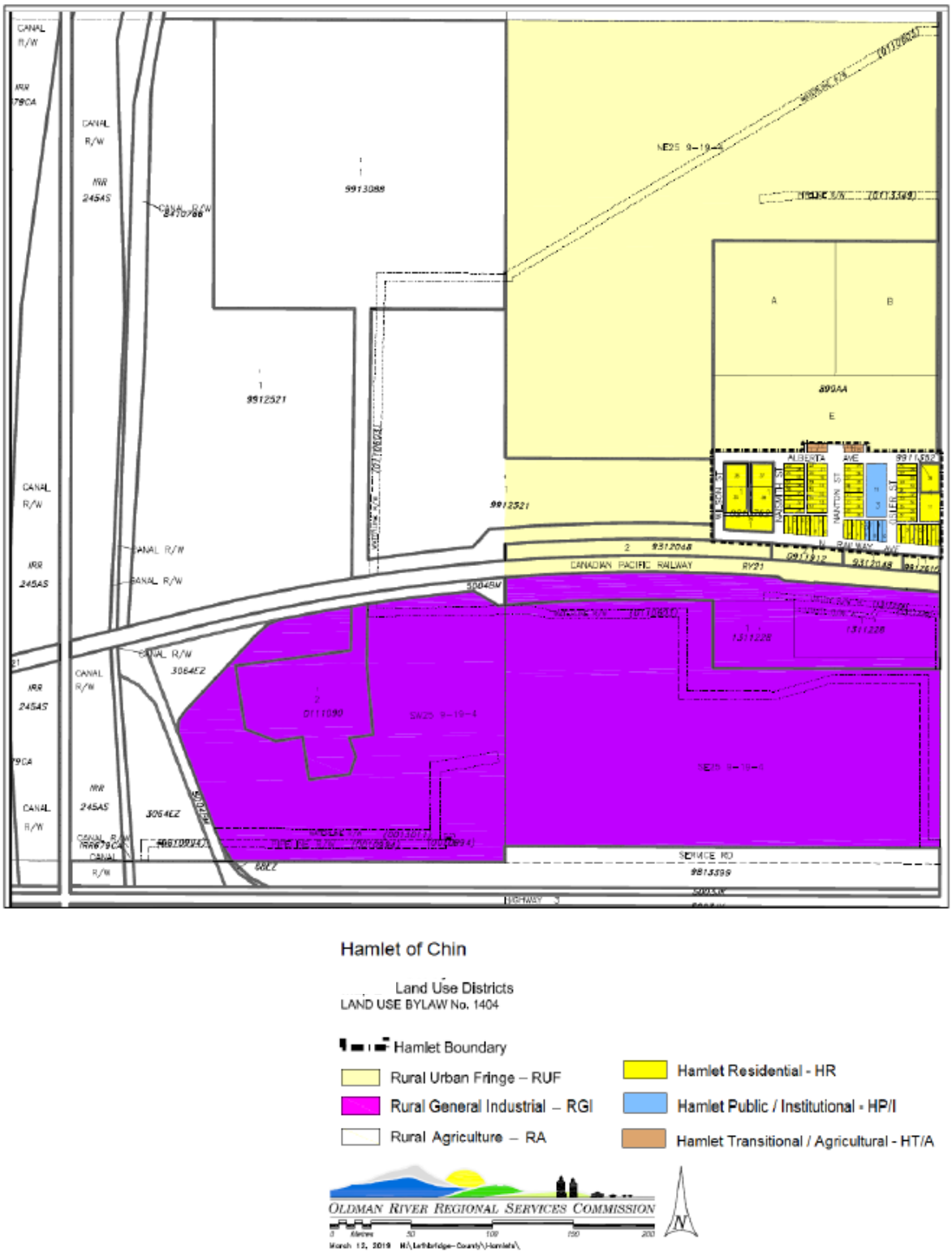


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 2.0 – Land Use Districts

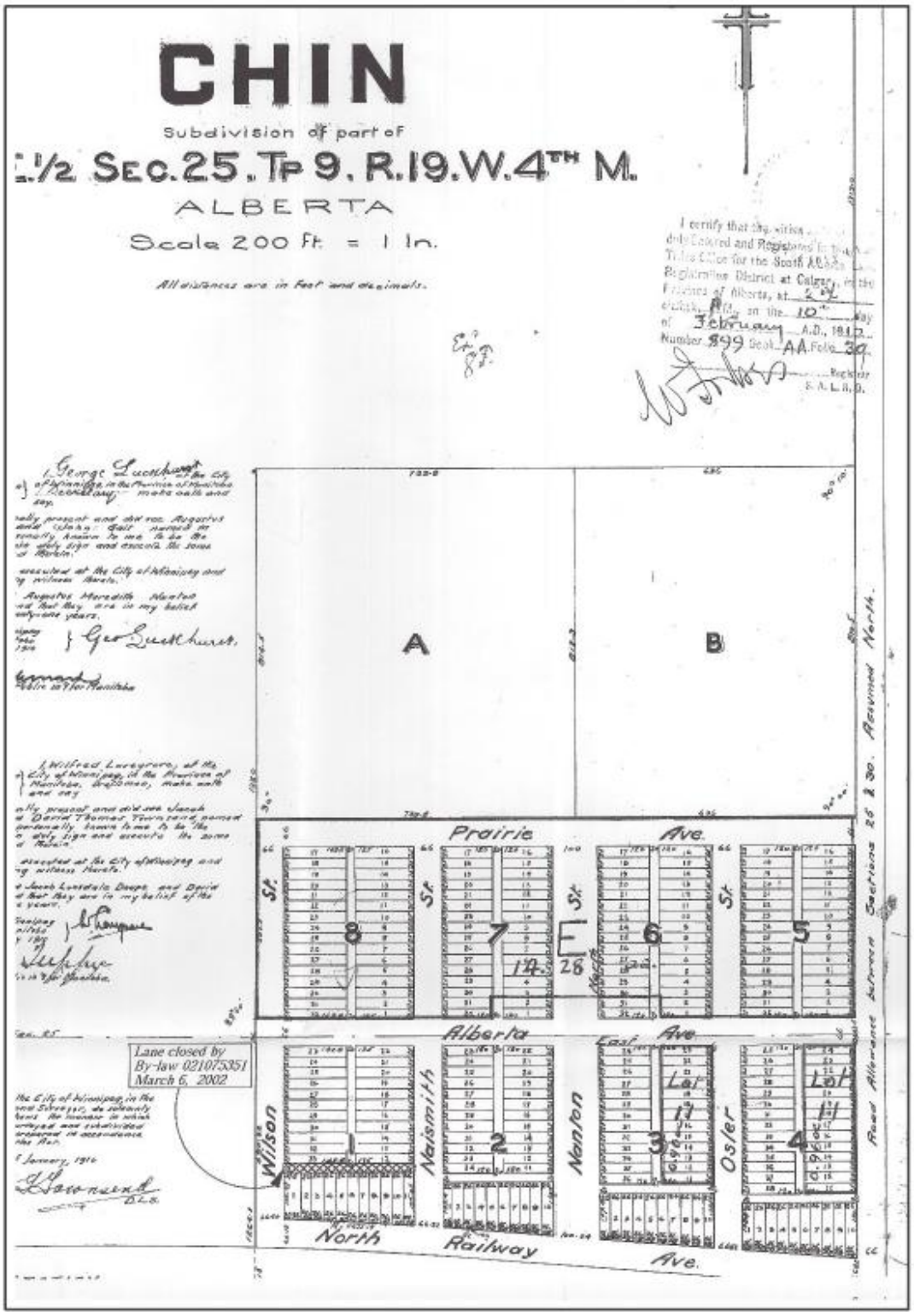


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 3.0 – Original Subdivision Plan for Chin

Chin never grew as originally anticipated and today it basically provides for a rural lifestyle within a small urban community setting. After a slight reduction in population size that occurred during the mid-century, the hamlet has experienced significant population growth over the last two decades. Population increases have included three census periods of 20% growth or higher, including one of 52.1% between 1996 and 2001. It is noted that these growth percentages appear high as the population itself is quite small at approximately 62 people. Chin remains a viable rural residential living option, especially as Taber and Coaldale continue to experience significant growth in the region.

Today, the hamlet is situated in close proximity to several large industrial operations, such as McCain Foods Ltd. and an anaerobic digester facility located adjacent in the MD of Taber, which help provide economic viability to the Chin area. This opportunity is recognized by the current land owner and therefore the preparation of this Area Structure Plan.

1.3 APPROVAL PROCESS

This Area Structure Plan will be submitted to the Lethbridge County in support of an application to amend the Lethbridge County Land Use Bylaw. An application will be submitted for a land use amendment from Rural Urban Fringe (RUF) to Grouped Country Residential (GCR) and Business Light Industrial (BLI). The Area Structure Plan application will be circulated in accordance with the Lethbridge County policies seeking comment from the appropriate authorities including:

1. The Oldman River Regional Services Commission
2. St. Mary's Irrigation District
3. Alberta Environment and Parks
4. Alberta Agriculture Food and Rural Development
5. The Chinook Regional Health Authority
6. Municipal District of Taber

Lethbridge County council will evaluate the comments received from the above mentioned authorities prior to rendering a decision on the application for re-designation. If the Area Structure Plan and rezoning applications are approved, the applicant will have a framework from which to make application for the subdivision of the various lots. A Development Agreement will be entered into between the Lethbridge County and the applicant to ensure orderly and quality infrastructure as directed by the agreement.

1.4 LEGISLATIVE FRAMEWORK

1.4.1 The Municipal Government Act

The Municipal Government Act (MGA) is the provincial legislation which regulates municipal land use planning. This legislation sets out the requirements for two documents which this proposal is subject to: The Lethbridge County Municipal Development Plan and the Land Use Bylaw.

1.4.2 The Municipal Development Plan

The Lethbridge County Municipal Development Plan (MDP) documents broad policies relative to development and growth within the County. This planning document pays particular attention to the desire of the County to maintain a strong agricultural base.

The subject property is of a size and scale that does not allow for a viable farming operation and therefore is suitable for consideration of reclassification and further subdivision. This Area Structure Plan is intended to provide the information required by the MDP to enable council to make an informed decision on the application.

1.4.3 Subdivision Regulations

The MGA outlines the requirements for the creation of new parcels of land in the County. The application for subdivision of the new lots as laid out in this Area Structure Plan will be submitted to the Oldman River Regional Services Commission (ORRSC) for processing.

1.4.4 Land Use Bylaw

The Lethbridge County Land Use Bylaw No. 1404 recognizes the area of the proposed development as Rural Urban Fringe (RUF). The purpose of this classification is by in large to protect land for agricultural purposes and prevent fragmentation of parcels that may be considered in future annexations of the Hamlet of Chin. The proposed re-designation of the subject land is intended to be Grouped Country Residential (GCR) for the 12 new residential lots as well as the existing residential parcel. The existing tire shop site would also be considered for reclassification to Business Light Industrial (BLI). See **Figure 8.0 – Subdivision Layout**.

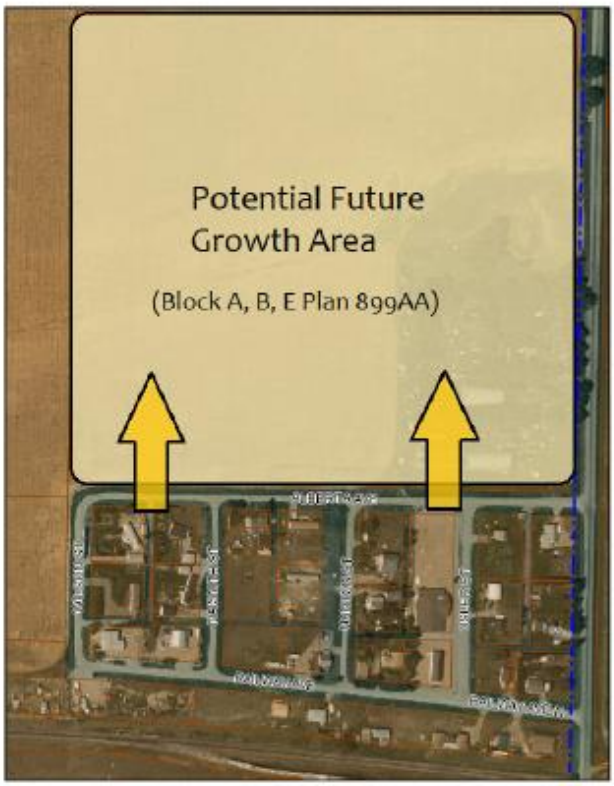
1.5 JUSTIFICATION

The Hamlet of Chin Growth Study approved by a Resolution of County Council in June of 2020 makes way for the further subdivision of Blocks A, B & E. The overall parcel does not have St. Mary's River Irrigation District irrigation rights and is of an odd shape. Small irregular parcels without irrigation rights are greatly compromised as viable farming operations.

Part 7 Paragraph 3 of the Chin Growth Study recognizes that "future hamlet growth should be directed to land to the north (Blocks A, B and E, Plan 899AA)." See **Figure 4.0 for Recommended Growth Direction**.

This diminished value as agricultural land gives way to a higher and better use of the property as a residential development. Small acreage parcels are a viable option for consideration. This proposed use is prevalent in fringe areas of many County communities with the Hamlet of Chin being no exception. There is increased benefit to the County should this proposal be approved given the land value would increase making way for a greater tax base.

The owner believes that the proposal outlined in this ASP is in keeping with the Municipal Development Plan as well as the Hamlet of Chin Growth Study and therefore offers support for further subdivision.



Map 4A

Map 4B

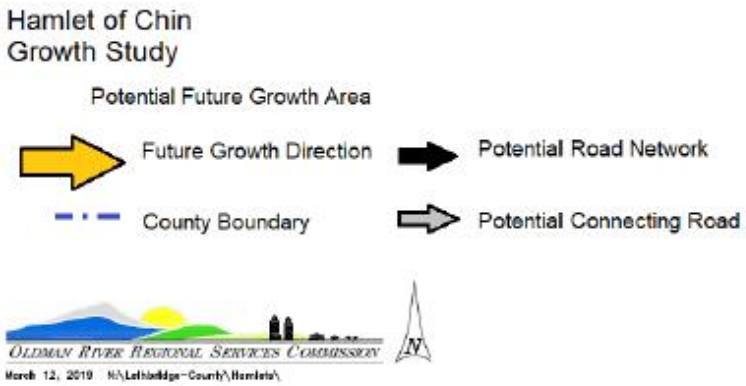


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 4.0 – Recommended Growth Direction

2. GOALS

2.1 GOALS

The principal goals of the Chin Meadows Area Structure Plan are:

1. To provide the information required to support the further subdivision of the land;
2. To establish a framework for the future development of the subject parcels;
3. To set out the access, servicing, and development standards that must be met in the development of the lands.

3. PLAN AREA

3.1 SITE ANALYSIS

3.1.1 Site Location

The parcels of subject land are located immediately north of The Hamlet of Chin in Lethbridge County. The proposed subdivided area is 'L' shaped with an existing homestead in the southeast corner. The 'L' shaped portion makes up some 32 acres of the original 41 acre parcel. See **Figure 5.0 – Aerial Photo**.

3.1.2 Existing Land Use

The property is currently farmed as dryland with a grain crop. The lack of irrigation rights prohibits strong consistent yields and therefore the subject 32 acres do not support a viable farming operation.

3.1.3 Topography and Site Characteristics

The property is virtually flat with minimal slopes from the north and south boundary to the centre of the property. The high point along the northern property line is at elevation 847.95 sloping to a low point of 846.84 near the centre. The high point along the southern boundary is at elevation 847.71. The natural low point runs east to west at the midpoint of the parcel. See **Figure 6.0 - Spencer Geometrics Topographical Survey**.

The proposed area to be subdivided is void of any vegetation or site features. The existing farmstead is bounded by a mature shelter belt with several buildings including a residence and shop.

The soils are generally comprised of a 100 mm layer of topsoil on top of low plastic clay and clay till. A geotechnical study was conducted on the site by BDT Engineering Ltd. to evaluate the property for its suitability for residential development and the building of roads. The results of the study support the proposed country residential development. The engineering document is available in **Appendix A – Geotechnical Investigation.**

3.1.4 Environmental, Historical, and Archaeological Significance

The County provided the applicant with a copy of the "Environmentally Significant Areas in the Oldman Region, County of Lethbridge" (February 1987) document. This study provides valuable information relative to this site.

Figure 5.0 – Aerial Photo

Figure 6.0 – Spencer Geometrics
Topographical Survey

The figures contained in the study revealed that the subject property is outside of any of the noted sensitive areas. The site has historically been used for agriculture and is located away from the edge of the river valley which comprises the most archaeologically significant area. See **Figure 7.0 – Environmentally Significant Areas.**

3.1.5 Opportunities and Constraints

3.1.5.1 Opportunities

This property offers an excellent opportunity for rural residential living. It's proximity to Coaldale offers convenience for daily necessities as well as a short bus ride for children attending schools.

There is increasing demand for labour in the immediate area given the expansion of the McCain's food plant to the west as well as the expanded irrigation acres by St. Mary's River Irrigation District.

Vital utilities such as natural gas and electricity are readily available adjacent to the property which will facilitate servicing convenience.

3.1.5.2 Constraints

The site has limited agricultural viability given the irregular shape coupled with lack of irrigation access.

Access to Potable Water

The Hamlet of Chin does not have sanitary sewer infrastructure which limits the residential parcel size to a minimum of 2.0 acres for future development in order to accommodate a septic field/mound system.

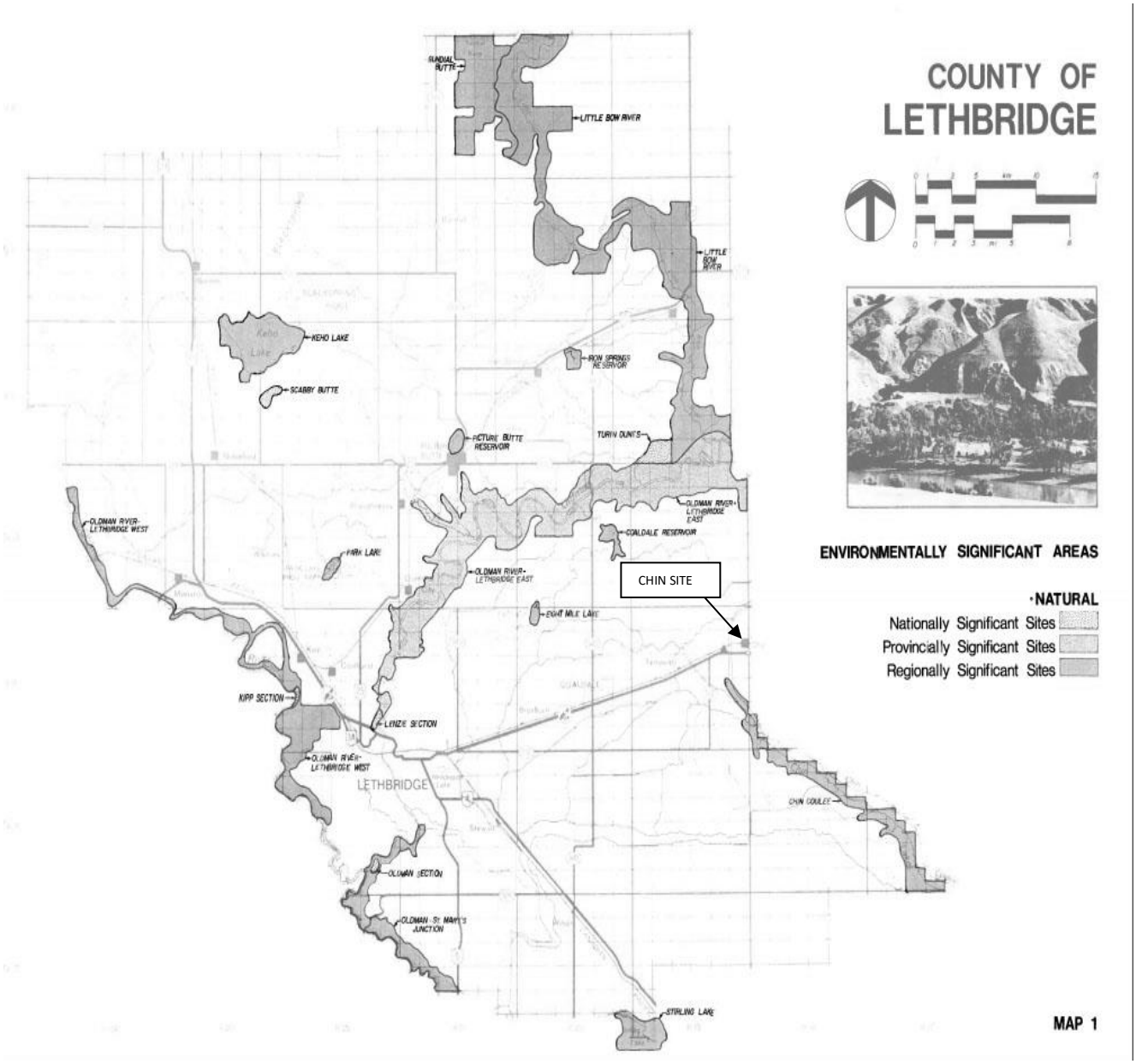


Diagram sourced from Environmentally Significant Areas in the Oldman River Region, County of Lethbridge, February 1987; prepared by Cottonwood Consultants Ltd.

Figure 7.0 – Environmentally Significant Areas

4. PROPOSED LAND AND DEVELOPMENT CONCEPT

4.1 DEVELOPMENT CONCEPT

The concept for the proposed lot layout is illustrated in **Figure 8.0 - Subdivision Layout**. The development proposal consists of 13 lots. Lot number 1 will be occupied by the Southern Alberta Christian Learning Centre as per Development Permit # 2023-112 and will remain as currently zoned – Rural Urban Fringe (RUF). See **Figure 9.0 School Development Permit.**

The remainder of the proposed residential lots will be zoned Grouped Country Residential (GCR) as governed by the Lethbridge County Land Use Bylaw. A gravel surface road is proposed to connect Alberta Ave with Range Road 19-0. The existing tire shop site would also be rezoned from Rural Urban Fringe (RUF) to Business Light Industrial (BLI).

4.2 CROWN LOT CONSOLIDATION

The CPR and Alberta Railway and Irrigation Company registered four lots on the north side of Alberta Ave. with the legal descriptions:

Lot 1	Block 7	Plan 899AA
Lot 2	Block 7	Plan 899AA
Lot 31	Block 6	Plan 899AA
Lot 32	Block 6	Plan 899AA

The lots are currently owned by the Crown and front onto Nanton St. See **Figure 10.0 – Hamlet Plan with Existing Lot Layout**. In the event that this Area Structure Plan is adopted, steps will be taken to have these lots turned over to Lethbridge County and consolidate them with proposed lot #13 at the appropriate cost.
A partial road closure of Nanton St. as well as the adjacent lane ways will also need to be undertaken.

4.3 DEVELOPMENT AGREEMENT

As stipulated by the Land Use Bylaw, the Developer will enter into a Development Agreement with the Lethbridge County. The development agreement will outline specific conditions for development of the site. It is expected that these will include:

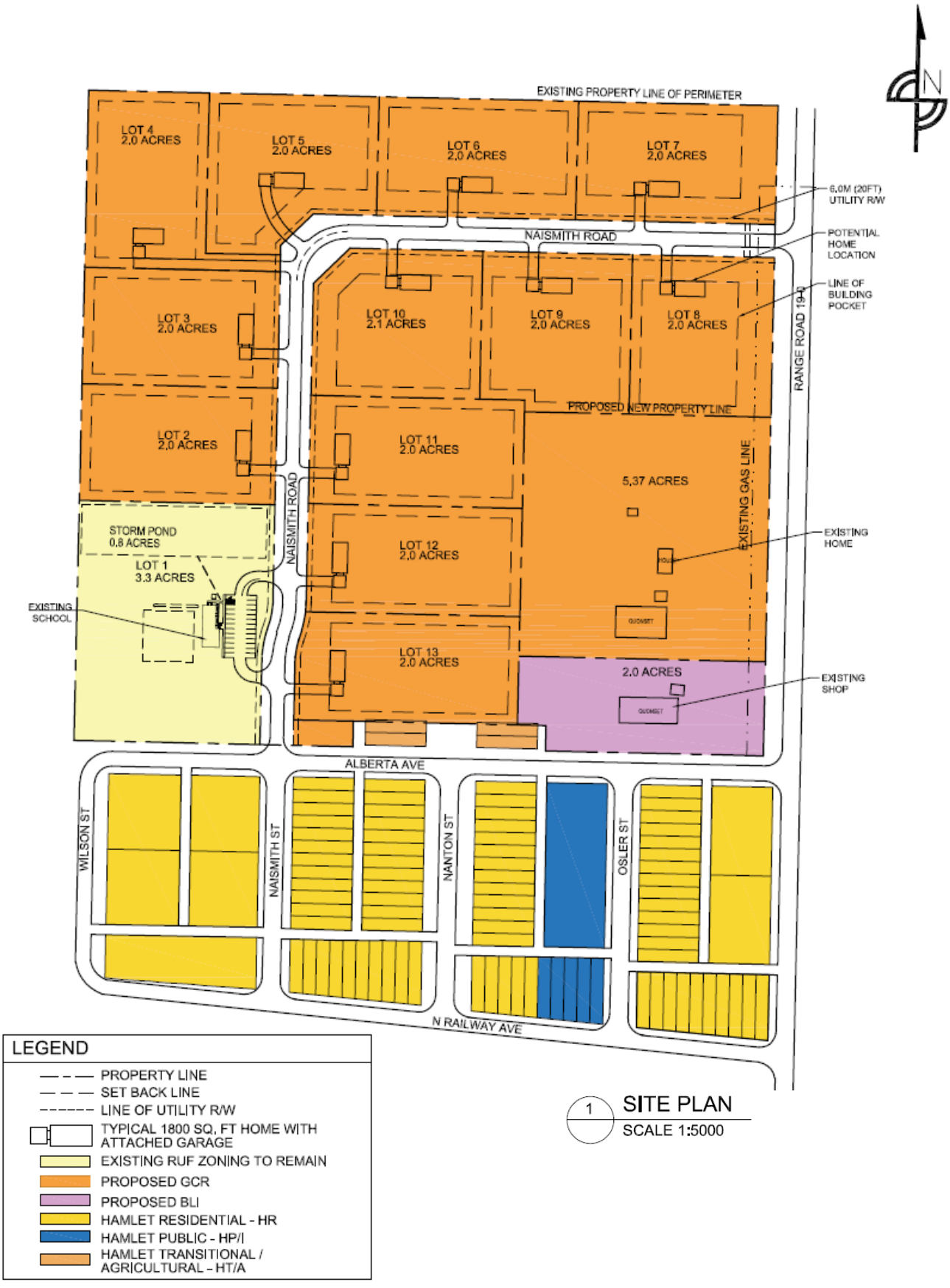


Figure 8.0 – Subdivision Layout

LETHBRIDGE COUNTY

Lethbridge County
#100, 905 - 4th Ave S
Lethbridge, AB T1J 4E4
403-328-5525

FORM B

LETHBRIDGE COUNTY
DEVELOPMENT PERMIT
Pursuant to Land Use Bylaw No. 1404

Development Permit No: 2023-112

Applicant: Southern Alberta Christian Learning Centre, Box 1033, Coaldale, Alberta, T1M 1M8

In respect of works consisting of: Public / Institutional (School - 4,000 sq. ft.) with Accessory Structure (Playground – 14,400 sq. ft.)

On land located at: Plan 899AA Block A (94048 RR 190) and as described on plans submitted by the applicant.

This permit refers only to works outlined in Development Application No. 2023-112 and is **subject to the conditions contained herein**:

- The School and Playground shall be located as per the submitted site plan.
- The applicant shall enter into a Dust Control Agreement to apply Dust Control to Alberta Avenue on an annual basis.
- The area surrounding the playground shall be fenced, to the satisfaction of the Development Authority, to ensure that users do not present a hazard to traffic.
- Any signage on this parcel shall require a new Development Permit.
- Approval of all Building Permits (includes Plumbing, Electrical, Gas permits, and Private Sewage Disposal Systems) must be obtained ***prior*** to commencement. Building Permits are obtained through **Park Enterprises**, #10, 491 W.T. Hill Blvd. South, Lethbridge. Phone - (403) 329-3747.
- Any planned work in the County right-of-way (driveway, approaches, etc.) requires separate approval from the County Director of Public Operations (call 403-328-5525).

INFORMATIVE: Alberta Transportation and Economic Corridors has provided comment on this development, stating that a Roadside Development Permit is required for this development. See attached correspondence for details.

Date of Decision: July 25, 2023

Appeal Period Expiry Date: August 15, 2023

The above-mentioned permit is subject to an appeal period. Any person affected by a decision regarding a Development Permit may file an appeal with the Development Appeal Board within twenty-one (21) days of the date of decision (section 686 of the Municipal Government Act).

Figure 9.0 – School Development Permit

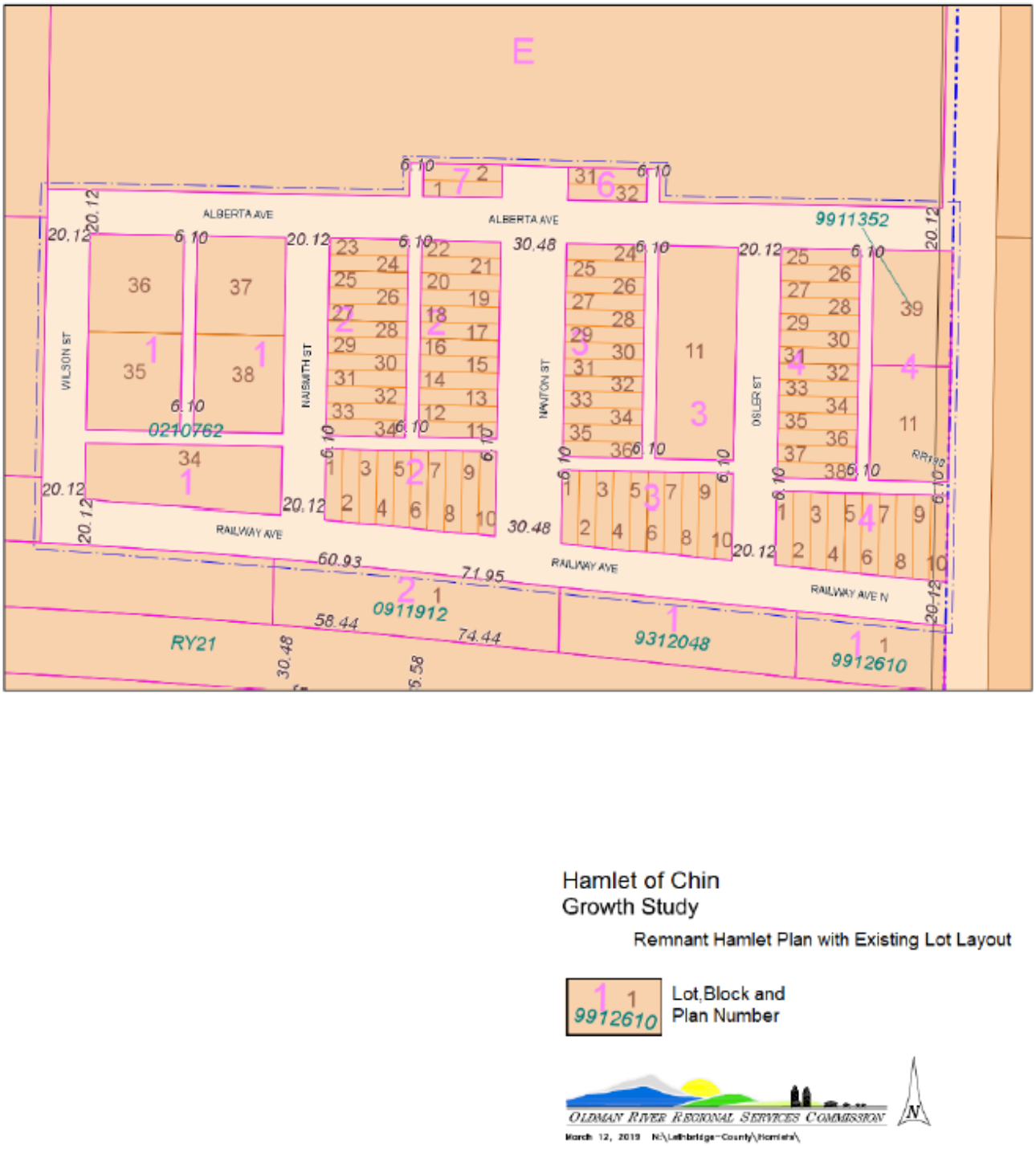


Diagram sourced from Lethbridge County - Hamlet of Chin Growth Study, June 2020; prepared by Lethbridge County and Oldman River Regional Services Commission

Figure 10.0 – Hamlet Plan with Existing Lot Layout

- Standards and requirements for municipal infrastructure that will be constructed by the Developer and turned over to the County.
- Any other improvements deemed necessary to support the development.
- Timelines for completion of Developer-led improvements.

4.4 BUILDING SETBACKS

The useable building envelope within each lot will depend on the setbacks imposed by the County Land Use Bylaw and are summarized in the following table:

Criteria	**County Land Use Bylaw**
Building setback from centreline of a rural road	38.1 m (125 ft)
Front yard setback	15.2 m (50 ft)
Rear yard setback	6.1 m (20 ft)

Where Range Road 19-0 is considered a rural road, the building setbacks imposed by Schedule 6 of the Land Use Bylaw will govern the adjacent boundary of the proposed lots. The proposed front yard setback of the lots will be 15.2 m (50 ft). See **Figure 8.0 – Subdivision Layout**.

Shallow utility easements will be registered against the property to protect these installations. No building development will occur on these easements.

4.5 MUNICIPAL RESERVES

Municipal reserve will be owing on the parcel as cash in lieu of land.

4.6 DESIGN POPULATION AND DENSITY

For the purpose of this Area Structure Plan, the development population has been estimated using an assumed population of 3 persons per household (pph) and a total of 14 new residential lots. Therefore, the ultimate population for the development is:

14 lots x 3 pph = 42 persons

The overall population density is calculated by:

42 persons/11.33 = 3.7 persons per ha

The school will be occupied by some 70 students and 6 teachers from 8:30 am – 4:30 pm, Monday to Friday. Students will arrive and depart via school bus. Staff will travel to and from school by car.

4.7 PHASING

This development will be serviced and built out as one single phase. All improvements will be constructed and installed in a timely fashion as per the terms in the development agreement, should approval for this ASP be granted.

5. PROPOSED INFRASTRUCTURE

5.1 TRANSPORTATION

The developer is proposing that all 13 lots be serviced via a new gravel surface road with access off of RR 19-0 from the east and Alberta Ave from the south. New approaches for the access road will be constructed to meet Lethbridge County criteria. Culverts will be sized to meet County standards to ensure proper drainage along each side of the road. See **Figure 11.0 – Road Design.**

5.1.1 Traffic Generation

ISL Engineering has provided a Traffic Memo which reports that traffic generated from this proposed development will not negatively impact the existing infrastructure and further that current roads have the capacity for the additional traffic. See **Appendix B – Trip Generation Letters for both 19-0 and Highway 3 corridor.**

5.1.2 School Bus Routes

Access for school buses is provided by Alberta Ave and Range Road 19-0 which is located in the Municipal District of Taber.

5.1.3 Parking

It is assumed that all parking requirements will be satisfied on the individual lots.

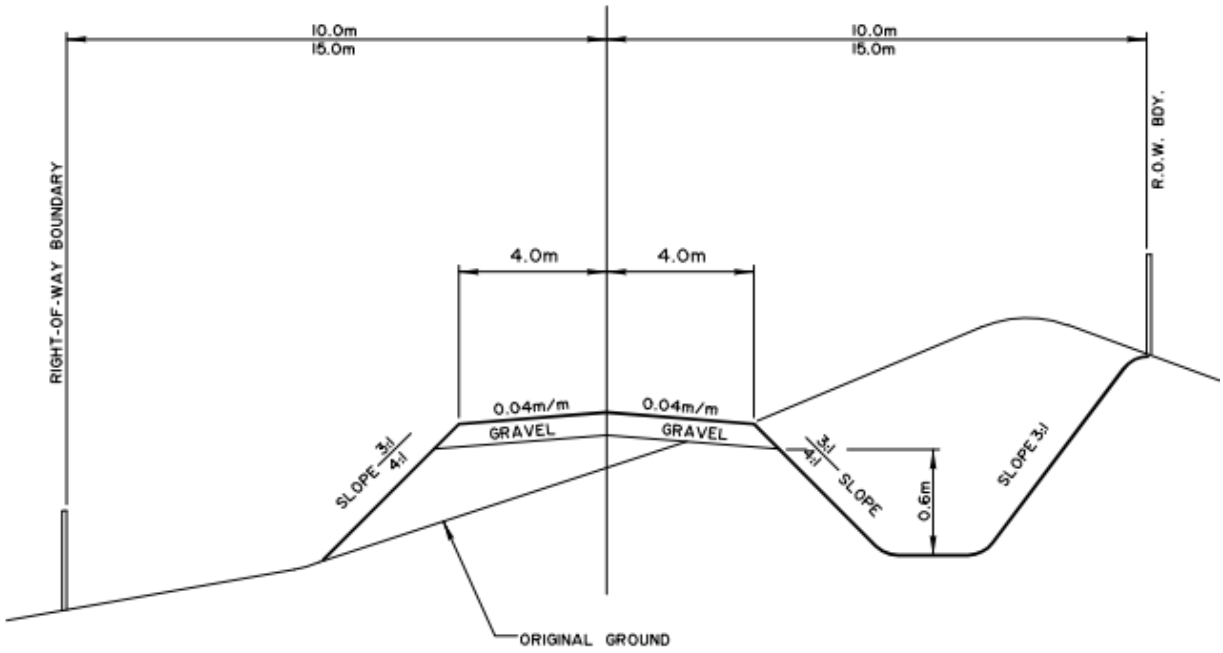
5.1.4 Range Road 19-0

The Municipal District of Taber was invited to make comment on this proposed development since it is adjacent to their boundary and Range Road 19-0 is in the Municipal District of Taber. On February 5th, 2024, the MD of Taber Development Authority made the following.

RESOLUTION #: 2024-0-036

That the Subdivision and Development Authority authorizes Administration to respond to the Lethbridge County advising Lethbridge County ensure the following are addressed within the proposed Area Structure Plan: Chin Grouped Country Residential:

- No additional approaches will be permitted off of Rge Rd 19-0
- Require a minimum 15m radius on all intersecting roads to Rge Rd 19-0



SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
8.0	20.0 - 30.0	4:1	3:1	3:1	3:1	300	0.08	7.0

NOTES:

1. IF ADDITIONAL RIGHT-OF-WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT, OTHERWISE PURCHASE.

LETHBRIDGE COUNTY	TITLE: GRAVEL ROAD STANDARD CROSS–SECTION WITHIN A SUBDIVISION DEVELOPMENT	SCALE: N.T.S DATE: SEPTEMBER 2019 STD. DWG NO. G–114 APPROVED BY: DIRECTOR OF MUNICIPAL SERVICES

Diagram sourced from Lethbridge County – Engineering Guidelines & Minimum Servicing Standards, September 2019; prepared by WSP

Figure 11.0 Road Design

Access to all of the proposed lots will be provided via the proposed new Naismith Street which eliminates any need for additional access points into Range Rd 19-0. The intersection of Naismith Street and RR 19-0 will have 15.0m radius surface. This Area Structure Plan therefore supports the comments from the MD of Taber.

5.2 MUNICIPAL SERVICING

5.2.1 Potable Water Supply

It is envisioned that domestic potable water will be supplied to the lots in one or a combination of the following 3 alternatives:

1. Cisterns could be installed below grade or within the basement of the homes as a vessel to store water. Potable water would be delivered by truck.
2. The Hamlet of Chin is serviced by the County of Lethbridge Rural Water Association. The association has acknowledged that the system is currently at capacity and that no further units are available in the foreseeable future. See **Figure 11.a - County of Lethbridge Rural Water Association letter**. The developer is providing a 10.0m (32'-10") utility right of way at the front of each lot to allow for future installation of a potable water pipeline should capacity become available.

It should be noted that all of the proposed lots are conditionally sold to buyers who are in agreement with cisterns as the method of providing potable water.

5.2.2 Domestic Wastewater

Domestic wastewater will be managed by means of individual on-site wastewater treatment systems for each lot. The geotechnical investigation completed by BDT Engineering Ltd. (attached as **Appendix A – Geotechnical Investigation**) and the report by Osprey Engineering Ltd. (**See Appendix C – Osprey's Septic Report**) confirms the feasibility of individual on-site wastewater treatment systems and provides general recommendations for their design and construction. Lot purchasers will be responsible for the installation of on-site wastewater treatment systems in accordance with the Alberta Private Sewage Systems Standard of Practice (2021).

RE: County of Lethbridge Rural Water Association Availability of Units in Chin

O

Sid Bilcik via colrwa.onmicrosoft.com Thu, Dec 7, 11:55 AM (13 days ago)

to Douglas

Hi Doug,
As to our conversation, the County of Lethbridge Rural Water Association currently does not have any water units available anywhere in our system.
I can not speculate if there will be any units available or upgrades in the future.

Sid Bilcik
Manager
County of Lethbridge Water Association
403-380-9791

Figure 11.a COLRWA Letter

5.2.3 Storm Water Drainage

Storm water drainage will be managed on site via a system of dedicated drainage swales which convey storm water to a dedicated storm pond. The grass swales will be located at the natural low point along the south boundary of the lots located central to the development. See **Figure 12.0b (Appendix F) Preliminary Roadway & Drainage Design.** These swales will be graded toward the storm pond at the westerly boundary of the site and protected by an easement to ensure County control. Areas of the parcel that currently naturally store storm water will be filled to prevent ponding in those areas.

The storm pond will be registered as a Public Utility lot in favor of the County. Excess drainage overflowing out of the existing ponding areas during major rainfall events will discharge to the Chin Reservoir via natural channels as per pre-development conditions. See **Appendix D – Osprey's Storm Water Report**

There was no groundwater detected by the Geotechnical investigation which included five boreholes drilled to a depth of 5.0 metres. (see **Appendix A – Geotechnical Investigation**) Excavation and soils logs performed by Osprey Engineering do not indicate continued or frequent saturation of the natural depression areas. The proposed development does not impact runoff to a measurable degree.

The school site and the new roadway both require fill material. It is proposed to excavate a pond with side slopes of 5H:1V similar to a dry pond excavation. A pad will be provided to install a pump to de-water the pond when necessary. Discharge will be directed to grassed areas adjacent to the existing swale outlet.

All drainage areas will be protected by caveat, easement or right-of-way as required. Buildings adjacent to the existing and proposed drainage swale should be constructed with main floor and entrances above the 100-year maximum depth of ponding (elevation of 847.00m). The storm water plan will be formalized with the detailed engineering should this ASP be adopted.

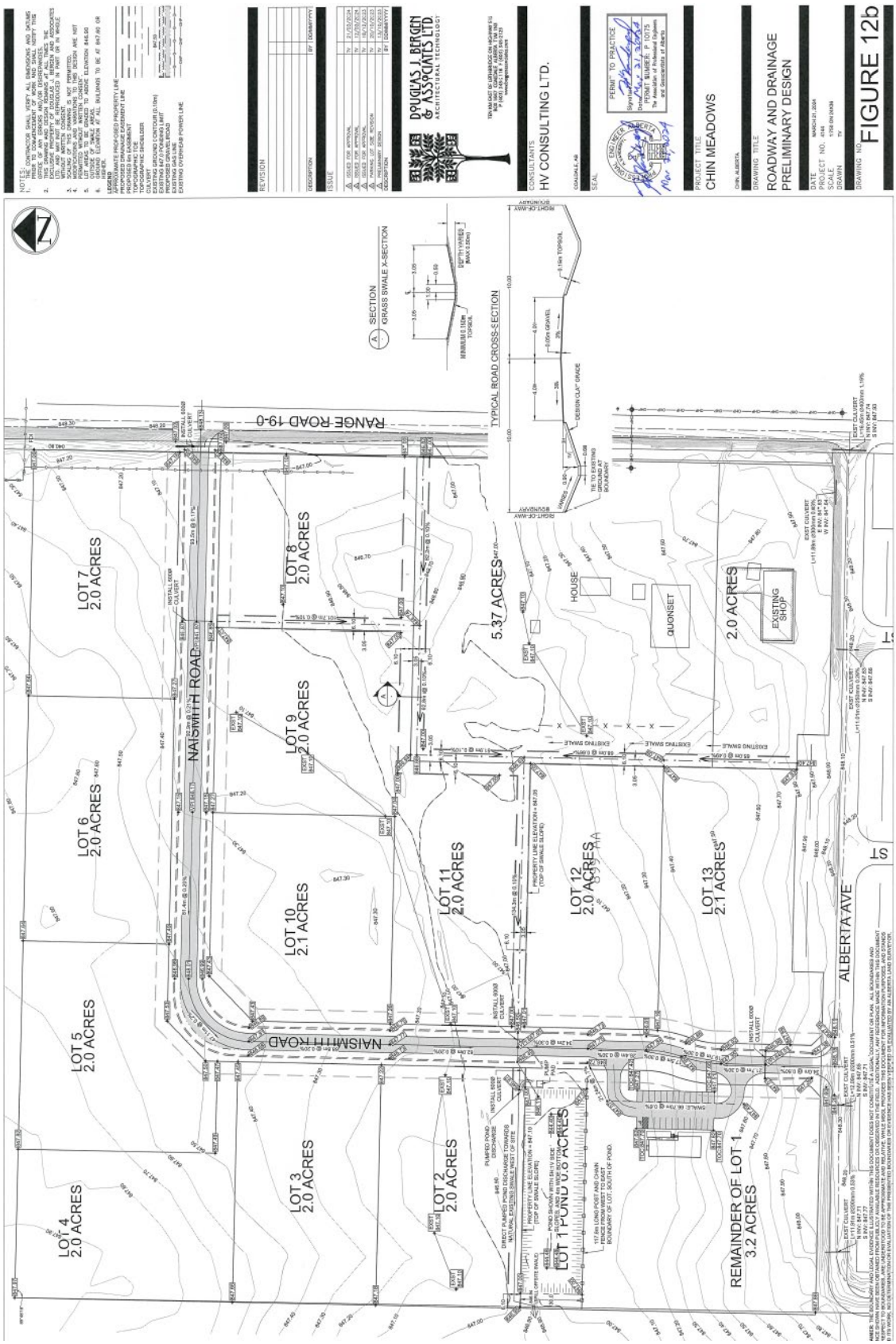


Figure 12.0b Preliminary Roadway & Drainage Design

5.2.4 Sewage Treatment and Dispersal

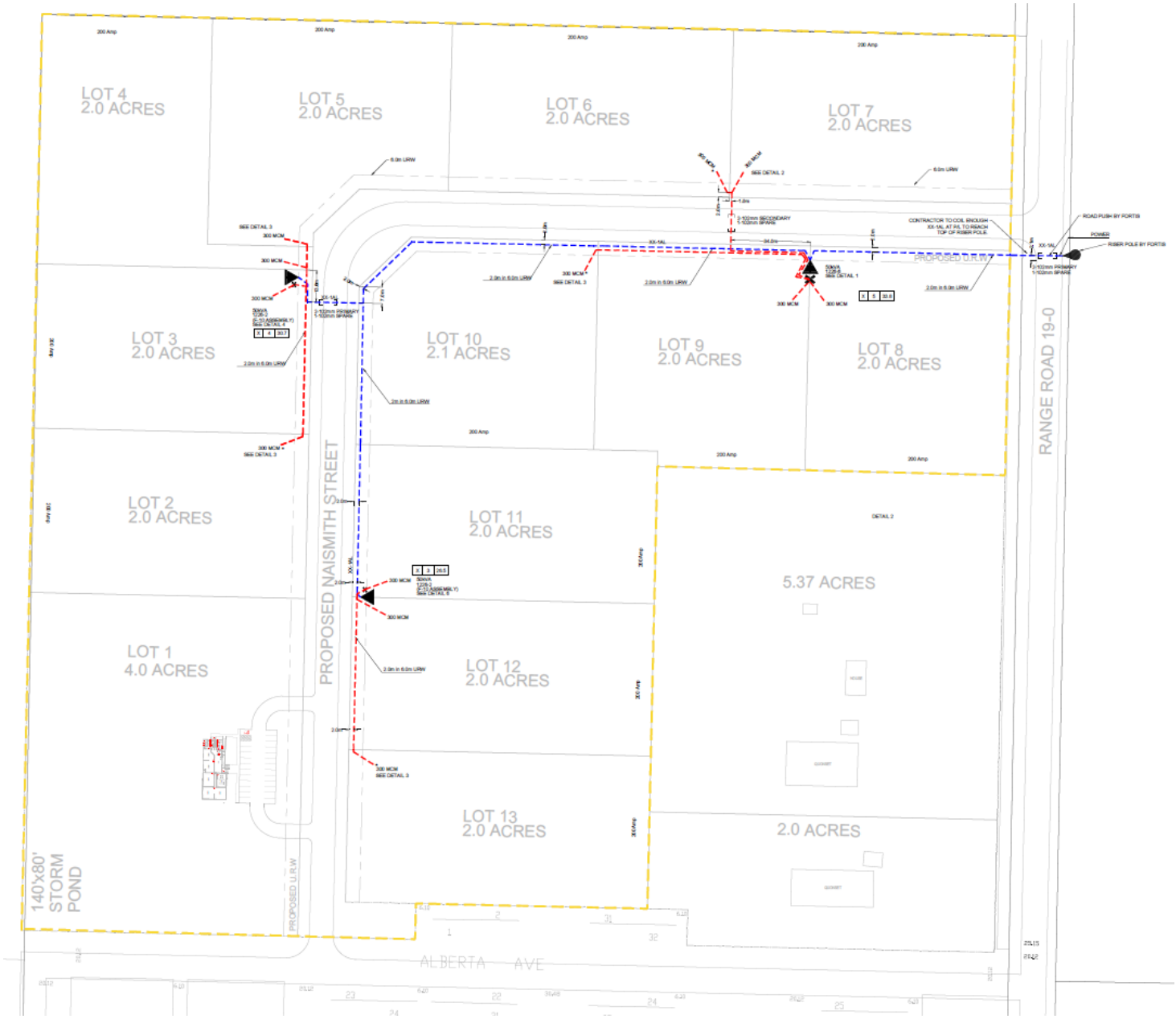
A Private Sewage Treatment Systems (PSTS) will be installed on each lot. Sizing of the system will be determined by the number of occupants in the residence as it relates to the Alberta Private Sewage Systems Standard of Practice (Safety Codes Council 2021).

Osprey Engineering Inc. was retained to evaluate each site relative to its suitability for a PSTS. BDT Engineering's soils report was relied on and supplemented by onsite excavations for this evaluation. See **Appendix C – Osprey's Septic Report**.

5.3 PUBLIC UTILITIES

5.3.1 Electricity

Existing one-wire, single phase overhead power lines operated by Fortis Alberta are present along the east side of Range Road 19-0. Fortis has confirmed that their infrastructure is adequate to support the proposed development and that they are receptive to the development proposal. Service would be provided to each lot by means of underground infrastructure and pad mounted transformers. See **Figure 13.0 - Existing FORTIS Facilities**.



LEGEND:

- Single Phase Padmount Transformer
- 3–Compartment Power Pedestal
- Side box, power only
- CABLE, Primary (#1AL)
- CABLE, Secondary (300MCM)
- * Worst case voltage drop
- Duct, PVC, Type DBII

Figure 13.0 – Existing FORTIS Facilities

5.3.2 Natural Gas

ATCO Gas has advised that there is an existing distribution line along the east side of Range Road 19-0. See **Figure 14.0 – ATCO Infrastructure**. Preliminary discussions with ATCO have suggested that their infrastructure can support the development. Details regarding the extension of natural gas distribution infrastructure will be confirmed following approval of the Area Structure Plan.

5.3.3 Telecommunication

Telus has advised that they have existing infrastructure along Range Road 19-0. Preliminary discussions with Telus have suggested that their existing facilities can support the proposed development. Details for extension of their infrastructure will be confirmed following approval of the Area Structure Plan.

Shaw Cable has advised that they do not have existing infrastructure in the area immediately surrounding the site. Shaw has provided a preliminary estimate of the cost to extend their infrastructure to the site which is prohibitive. Shaw cable will therefore not be provided to the development.

Wireless communications services are also available in the area.

5.3.4 Right of Way

A 6.0m (20.0ft) right of way will be registered parallel to the front property line to accommodate shallow utilities. This right of way will provide ample room should a domestic water pipeline be considered at a future date.

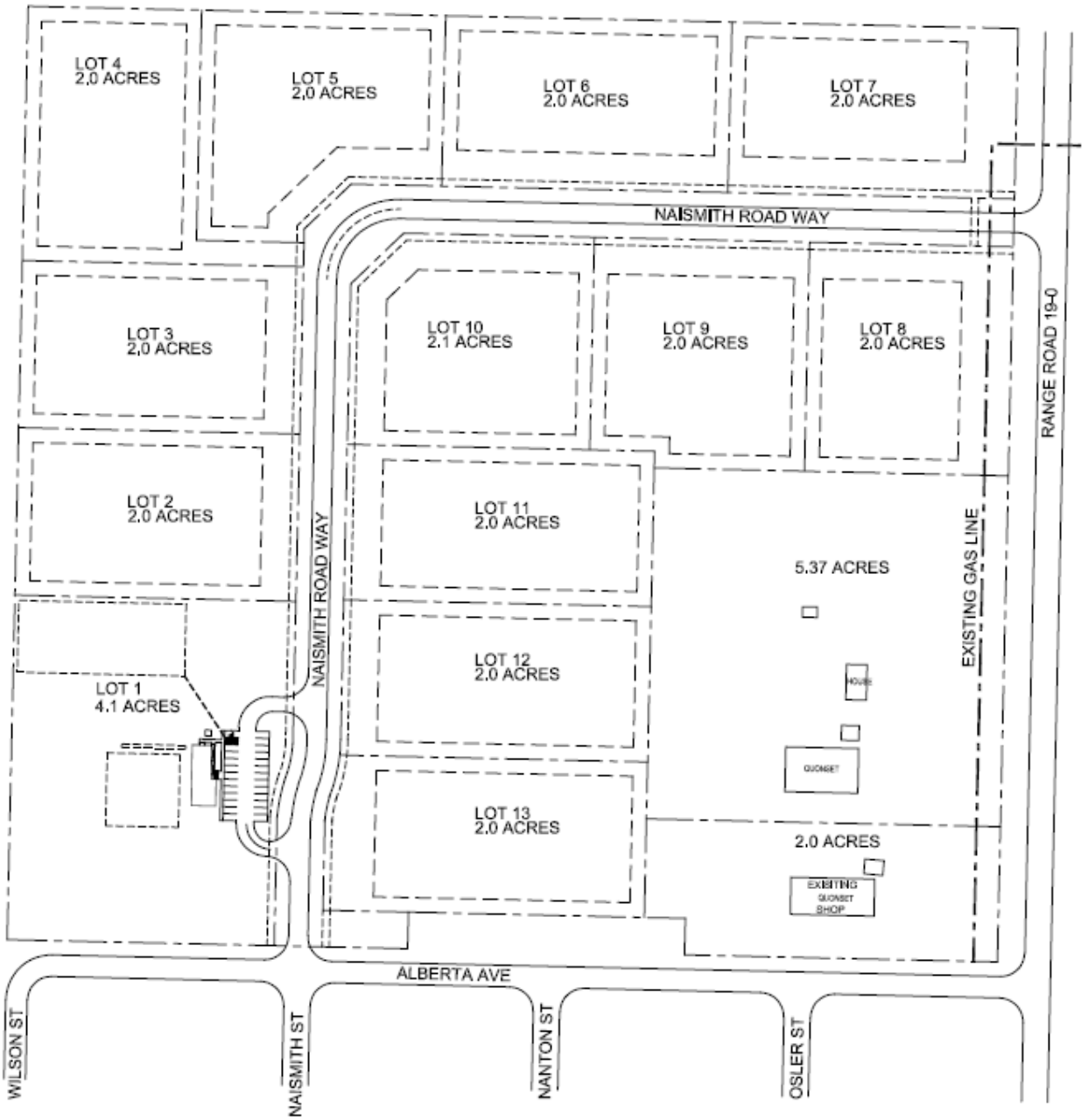


Figure 14.0 – ATCO Infrastructure

5.4 PROTECTIVE SERVICES

5.4.1 Fire

Response to fire emergencies would be dispatched by the City of Lethbridge Emergency Dispatch Centre through the 911 system. The site is located within the Coaldale Rural Emergency Service Zone (ESZ) of the County and therefore the Coaldale Fire Department will respond to emergency calls.

5.4.2 Police

Police service in the area of the development is provided by the Royal Canadian Mounted Police (RCMP) from the Coaldale Detachment. Response to emergencies would be dispatched through the 911 system.

5.4.3 Ambulance

Emergency medical transport services in the area of the development are operated by Alberta Health services and would be dispatched through the 911 system. Ambulance services base stations are located in the City of Lethbridge, Town of Picture Butte and Town of Coaldale.

5.5 OTHER SERVICES

5.5.1 Solid Waste

Lot owners will be responsible for solid waste collection. The Lethbridge County operates a solid waste transfer station located in Coaldale. Lot owners also have the option to transport waste to the Lethbridge Regional Landfill. Alternatively, lot owners may contract with a private waste collection company for solid waste removal and disposal.

5.5.2 Mail Service

Application will be made to Canada Post for postal service to the new lots following approval of the Area Structure Plan.

6. ARCHITECTURAL CONTROLS

The proposed development will form a northerly exterior of the Hamlet of Chin as described in the Lethbridge County Hamlet of Chin Growth Study of June 2020, prepared by Lethbridge County and Oldman River Regional Services Commission.

It is therefore desirable that the architectural fabric of the proposed development be in keeping with that of existing conditions. The Hamlet of Chin is not subject to any Architectural Controls and therefore there are none proposed for this development.

7. IMPLEMENTATION AND DEVELOPMENT CONTROL

- This Area Structure Plan will become a Lethbridge County bylaw should it be adopted. Amendment to the Land Use Bylaw will follow accordingly.
- One the Area Structure Plan is adopted, a subdivision application in keeping with the Area Structure Plan will be filed with Lethbridge County.
- Landowners will be responsible to acquire all permits required to further develop their lot including: Development Permit, Building Permit, Private Sewage Permit along with other utility permits required by the province.

8. ADJACENT LANDOWNER CONSULATION AND OTHER CORRESPONDENCE

Notices were hand delivered to all residents of the Hamlet of Chin as well as other adjacent landowners inviting them to an open house held on December 19th, 2023. The open house ran from 5:00pm to 7:00 pm at the Peace Valley Church.

Neighbouring landowners were generally in favor with the proposed development.

9. MARKET DEMAND

The developer has received very favorable response to the marketing of the lots. All proposed lots have been conditionally sold subject to approvals.

10. CONCLUSION

This Area Structure Plan has been prepared and submitted to support the proposal of creating 13 Grouped Country Residential parcels and a school site north of the Hamlet of Chin for consideration by the Lethbridge County Council by way of an application for amendment of the Lethbridge County Land Use Bylaw. The proposed amendment would be supported by the formal adoption of this ASP by County Council. The proponents believe this proposal establishes the highest and best use of the property as 12 residential lots and one school site since a productive farming operation is not viable on the property.

This document has been drafted and assembled in consultation with local authorities as well as experts in the area of civil and geotechnical engineering. The ASP outlines the result of considerable consultation with the many stakeholders and we trust provides Lethbridge County with the information required to consider a request for reclassification of the lands.

APPENDIX A

Geotechnical Investigation

GEOTECHNICAL EVALUATION
CHIN MEADOWS
CHIN, ALBERTA

Prepared for: Douglas J. Bergen & Associates Ltd.
2023-139
August, 2023

BDT Engineering Ltd.
thurberbruce@outlook.com

1 CONTENTS

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by BDT Engineering Ltd. (BDT) for the proposed residential lands located east of Range Road 19-0 and north of Chin, AB.

The scope of work for this evaluation was outlined in a discussion and email with Douglas Bergen. The objective of this evaluation was to determine the general subsurface conditions in the area of the proposed development and provide recommendations for the geotechnical aspects of design and construction.

Authorization to proceed with this work was received from Mr. Bergen on August 10, 2023.

2.0 PROJECT DETAILS AND SCOPE OF WORK

Based on the information provided, the proposed development will consist of approximately 13 lots between about 2.0 acres to 4.1 acres. An internal access roadway is also envisioned.

The scope of work for this evaluation included drilling five (5) boreholes, a laboratory program to assist in classifying subsurface soils and a report providing the following design and construction recommendations:

- Design parameters for shallow foundations.
- Recommendations for Backfill materials and compaction.
- Design and construction provisions for control of groundwater and mitigation, if required.
- Concrete type for structural elements in contact with soils.
- Trench excavation recommendations as well as backfill materials, compaction and moisture content requirements.
- Recommendations for Seismic design

3.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for this evaluation was carried out on August 21, 2023, using a truck mounted solid stem auger drill rig contracted from Chilako Drilling Services Ltd. of Coaldale, Alberta. The drill rig was equipped with 150 mm diameter solid stem continuous flight augers. The borehole locations are presented on Figure 1 in Appendix A.

Five boreholes, (BH001 to BH005), were drilled at locations across the development area.

Disturbed grab samples were obtained from each borehole at 0.75 m intervals. All soil samples were visually classified in the field, and the individual soil strata and the interface between them were noted. The borehole logs are presented in Appendix B. An explanation of the terms and symbols used on the borehole logs is also included in Appendix B.

A slotted 25 mm diameter PVC standpipe was installed in each of the boreholes to monitor groundwater levels. Auger cuttings were used to backfill around the standpipes and the boreholes were sealed at the surface with approximately 600 mm of bentonite chips.

Classification tests including natural moisture content, Atterberg Limits were subsequently performed on the collected borehole samples at BDT's Lethbridge Laboratory to aid in the determination of engineering properties. Laboratory results are noted on the borehole logs in Appendix B.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site is located west of Range Road 19-0 and north of Chin, AB. At the time of the field drilling the lands were agricultural in nature. The site generally slopes to the south and west.

4.2 SOIL CONDITIONS

It should be noted that geological conditions are innately variable. At the time of preparation of this report, information on subsurface stratigraphy was available only at discreet borehole locations. In order to develop recommendations from this information, it is necessary to make some assumptions concerning conditions other than at the borehole locations. Adequate field reviews should be provided during construction to check that these assumptions are reasonable.

The general subsurface stratigraphy comprised surficial layer of topsoil, underlain by native clay and clay till in descending order. The following sections provide a summary of the soils encountered in the borehole logs. A more detailed description is provided on the borehole logs in Appendix B.

4.2.1 TOPSOIL

A layer of topsoil was encountered in all boreholes. The topsoil was consistently 100 mm thick across the site.

4.2.2 CLAY

Clay was encountered beneath the topsoil in all boreholes. The clay ranged in thickness from 600 mm to 800 mm. The clay was described as silty, sandy, firm to stiff, low plastic, damp and light brown. A gravelly sand layer about 300 mm thick was encountered in BH005 below the clay.

4.2.3 CLAY TILL

Clay till was encountered beneath the clay in all boreholes and present to the maximum depths drilled. The clay till was silty, sandy, with gravel. The clay till was firm to stiff, generally increasing slightly with depth, low to medium plastic, and damp to very moist. The clay till was olive brown. White precipitates, oxide stains and coal specks were noted in the clay till.

4.3 GROUNDWATER CONDITIONS

At the time of drilling, some sloughing and no seepage was encountered in the boreholes. The groundwater levels were measured on August 30, 2023. Table 4.3 summarizes the groundwater monitoring data.

Table 4.3 Groundwater Monitoring Data August 30, 2023

Borehole Number	Depth of Standpipe below Ground Surface (m)	Depth to groundwater from ground surface (m)
BH001	4.42	Dry
BH002	5.03	Dry
BH003	4.27	Dry
BH004	5.03	Dry
BH005	3.96	Dry

Groundwater is not expected to impact the proposed development. It is noted that groundwater levels will fluctuate seasonally in response to climatic conditions and may be at a different depth when construction commences. Groundwater levels should be monitored prior to development. The intent is to provide an early indication of dewatering requirements during excavations for underground utilities and foundations.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 GENERAL

The recommendations that follow offer options intended to aid in the development of the area. The recommendations are provided on the understanding and condition that BDT will be retained to review the relevant aspects of the final design drawings and specifications and will be retained to conduct such field reviews as are necessary to ensure compliance with geotechnical aspects of the Building Code, this report, and final plans and specifications. BDT accepts no liability for any use of this report in the event that BDT is not retained to provide these review services.

Recommendations are provided for shallow footings, grade supported floor slabs, below grade construction, general site development and lot grading, trench excavation and backfill, backfill materials and compaction, roadway design considerations and concrete type.

Shallow footings are generally feasible for residential and light commercial/institutional buildings in all areas of the proposed development area. Further recommendations are provided in Section 5.10. However, because footings may be placed within areas of general engineered fill, quality assurance monitoring by geotechnical personnel is recommended during fill placement. It is noted that placement of foundations on engineering cohesive fill thicknesses greater than 1.5 m may require special consideration regarding long-term consolidation of the fill and subsequent performance issues with the foundations / floor slabs-on-grade.

Slabs-on-grade construction for the development area should consider the precautions recommended for slabs-on-grade, including the subgrade preparation measures intended to improve slab performance.

All foundation recommendations presented in this report are based on the assumption that an adequate level of monitoring will be provided during construction and that all construction will be carried out by suitably qualified contractors, experienced in foundation and earthworks construction. An adequate level of monitoring is considered to be:

- For earthworks, and underground utility construction, full-time monitoring and compaction testing.
- For shallow foundations and slabs, inspection of bearing surfaces prior to placement of concrete of mudslabs, and design review during construction.

All such monitoring should be carried out by suitably qualified persons, independent of the contractor. One of the purposes of providing an adequate level of monitoring is to check those recommendations, based on information collected at discrete borehole locations, are applicable to other areas of the site.

5.2 Site Preparation

Subgrade preparation is required in all lots, where there will be grade changes, as well as all paved areas. This includes stripping of topsoil and deleterious fill materials, scarification, moisture conditioning, and compaction. The native clay and clay till soils are suitable for site grading purposes. The clay soils appear to be below the optimum moisture content (OMC) at shallower depths, and it is expected that moisture conditioning consisting of wetting and/or mixing will be required to reduce the swelling potential of this soil and to achieve the compaction standards recommended. Proof-rolling within roadways to detect soft areas is also recommended. The contractor should expect soil moisture variability across the site.

5.3 Site Grading

All lots, in the vicinity of the buildings, should be graded for drainage at a minimum of 2.0 %. The existing surficial site soils comprising clay and clay till are suitable for use as landscape fill materials or for use as general engineered fill materials for general grading. The moisture content of the site soils at surface generally appear to be slightly below their OMC and may require some wetting and/or mixing to achieve their anticipated OMC. General engineered fill materials for lot grading should be moisture conditions to within a range of -1 % to +2% of the OMC prior to compaction and compacted to a minimum of 98 % of SPD.

Further recommendations regarding backfill materials and compaction are in Appendix C.

5.4 CONSTRUCTION EXCAVATIONS

Excavations should be carried out in accordance with the Alberta Occupational Health and Safety (OH&S) Regulations. For this project, the depth for the majority of the excavations is assumed to be less than 3.0 m below existing ground surface. Excavations to deeper depths require special considerations. The following recommendations notwithstanding, the responsibility of trench and all excavation cutslopes resides with the Contractor and should take into consideration site-specific conditions concerning soil stratigraphy and groundwater. All excavations should be reviewed by a geotechnical engineer prior to personnel working within the base of the excavation.

Temporary excavations within stiff clay or clay till soils which are to be deeper than 1.5 m should have the sides shored and braced or the slopes should be cut back no steeper than 1.0 horizontal to 1.0 vertical (1H:1V)

Flatter sideslopes may be required in some areas where groundwater is encountered within sand layers, which may cause local sloughing and instability of the excavation sidewalls. In these instances, the excavation configuration design should be reviewed by experienced personnel, prior to allowing personnel to enter the base of the excavation. Vertical trench cuts using trench box wall support are not recommended for this project due to the inherent difficulty in compacting the backfill materials to an engineered standard, as well as the potential of cave-ins of the excavation sidewalls against the utility box.

Any encountered groundwater seepage should be directed towards sumps for removal. Conventional construction sump pumps should be capable of groundwater control.

Temporary surcharge loads, such as spill piles, should not be allowed within a distance equal to the depth of the excavation from an unsupported excavation face or 3.0m, whichever is greater, while mobile equipment should be kept back at least 3.0m. All excavation sideslopes should be checked regularly for signs of sloughing, especially after rainfall periods. Small earth falls from the sideslopes are a potential source of danger to workmen and must be guarded against.

General recommendations regarding construction excavations are included in Appendix C.

5.5 TRENCH EXCAVATION AND BACKFILL

The moisture content of the clay and clay till soils encountered across the site is generally below the anticipated optimum moisture content. It is expected that such soils will require slight wetting to achieve desired moisture content and proper compaction.

Trenches must be backfilled in such a way as to minimize the potential differential settlement and/or frost heave movements. A minimum density of 98% of Standard Proctor Density (SPD) is recommended for all trenches. Clay backfill should be uniformly moisture conditioned to between ± 2% of optimum moisture content (OMC). The compacted thickness of each lift of backfill should not exceed 150 mm. In order to achieve this uniformity, the lift thickness and compaction criteria must be strictly enforced.

General recommendations for trench excavation and backfill are included in Appendix C.

5.6 SUBGRADE PREPARATION

For all roadways the upper 300 mm of clay or clay till soils should be scarified and uniformly moisture conditioned to between -1% of optimum and 2% over OMC. The subgrade should then be uniformly compacted to a minimum of 98% of SPD.

All deleterious and unsuitable materials, including any sand pockets, if encountered, should be excavated from under proposed fill areas during the reconstruction operations.

The clay, clay till soils encountered are acceptable for subgrade construction. Sand layers if encountered should be removed. Proof-rolling to detect soft areas once the subgrade preparation activities are completed is also recommended.

5.7 ROADWAY DESIGN RECOMMENDATIONS

The roadway design section for gravel 'Local' roadways, is recommended as follows:

Design Roadway Section	
Material Type	**Gravel Surfaced**
Granular Base Course	200 mm
Subgrade Preparation	300 mm

The above recommended pavement layer thicknesses generally refer to average values and recognize typical construction variability. As such, constructed layer thicknesses should satisfy the thickness tolerances identified in the City of Lethbridge Engineering Standards for granular materials.

The roadway design should include provisions for subsurface drainage of the pavement granular layers. It is understood that the roadway cross section for this development contemplates a semi-rural cross section. Therefore, the granular layers should daylight to the ditches where possible.

5.8 CEMENT TYPE

Based on BDT's local experience with the local soils, as well as the laboratory testing conducted to determine soluble sulphate levels, the properties of concrete for foundations in contact with soil or groundwater shall meet the requirements of CSA A23.1-14 Class S-2 exposure and have a minimum specified 56-day compressive strength of 32 MPa.

For this exposure classification, alternatives include the usage of Type HS Portland cement or blends of cement and supplementary cementing materials conforming to Type HS and/or Type HSb cements.

5.9 LIMIT STATES DESIGN

The design parameters provided in the following sections may be used to calculate the ultimate foundation capacity in each case. For Limit States Design (LSD) methodology, in order to calculate the factored load capacity, the appropriate Soil Resistance Factors must be applied to each loading conditions as follows:

Factored Capacity = Ultimate Capacity X Soil Resistance Factors

In general, the following soil resistance factors in Table 5.9 must be incorporated into the foundation design. These factors are considered to be in accordance with the CFEM (2006).

Table 5.9 Soil Resistance Factors

Item	Soil Resistance Factor
Shallow Foundations	
Bearing Resistance	0.5
Passive Resistance	0.5
Horizontal resistance (sliding)	0.8

5.10 SHALLOW FOUNDATIONS

Shallow foundations, should be constructed a minimum of 1.4 m below the final design ground surface (frost protection requirements). Based on the soil stratigraphy and conditions on this site, it is recommended that shallow footings be founded on the clay or clay till.

The ultimate static bearing pressure for the design of strip and spread footings at these depths may be taken as 200 KPa for the clay or clay till. Factoring should be considered as noted in section 5.9. Footing dimensions should be in accordance with the minimum requirements of the Building Code.

Bearing certification by a geotechnical engineer is recommended to ensure that the shallow foundations are placed on competent native soils. If softer native soils are encountered at footing level, recommendations may be provided to lower the footing elevations to materials satisfying the design bearing capacity or to widen the footings within these areas. This should be a field determination at the time of bearing observation.

The anticipated foundation soils are of a low to medium plasticity, and therefore, are prone to volume changes (both heave and settlement) with varying moisture content. Exposed soils beneath building structures must be protected against changes in moisture content during construction to reduce the risk of heaving. A permanent weeping tile system is also recommended around the outside perimeter of any structure at the foundation elevation to maintain a consistent moisture profile of the foundation soils.

Settlement of footings designed and constructed in accordance with the above recommendations should be well within the normally tolerated values of 25 mm total and 15 mm differential at factored loading. If this range of settlement is not tolerable, then a pile foundation system may be considered for the building.

Further recommendations regarding shallow foundations are presented in Appendix C.

5.11 FLOOR SLABS-ON-GRADE

For construction of floor slabs-on-grade for buildings in the development area the subgrade should be scarified to a minimum depth of 300 mm, and moisture conditioned to within –1% to +2% of the OMC. The minimum compaction should be 98% of SPD. The prepared subgrade

should be proof-rolled and any soft or loose pockets detected should be reconditioned as recommended above or over-excavated and replaced with general engineered fill.

A levelling course of clean well-graded crushed gravel, at least 150 mm in compacted thickness, is recommended directly beneath the slabs-on-grade, unless a thicker course is required for structural purposes. The subgrade beneath slabs-on-grade should be protected at all times from moisture or exposure which may cause softening or disturbance of the subgrade soils. This applies during and after the construction period (and before and after replacement of the required general engineered fill). Should the exposed surface become saturated or disturbed, it should be reworked to achieve the above standards. If the subgrade is properly prepared as noted above, floor slab movements should be limited to less than approximately 25 mm. Slabs-on-grade should be separated from bearing members to allow some differential movement. If this range of differential movement is unacceptable, the owner should consider a structurally supported floor.

Recommended procedures for proof-rolling and backfill materials and further recommendations for slabs-on-grade construction are included in Appendix C.

5.12 Below Grade Walls

All below-grade walls should be designed to resist lateral earth pressure in an “at-rest” condition. This condition assumes a triangular pressure distribution and may be calculated using the following expression:

$$P_o = K_o (\gamma H + Q)$$

Where: P_o = Lateral earth pressure “at-rest” condition (no wall movement occurs at a given depth)

K_o = Coefficient of earth pressure “at-rest” condition (use 0.5 for cohesive backfill and 0.45 for sand and gravel backfill)

γ = Bulk unit weight of backfill soil (use 19 or 21 kN / m^3 for cohesive or granular backfill, respectively).

H = Depth below final grade (m).

Q = Surcharge pressure at ground level (kPa).

It is assumed that drainage is provided for all below-grade walls through the installation of the weeping tile, and hydrostatic pressure will not be a factor in design. An acceptable weeping tile system should consist of a perforated weeping tile wrapped in a geosock or geotextile fabric, in turn surrounded with a minimum of 150 mm thick covering of washed rock (maximum size 25 mm). The weeping tile should have a minimum 0.5 % slope leading to a sump. The preferred method would be to have the sump discharge any water accumulation remotely from the building footprint towards ditches or other stormwater conveyance features. Based on site conditions it is anticipated that the sump pump will run intermittently and more often during and after rain events.

Backfill around concrete walls should not commence before the concrete has reached a minimum two-thirds of its design strength and the walls are laterally braced. Only hand-operated compaction equipment should be employed within 600 mm of the concrete walls. Caution should be used when compacting backfill to avoid high lateral loads caused by excessive compactive effort. A compaction standard of 95 % Standard Procter Density is recommended. To avoid differential wall pressures, the backfill should be brought up evenly around the walls. A minimum 600 mm thick clay cap should be placed at the ground surface to reduce the infiltration of surface water.

5.13 Frost Protection

For protection against frost-action, perimeter footings in heated structures should be extended to such depths as to provide a minimum soil cover of 1.4 m. Isolated or exterior footings in unheated structures should have a minimum soil cover of 2.1 m unless provided with equivalent insulation.

Pipes buried with less than 2.1 m of soil cover should be protected with insulation to avoid frost effects that might cause damage to or breakage of the pipes. Rigid insulation place under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

5.14 Septic Fields

The Safety Codes Council's, Alberta Private Sewage Systems Standard of Practice, 2021, notes that percolation testing can be used in support of a design that used site specific investigation. Previous percolation testing conducted on similar soils indicated percolation rates close to 24 mins/cm (clay), which indicates the area surficial soils may be suitable for septic field development.

For design purposes, groundwater is expected to be measured below 4.5 m from the ground surface and is not expected to impact the design of the fields. The slopes of the area are less than 10 %. Soils within the top 900 mm of the surface are generally considered to be a clay (C) or silty clay (SIC). The topsoil encountered on the site, may be considered a silty clay loam. Surface water features are located beyond the 100 m threshold and there are no bedrock outcrops in the area.

During installation of the weeping trenches, the installer should pay close attention to the soil conditions encountered, to define the extent of any silt or sand pockets (areas subject to faster percolation rates) or medium to high plastic clays (areas of slower percolation rates). These should be immediately reported to the disposal field designer for review prior to completion of the septic disposal field.

5.15 Seismic Design

The site classification recommended for seismic site response is Classification D, as noted in Table 4.1.8.4a of the NBCC.

6.0 DESIGN AND CONSTRUCTION GUIDELINES

General design and construction guidelines are provided in Appendix D, under the following supplemental heading:

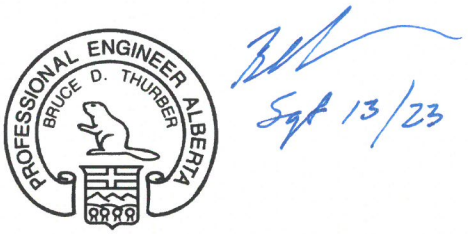
- Shallow Foundations
- Floor Slabs-on-Grade
- Backfill Materials and Compaction
- Construction Excavations
- Proof Rolling

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that these guidelines will be followed. The design and construction guidelines are not intended to represent detailed specifications for the works although they may prove useful in the preparation of such specifications. In the event of any discrepancy between the main text of this report and Appendix D, the main text should govern.

7.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully Submitted



Sept 13/23

Bruce D. Thurber, P.Eng.
BDT Engineering Ltd. P13556

APPENDIX A – SITE PLAN SHOWING BOREHOLE LOCATIONS

Figure 1 – Site Plan
Borehole Location

APPENDIX B – BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

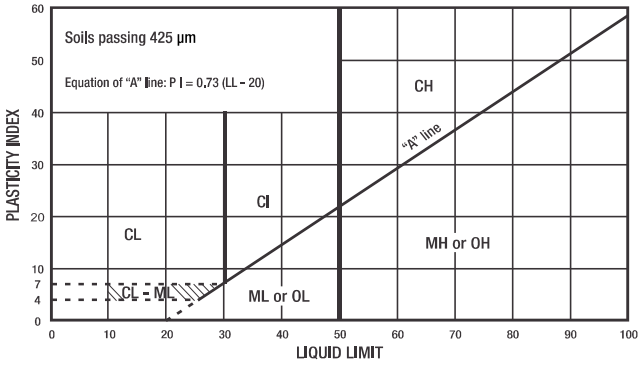
GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on 4.75 mm sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines: Less than 5% Pass 75 µm sieve; More than 12% Pass 75 µm sieve; 5% to 12% Pass 75 µm sieve	$C_U = D_{60} / D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	GW, GP, SW, SP GM, GC, SM, SC Borderline Classification requiring use of dual symbols	Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes 4.75 mm sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_U = D_{60}/D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS Liquid limit <50		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity	For classification of fine-grained soils and fine fraction of coarse-grained soils.		
	SILTS Liquid limit >50		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit <30		CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit 30-50		CI	Inorganic clays of medium plasticity, silty clays			
	CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit >50		CH	Inorganic clays of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS Liquid limit <50		OL	Organic silts and organic silty clays of low plasticity			
	ORGANIC SILTS AND CLAYS Liquid limit >50		OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils			

PLASTICITY CHART



*Based on the material passing the 75 mm sieve
Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA

SOIL COMPONENTS

FRACTION	SIEVE SIZE PASSING	SIEVE SIZE RETAINED	DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm		
fine	425 µm	75 µm	>0 to 10 %	"trace"
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior	

OVERSIZE MATERIAL

Rounded or subrounded

COBBLES	75 mm to 300 mm
BOULDERS	> 300 mm

Not rounded

ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

Project: Chin Meadows		BOREHOLE NO: **BH001**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)						
		Clay - silty, sandy, firm, damp, low plastic, light brown.						
		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1				
1		- moist						
				S1	2-2-4			
2				B2				
3		- some sand, inclusions of bedrock / mudstone		S2	2-3-5			
				B3				
4								
				S3	4-5-6			
5		End of borehole at 5.03 m, 0.61 m sloughing from surface topsoil and no seepage. Standpipe installed to 4.42 m. Standpipe dry when monitored on August 30, 2023.						
6								
7								
8								

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH002**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID (20 40 60 80)	▲ VANE SHEAR (kPa) ▲ (100 200 300 400) / ■ BLOW COUNT ■ (20 40 60 80) / ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) / ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)								
		Clay - silty, sandy, firm, damp, low plastic, light brown.								
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1						
				S1	4-7-11					
2				B2						
3		- inclusions of bedrock		S2	3-4-4					
				B3						
4										
				S3	4-5-7					
5		End of borehole at 5.03 m, no sloughing and seepage. Standpipe installed to 5.03 m. Standpipe dry when monitored on August 30, 2023.								
6										
7										
8										

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH003**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID (20 40 60 80)	▲ VANE SHEAR (kPa) ▲ (100 200 300 400) / ■ BLOW COUNT ■ (20 40 60 80) / ◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400) / ● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)								
		Clay - silty, sandy, firm, damp, low plastic, light brown.		B1						
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.								
				S1	5-6-9					
2				B2						
3				S2	3-4-5					
				B3						
4										
				S3	3-8-5					
5		End of borehole at 5.03 m, 0.76 m sloughing and no seepage. Standpipe installed to 4.27 m. Standpipe dry when monitored on August 30, 2023.								
6										
7										
8										

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH004**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm
0		Topsoil (100mm)			
		Clay - silty, sandy, firm, damp, low plastic, light brown.			
		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		B1	
1					
				S1	3-5-7
2				B2	
		- inclusions of bedrock / mudstone			
3				S2	2-3-5
				B3	
4					
				S3	3-4-5
5		End of borehole at 5.03 m, no sloughing or seepage. Standpipe installed to 5.03 m. Standpipe dry when monitored on August 30, 2023.			
6					
7					
8					

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

OTHER DATA

SLOTTED PIEZOMETER

Elevation (m)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

Project: Chin Meadows		BOREHOLE NO: **BH005**
Client: Douglas J. Bergen & Associates Ltd.		PROJECT NO: 2023-139
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE: SHELBY TUBE | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE | NO RECOVERY

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0		Topsoil (100mm)						
		Clay - silty, sandy, firm, damp, low plastic, light brown.						
		Sand - gravvely, some clay and silt, loose, damp, fine grained, brown, poorly graded.		B1				
1		Clay Till - silty, sandy, trace gravel, firm, damp to moist, low plastic, olive brown with coal inclusions and oxide stains.		S1	7-8-11			
2				B2				
3				S2	4-5-7			
				B3				
4				S3	3-4-5			
5		End of borehole at 5.03 m, 1.07 m sloughing and no seepage. Standpipe installed to 3.96 m. Standpipe dry when monitored on August 30, 2023.						
6								
7								
8								

PLASTIC — M.C. — LIQUID (20 40 60 80)

▲ VANE SHEAR (kPa) ▲ (100 200 300 400)

■ BLOW COUNT ■ (20 40 60 80)

◆ UNCONF. SHEAR STR. (kPa) ◆ (100 200 300 400)

● 0.5 x POCKETPEN. (kPa) ● (100 200 300 400)

LOGGED BY: CA	COMPLETION DEPTH: 5.03 m
REVIEWED BY: BDT	COMPLETION DATE: 8-21-23
	Page 1 of 1

AB TRANS BOREHOLE LOG CHIN MEADOWS.GPJ AB_TRANS.GDT 8-30-23

APPENDIX C – GENERAL CONSTRUCTION GUIDELINES

Shallow Foundations

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term ‘shallow foundations’ includes strip and spread footings, mat slab and raft foundations. Minimum footing dimensions in plan should be 0.45m and 0.9m for strip and square footings respectively.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations.

Hand cleaning should be undertaken to prepare an acceptable bearing surface. Recompaction of disturbed or loosened bearing surface may be required.

Foundation excavations and bearing surfaces should be protected from rain, snow, freezing temperatures, excessive drying and the ingress of free water before, during and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil and provide a working surface for construction, should immediate foundation construction not be intended.
All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to check that the recommendations contained in this report have been followed.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined under the separate heading ‘Backfill Materials and Compaction’.

Floor Slabs-on-Grade

All soft, loose or organic material should be removed from beneath slab areas. If any local 'hard spots' such as old basement walls are revealed beneath the slab area, these should be over-excavated and removed to not less than 0.9 m below underside of slab level. The exposed soil should be proof-rolled and the final grade restored by general engineered fill placement. If proof-rolling reveals any soft or loose spots, these should be excavated and the desired grade restored by general engineered fill placement. Proof-rolling should be carried out in accordance with the recommendations given elsewhere in this Appendix. The subgrade should be compacted to a depth of not less than 0.3m to a density of not less than 98 percent Standard Proctor Maximum Dry Density (ASTM Test Method D698).

A levelling course of 20mm crushed gravel at least 150 mm in compacted thickness, is recommended directly beneath all slabs-on-grade. Alternatively, a minimum thickness of 150mm of pit-run gravel overlain by a minimum thickness of 50 mm of 20mm crushed gravel may be used. Very coarse material (larger than 25 mm diameter) should be avoided directly beneath the slab-on-grade to limit potential stress concentrations within the slab. All levelling courses directly under floor slabs should be compacted to 100 percent of Standard Proctor maximum dry density.

General engineered fill, pit-run gravel and crushed gravel are defined under the heading 'Backfill Materials and Compaction' elsewhere in this Appendix.

The slab should be structurally independent from walls and columns supported on foundations. This is to reduce any structural distress that may occur as a result of differential soil movements. If it is intended to place any internal non-load bearing partition walls directly on a slab-on-grade, such walls should also be structurally independent from other elements of the building founded on a conventional foundation system so that some relative vertical movement of the walls can occur freely.

The excavated subgrade beneath slabs-on-grade should be protected at all times from rain, snow, freezing temperatures, excessive drying and the ingress of free water. This applies during and after the construction period.

A minimum slab concrete thickness of 100mm is recommended. Control joints should be provided in all slabs. Typically for a 125mm slab thickness; control joints should be placed on a 3 m square grid, should be sawn to a depth of one-quarter the slab thickness and have a width of approximately 3 mm.

Wire mesh reinforcement, 150 mm square grid, should be provided to reduce the possibility of uncontrolled slab cracking. The mesh should be adequately supported and should be located at mid-height of the slab with adequate cover.

Backfill Materials and Compaction

1.0 Definitions

“Landscape fill” is typically used in areas such as berms and grassed areas where settlement of the fill and noticeable surface subsidence can be tolerated. “Landscape fill” may comprise soils without regard to engineering quality.

“General engineered fill” is typically used in areas where a moderate potential for subgrade movement is tolerable, such as asphalt (i.e., flexible) pavement areas. “General engineered fill” should comprise clean, granular or clay soils.

“Select engineered fill” is typically used below slabs-on-grade or where high volumetric stability is desired, such as within the footprint of a building. “Select engineered fill” should comprise clean, well-graded granular soils or inorganic low to medium plastic clay soils.

“Structural engineered fill” is used for supporting structural loads in conjunction with shallow foundations. “Structural engineered fill” should comprise clean, well-graded granular soils.

“Lean-mix concrete” is typically used to protect a subgrade from weather effects including excessive drying or wetting. “Lean-mix concrete” can also be used to provide a stable working platform over weak subgrades. “Lean-mix concrete” should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa. Standard Proctor Density (SPD) as used herein means Standard Proctor Maximum Dry Density (ASTM Test Method D698). Optimum moisture content is defined in ASTM Test Method D698.

2.0 General Backfill and Compaction Recommendations

Exterior backfill adjacent to abutment walls, basement walls, grade beams, pile caps and above footings, and below highway, street, or parking lot pavement sections should comprise “general engineered fill” materials as defined above. Exterior backfill adjacent to footings, foundation walls, grade beams and pile caps and within 600 mm of final grade should comprise inorganic, cohesive “general engineered fill”. Such backfill should provide a relatively impervious surficial zone to reduce seepage into the subsoil against the structure.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflections are apparent, the compactive effort should be reduced accordingly.

In order to reduce potential compaction induced stresses, only hand-held compaction equipment should be used in the compaction of fill within 1 m of retaining walls or basement walls. If compacted fill is to be placed on both sides of the wall, they should be filled together so that the level on either side is within 0.5 m of each other.

All lumps of materials should be broken down during placement. Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade.

Where the maximum-sized particles in any backfill, material exceed 50 percent of the minimum dimension of the cross-section to be backfilled (e.g., lift thickness), such particles should be removed and placed at other more suitable locations on site or screened off prior to delivery to site.

Bonding should be provided between backfill lifts. For fine-grained materials, the previous lift should be scarified to the base of the desiccated layer, moisture-conditioned, and recompacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture-conditioning and recompaction.

3.0 COMPACTION AND MOISTURE CONDITIONING

"Landscape fill" material should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90 percent of SPD unless a higher percentage is specified by the jurisdiction.

"General engineered fill" and "select engineered fill" materials should be placed in layers of 150 mm compacted thickness and should be compacted to not less than 98 percent of SPD. Note that the contract may specify higher compaction levels within 300 mm of the design elevation. Cohesive materials placed as "general engineered fill" or "select engineered fill" should be compacted at 0 to 2 percent above the optimum moisture content. Note that there are some silty soils which can become quite unstable when compacted above optimum moisture content.

Granular materials placed as "general engineered fill" or "select engineered fill" should be compacted at slightly below (0 to 2%) the optimum moisture content. "Structural engineered fill" material should be placed in compacted lifts not exceeding 150 mm in thickness and compacted to not less than 100 percent of SPD at slightly below (0 to 2%) the optimum moisture content.

4.0 "GENERAL ENGINEERED FILL"

Low to medium plastic clay is considered acceptable for use as "general engineered fill," assuming this material is inorganic and free of deleterious materials. Materials meeting the specifications for "select engineered fill" or "structural engineered fill" as described below would also be acceptable for use as "general engineered fill."

5.0 "SELECT ENGINEERED FILL"

Low to medium plastic clay with the following range of plasticity properties is generally considered suitable for use as "select engineered fill":

Liquid Limit	=	20 to 40%
Plastic Limit	=	10 to 20%
Plasticity Index	=	10 to 30%

Test results should be considered on a case-by-case basis.

"Pit-run gravel" and "fill sand" are generally considered acceptable for use as "select engineered

fill." See exact project or jurisdiction for specifications. The "pit-run gravel" should be free of any form of coating and any gravel or sand containing clay, loam or other deleterious materials should be rejected. No material oversize of the specified maximum sieve size should be tolerated. This material would typically haves a fines content of less than 10%. The materials above are also suitable for use as "general engineered fill."

Construction Excavations

Construction should be in accordance with good practice and comply with the requirements of the responsible regulatory agencies.

All excavations greater than 1.5m deep should be sloped or shored for worker protection.

Shallow excavations up to about 3m depth may use temporary sideslopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to BDT for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in situ conditions and the movement of the system. If anchors are used, they should be load tested. BDT can provide further information on monitoring and testing procedures if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down, at 45 degrees from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

Proof Rolling

Proof-rolling is a method of detecting soft areas in an 'as-excavated' subgrade for fill, pavement, floor or foundations or detecting non-uniformity of compacted embankment. The intent is to detect soft areas or areas of low shear strength not otherwise revealed by means of test holes, density testing, or visual examination of the site surface and to check that any fill placed or subgrade meets the necessary design strength requirements.

Proof-rolling should be observed by qualified geotechnical personnel.

Proof-rolling is generally accomplished by the use of a heavy (15 to 60 tonne) rubber-tired roller having 4 wheels abreast on independent axles with high contact wheel pressures (inflation pressures ranging from 550 kPa (80psi) up to 1030 kPa (150 psi).

A heavily loaded tandem axle gravel truck may be used in lieu of the equipment described in the paragraph above. The truck should be loaded to approximately 10 tonnes per axle and a minimum tire pressure of 550 kPa (80 psi). Ground speed - maximum 8 km/hr recommended 4 km/hr.

The recommended procedure is two complete coverages with the proof-rolling equipment in one direction and a second series of two coverages made at right angles to the first series; one 'coverage' means that every point of the proof-rolled surface has been subjected to the tire pressure of a loaded wheel. Less rigorous procedures may be acceptable under certain conditions subject to the approval of an engineer.

Any areas of soft, rutted or displaced materials detected should be either recompacted with additional fill or the existing material removed and replaced with general engineered fill, or properly moisture conditioned as necessary.

The surface of the grade under the action of the proof-roller should be observe, noting; visible deflection and rebound of the surface, formation of a crack pattern in the compacted surface or shear failure in the surface or granular soils as ridging between wheel tracks.

If any part of an area indicates significantly more distress than other parts, the cause should be investigated, by, for example, shallow auger holes.

In the case of granular subgrades, distress will generally consist of either compression due to insufficient compaction or shearing under the tires. In the first case, rolling should be continued until no further compression occurs. In the second case, the tire pressure should be reduced to a point where the subgrade can carry the load without significant deflection and subsequently gradually increased to it specified pressure as the subgrade increases in shear strength under this compaction.

APPENDIX B

Trip Generation Letters

4105 7 Street SE Calgary, AB T2G 2Y9 T: 403.254.0544 F: 403.254.9186

October 5, 2023

Our Reference: 28449

Douglas Bergen & Associates Ltd.
PO Box 1667
Coaldale, Alberta
T1M 1N3

Attention: Douglas Bergen

Dear Sir:

Reference: Chin Subdivision Trip Generation

1.0 Introduction

ISL Engineering and Land Services Ltd. (ISL) was retained by Douglas Bergen & Associates Ltd. to determine the trip generation of a 12-lot country residential and school development in the Hamlet of Chin, Municipal District (MD) of Taber, Alberta. The school will have 70 students and 6 teachers.

The development is located just north of Highway 3 and west of Range Road 19-0. As part of the development, Naismith Street is proposed to be extended north and access to each lot is off the extended segment of Naismith Street. Figure 1 shows the site plan.

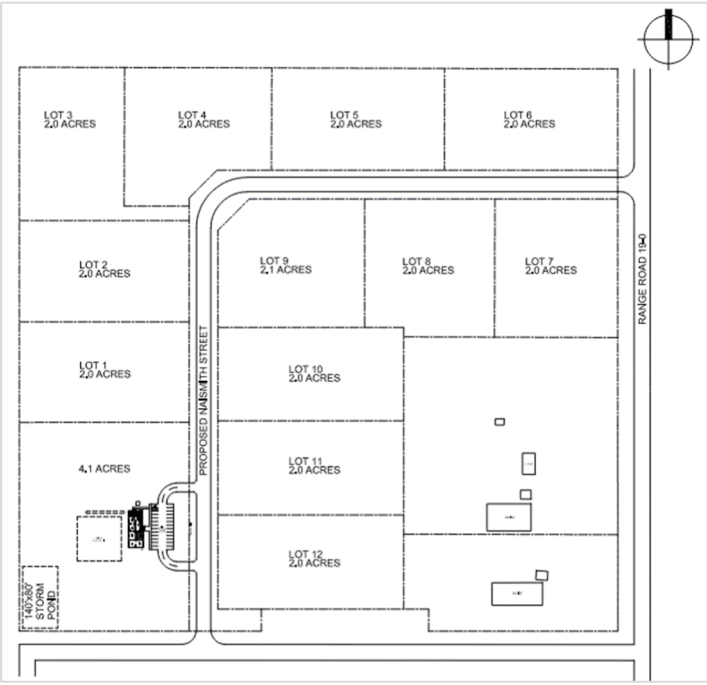


Figure 1: Site Plan

2.0 Analysis

In the MD's General Standards of Development in Schedule 5 of the Land Use Bylaw No. 1677, the guideline does not indicate when a TIA is required to be undertaken. Per typical engineering standards, a site that generates less than 100 trips during the commuter peak hour (between 7-9 AMand 4-6 PM) does not require a TIA.

For the 12 residential lots, the single-family trip generation rates from the ITE Trip Generation Manual, 11th Edition, was referenced. This manual is an industry accepted manual to estimate traffic.

- Single Family Residential (ITE Rates):
  - **AM Peak: 0.70 trips / hour / unit: 9 trips per hour**
  - **PM Peak: 0.94 trips / hour / unit: 12 trips per hour**

As there are no trip generation rates for rural schools in the ITE Manual, the following were assumed. The school times are 8:30 AM to 3:00 PM. Due to the rural location of the school, 90% of the students (63 students) are expected to be bussed to school on 2 buses while 10% of the students (7 students) are expected to be dropped off.

- School AM Start:
  - 2 buses: 2 trips in and 2 trips out
  - 6 teachers: 6 trips in
  - 7 student Drop offs: 7 trips in and 7 trips out
  - **AM Peak Total: 24 trips (15 trips in, 9 trips out)**
- School PM End:
  - As the school hours end outside of the typical PM commuter peak (4-6 PM), no trips are generated in the PM peak.
  - **PM Peak Total: 0 trips**

In total, there are **33 trips in the AM peak and 12 trips in the PM peak**. This is a negligible amount of traffic and will have minimal impact on existing traffic operations.

3.0 Closing

From the transportation review of the proposed 12 country residential homes and school, the following conclusions are drawn:

- The development generates at most 33 and 12 additional trips per hour in the AM and PM peaks, respectively. The amount of traffic generated is negligible and will have minimal impact on existing traffic operations.

If any additional information is required, please contact the undersigned at your convenience.

Sincerely,

Alex Ho, P.Eng., PTOE
Manager, Traffic Engineering

4105 7 Street SE Calgary, AB T2G 2Y9 T: 403.254.0544 F: 403.254.9186

February 15, 2024

Our Reference: 28449

Douglas Bergen & Associates Ltd.
PO Box 1667
Coaldale, Alberta
T1M 1N3

Attention: Douglas Bergen

Dear Sir:

Reference: Chin Subdivision Trip Generation

1.0 Introduction

ISL Engineering and Land Services Ltd. (ISL) was retained by Douglas Bergen & Associates Ltd. to determine the trip generation of a 12-lot country residential and school development in the Hamlet of Chin, Municipal District (MD) of Taber, Alberta. The school will have 70 students and 6 teachers.

The development is located just north of Highway 3 and west of Range Road 19-0. As part of the development, Naismith Street is proposed to be extended north and access to each lot is off the extended segment of Naismith Street. Figure 1 shows the site plan.

The lots, roads and school are anticipated to be constructed in September 2024. The houses on the residential lots will be built when a buyer purchases the lot.

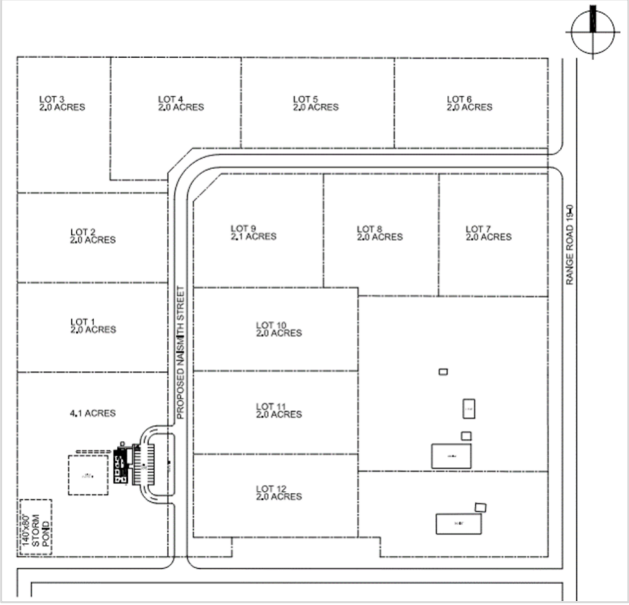


Figure 1: Site Plan

2.0 Trip Generation

In the MD's General Standards of Development in Schedule 5 of the Land Use Bylaw No. 1677, the guideline does not indicate when a TIA is required to be undertaken. Per typical engineering standards, a site that generates less than 100 trips during the commuter peak hour (between 7-9 AMand 4-6 PM) does not require a TIA.

For the 12 residential lots, the single-family trip generation rates from the ITE Trip Generation Manual, 11th Edition, was referenced. This manual is an industry accepted manual to estimate traffic.

- Single Family Residential (ITE Rates):
  - **AM Peak: 0.70 trips / hour / unit: 9 trips per hour**
  - **PM Peak: 0.94 trips / hour / unit: 12 trips per hour**

As there are no trip generation rates for rural schools in the ITE Manual, the following were assumed. The school times are 8:30 AM to 3:00 PM. Due to the rural location of the school, 90% of the students (63 students) are expected to be bussed to school on 2 buses while 10% of the students (7 students) are expected to be dropped off.

- School AM Start:
  - 2 buses: 2 trips in and 2 trips out
  - 6 teachers: 6 trips in
  - 7 student Drop offs: 7 trips in and 7 trips out
  - **AM Peak Total: 24 trips (15 trips in, 9 trips out)**
- School PM End:
  - As the school hours end outside of the typical PM commuter peak (4-6 PM), no trips are generated in the PM peak.
  - **PM Peak Total: 0 trips**

In total, there are **33 trips in the AM peak and 12 trips in the PM peak**. This is a negligible amount of traffic and should have minimal impact on existing traffic operations.

3.0 Highway Traffic

The latest traffic volumes on Highway 3 at Range Road 19-0 were downloaded from Alberta Transportation and Economic Corridors' (ATEC) website. In 2022, the Average Annual Daily Traffic (AADT) was 8,080 vehicles per day (vpd) while the Average Summer Daily Traffic (ASDT) was 8,860 vpd. As compared to the 10-year traffic history in 2012, the AADT (8,100 vpd) declined by -0.02% per year while the ASDT (8,650 vpd) grew by 0.24% per year. Based on the preceding, there is very minimal growth on Highway 3 at Range Road 19-0.

As compared to the Highway 3 peak hour traffic volumes (857 and 860 vehicles per hour in the AM and PM, respectively), the development will increase the traffic on Highway 3 by 4% and 1% in the AM and PM peak, respectively. This is a negligible amount and should have minimal impact on Highway 3, thus upgrades to the highway are not required.

4.0 Closing

From the transportation review of the proposed 12 country residential homes and school, the following conclusions are drawn:

- The development generates at most 33 and 12 additional trips per hour in the AM and PM peaks, respectively. The amount of traffic generated is negligible and will have minimal impact on existing traffic operations.
- On Highway 3 at Range Road 19-0, there has been minimal growth over the last 10 years.
- The development will increase the traffic on Highway 3 by 4% and 1% in the AM and PM peak, respectively. This is a negligible amount and should have minimal impact on Highway 3, thus upgrades to the highway are not required.

If any additional information is required, please contact the undersigned at your convenience.

Sincerely,

Alex Ho, P.Eng., PTOE
Manager, Traffic Engineering

APPENDIX C

Osprey Engineering Septic Report

OSPREY ENGINEERING INC.
BOX 1367 · BLACK DIAMOND, ALBERTA · T0L 0H0 CANADA
TEL: 403.933.2226 · EMAIL: ospreyeng@gmail.com

27 November 2023 Our file: 230876

Douglas J. Bergen Associates Ltd.
Box 1667
Coaldale, AB, T1M 1N3

Attention: Douglas Bergen, CET

RE: Chin Area Structure Plan
North Side of Alberta Avenue, Hamlet of Chin (Blocks A, B & E, Plan 899 AA, NE25-9-19-4)
Private Sewage Treatment Systems (PSTS) Assessment

Dear Douglas,

The following Private Sewage Treatment Systems Assessment was performed in support of an application for subdivision of the above-noted parcel in August 2023. *The proposed lots were found to be suitable for private sewage treatment systems (PSTS) with limitations noted.*
The site investigation and report were performed and prepared consistent with the following documents:

- (Safety Codes Council, 2021), *Alberta Private Sewage Standard of Practice*, Alberta Municipal Affairs, Edmonton ["SOP 2021"],
- (Alberta Association of Municipal Districts & Counties in parthnership with Alberta Municipal Affairs, 2011) Alberta Association of Municipal Districts and Counties [AAMDC] 2011, *Model Process for Subdivision Approval and Private Sewage* ["Model Process"] and related documents.

I. PROJECT BACKGROUND

The subject parcel is located on the west side of Range Road 190, and north of Alberta Avenue, in The Hamlet of Chin. The area of the subject parcel is 15.9 ha [39.4 acres] more or less. The location of the parcel is shown on Figure 1. The parcel is presently a farming field with no existing dwellings or buildings.

The owners propose to subdivide twelve country residential lots and one larger lot for a school. The proposed country residential lots will be 0.8 ha [2.0 ac]. The school lot will be 1.7 ha [4.1 ac]. The proposed lots will be accessed by extending the existing Naismith Street. The preferred lot layout is shown on Figure 2.

The proposed lots will be served by private water cisterns. The proposed lots are intended to be served by new private sewage systems.

II. METHODOLOGY AND LIMITATION

In support of a subdivision, Lethbridge County has requested that a private sewage treatment systems (PSTS) assessment be completed to justify that wastewater from dwellings on the proposed lots can be treated and dispersed on site consistent with relevant safety codes. Methodology in describing acceptable conditions for adequate operation of private sewage treatment systems (PSTS) is consistent with (Safety Codes Council, 2021).
As such, all loading rates are as per SOP 2021. No percolation tests were performed as these are no longer considered acceptable evidence in support of the selection of soil loading rates in SOP 2021.
Observations were taken from publicly available background information and field assessments noted:

- 28 August 2023: Osprey soil observations.

Observation and recording of the soil profiles was performed as directed in SOP 2021 using forms based on those provided by Alberta Municipal Affairs. Soil samples from the test pits were submitted to Down to Earth Labs of Lethbridge for texture analysis. These results are appended.
This report is to be used by the owners of the parcels noted and Lethbridge County in support of the area structure plan and eventual subdivision of the subject parcel, as described in the Model Process. It is not intended as a full system design. Full design and site investigation (including digging additional test holes or other tests as may be required) by a licensed installer consistent with the relevant standard of practice in force at the time is still assumed to be required as part of the permit process.

III. DESCRIPTION

This description is based on information provided by the owners of the parcel and information obtained from various public sources. Topography of the parcel based on a recent survey (performed by Mike Spencer Geomatics in September 2023) is included showing existing surface features within and immediately surrounding the subject parcel.

A. Density and Cumulative Impact

The surrounding quarter sections have 3 or fewer parcels per quarter section. The quarter sections to the south which includes The Hamlet of Chin has approximately 89 parcels within the quarter section. Figure 3 indicates the number of parcels in each of the surrounding quarter-sections based on cadastral data provided by AltaLIS and is current to the date of this report.
All country residential parcels in the area are assumed to be served by individual private sewage systems with water services from private water cisterns. Wells noted in the provincial database for the surrounding area are listed in Appendix C.
The cumulative impact due to additional density due to the proposed subdivision does not extend beyond the lot boundaries for the following reasons:

- Parcel sizes are sufficient and area density is low to moderate. As such, there will be adequate dilution due to precipitation such that nutrient loading due to the additional wastewater generated will not result in nutrient concentrations greater than CCME guidelines. Given this, no additional source water quality impact assessment is justified for this subdivision.

B. Topography, Surface Water and Vegetation

Surface features are shown on Figure 4. The site encompasses undulating, low relief terrain.
The subject parcel does not contain any steep slopes. The average slope of the parcel is 1%.
A depression and manmade swale crosses Lots 1, 7, 8, 10, 11, and the school. These areas could be subject to overland flows and pooling water, and it may be prudent to locate PSTS outside of this area. If the depression has a defined "shoreline" per the SOP, then a setback of 15.0 m [50 ft] would be prescribed from this shoreline. If no shoreline is noted, then no setback is applicable. These do not have a defined shoreline; therefore no setback is applicable.
An irrigation canal exists to the west but is more than 1000 m from the subject parcel.
No rivers, lakes, creeks, or streams affect the parcel.
No springs or wells using shallow groundwater (GWUDI) for domestic purposes were noted within 150 m (500 feet) of the subject parcel. No dugouts or surface water bodies were noted as being used for domestic purposes within 150 m (500 feet) of the subject parcel.

Vegetation across the subject parcel is as follows:

- Crops

Generally, the vegetation on site does not indicate features that would limit PSTS.

C. Encumbrances

No rights-of-way exist within the subject parcel. A pipeline right-of-way (011 3349) and a waterline right-of-way (011 0603) exist to the north of the subject parcel.
Standard setback (horizontal separation) distances for various PSTS components as per SOP 2021 are as follows:

- All soil-based treatment components (fields, mounds, etc…) must be **100 m** from a licensed municipal water well.
- All soil-based treatment components (fields, mounds, etc…) must be **90 m** from a lake, river, stream, or creek *unless* "…a principal building or other development feature is located between the soil based treatment system and the lake, river, stream or creek such that a failure causing effluent on the ground will be obvious and create an undesirable impact on the owner…" (SOP 2021, Art. 2.1.2.4). Generally, if the dwelling is constructed between the stream and the soil based treatment component, this is acceptable and the setbacks to a water source or water course as noted below are applicable;
- Septic tanks, settling tanks and effluent tanks:
  - 10 m from a water source,
  - 10 m from a water course,
  - 1 m from a property line and
  - 1 m from a building.
- Packaged (secondary) treatment plants and settling tanks which include pre-aeration:
  - Same as for septic tanks *except*
  - 6 m from a property line.
- Sand filters (to foot of berm):
  - Same as for septic tanks.
- Recirculating gravel filters (to foot of berm):
  - Same as for septic tanks *except*
  - 3 m from property line.
- Treatment field (edge of weeping lateral trench):
  - 15 m from a water source,
  - 15 m from a water course (unless building is located between water course and field),
  - 1.5 m from a property line,
  - 10 m from a basement, cellar, or crawl space,
  - 1 m from a building without a permanent foundation,
  - 5 m from a building with a permanent foundation but without a basement cellar or crawl space (e.g. slab-on-grade) and
  - 5 m from a septic tank or packaged sewage treatment plant.
- Treatment mound (from point where side slope of mound berm intersects natural soil contour):
  - Same as for a treatment field *except*
  - 3 m from a property line,

- 3 m from a septic tank,
- 10 m from a basement, cellar, or crawl space and
- 10 m from a building with a permanent foundation but without a basement cellar or crawl space (e.g. slab-on-grade).

D. Soils

According to the Alberta Soil Information Viewer (soil polygons 1337 and 1334) (Government of Alberta, 2023), the following soil series may be present in the subject parcel.

- Cranford (CFD): Orthic brown chernozem with medium textured soils (loam, silty loam, and very fine sandy loam) on medium or fine textured till.
- Chin (CHN): Orthic brown chernozem with medium textured soil (loam, silty loam, and very fine sandy loam) on medium textured sediments (loam to very fine sandy loam) deposited by wind and water.

CFD, and CHN would be *generally* amenable to PSTS.
General limitations for PSTS due to soil conditions include possible lower loading rates for dispersing effluent on fine-textured soil (e.g. clay loam or finer) or coarse textured soils (e.g. sand, loamy sand, or sandy loam) with weak or poor structure, restricting soil horizons which limit downward movement and high groundwater or seasonal high groundwater conditions.

All systems dispersing primary treated (septic tank) effluent (Effluent Level 1 per SOP 2021) to the soil via treatment fields must maintain a vertical separation of at least 1.5 m [5 ft] to restricting soil horizons, groundwater, and seasonal high groundwater. Systems dispersing secondary-treated (Effluent Level 2 or better per SOP 2021), including all treatment mounds, must maintain a vertical separation of at least 0.9 m [3 ft] to restricting soil horizons.

Soil profiles were developed for thirteen test pits. One test pit was excavated within each proposed lot, as shown on Figure 4. As noted, detailed soil profiles and laboratory texture analyses are appended.

Soils were generally consistent with the soil series noted for this area.

- Lot 1: A brown loam A-horizon (Ap) to approximately 23 cm [9"] overlays a pale brown loam Bm-horizon to approximately 130 cm [51"] which transitions to a brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying). No groundwater was found.
- Lot 2: A yellowish brown loam A-horizon (Ap) to approximately 20 cm [8"] overlays a pale brown loam Bm-horizon to approximately 84 cm [33"] which transitions to a dark yellowish brown loam Bm-horizon to approximately 102 cm [40"] which transitions to a brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 3: A dark yellowish brown clay loam A-horizon (Ap) to approximately 25 cm [10"] overlays a brown clay loam Bm-horizon to approximately 69 cm [27"] which transitions to a brown clay loam Bm-horizon to approximately 89 cm [35"] which transitions to a dark yellowish brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 4: A dark yellowish brown clay loam A-horizon (Ap) to approximately 23 cm [9"] overlays a brown clay loam Bm-horizon to approximately 84 cm [33"] which transitions

to a dark yellowish brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.

- Lot 5: A brown loam A-horizon (Ap) to approximately 3 cm [13"] overlays a pale brown to brown loam Bm-horizon to approximately 97 cm [38"] which transitions to a brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 6: A brown clay loam A-horizon (Ap) to approximately 18 cm [7"] overlays a brown to light yellowish brown clay loam Bm-horizon to approximately 114 cm [45"] which transitions to a dark grayish brown to dark yellowish brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 191 cm [75"]. No groundwater was found.
- Lot 7: A brown clay loam A-horizon (Ap) to approximately 23 cm [9"] overlays a brown to pale brown clay loam Bm-horizon to approximately 196 cm [77"] which transitions to a light olive brown coarse sandy loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 196 cm [77"]. No groundwater was found.
- Lot 8: A brown loam A-horizon (Ap) to approximately 25 cm [13"] overlays a light yellowish brown to a light olive brown sandy clay loam Bm-horizon to approximately 127 cm [50"] which transitions to a light olive brown and yellowish brown loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 9: A brown loam A-horizon (Ap) to approximately 30 cm [12"] overlays a brown and light olive brown clay loam Bm-horizon to approximately 81 cm [32"] which transitions to a light olive brown and brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 10: A brown loam A-horizon (Ap) to approximately 15 cm [6"] overlays a yellowish brown and brown clay loam Bm-horizon to approximately 84 cm [33"] which transitions to a yellowish brown and brown loam and clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.
- Lot 11: A brown clay loam A-horizon (Ap) to approximately 15 cm [6"] overlays an olive brown and light yellowish brown clay loam Bm-horizon to approximately 109 cm [43"] which transitions to a dark yellowish brown and brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 193 cm [76"]. No groundwater was found.
- Lot 12: A brown clay loam A-horizon (Ap) to approximately 20 cm [8"] overlays a light yellowish brown and light olive brown clay loam Bm-horizon to approximately 109 cm [43"] which transitions to a dark yellowish brown clay loam Ck-horizon below. Evidence of seasonal saturation (mottling) was observed below 208 cm [82"]. No groundwater was found.
- School Lot: A brown clay loam A-horizon (Ap) to approximately 15 cm [6"] overlays a pale brown and brown clay loam Bm-horizon to approximately 132 cm [52"] which transitions to a dark brown clay loam Ck-horizon below. No evidence of seasonal saturation (mottling or gleying) was observed. No groundwater was found.

IV. ESTIMATE OF SYSTEM DAILY FLOWS

Houses are predicted to be at least four bedrooms and generally include additional fixtures that can increase peak daily flows.

As such, a peak daily flow rate of 2300 L/day [500 gal/day] is used (a four-bedroom house with allowance for *some* extra fixture units). The installation of such fixtures as garbage grinders, large soaker tubs and other high-volume and/or high-strength effluent producing fixtures requires special consideration because:

- these increase the PSTS soil component size required and
- the possible lack of space for adequately sized soil treatment components and reserve field areas to accommodate such features.

Water treatment components (such as water softeners and iron filters) can generate large flows of clear water. When connected to private sewage systems, these large flows can cause treatment components to fail and become saturated. It is strongly recommended that backflush and overflow from water treatment components be directed elsewhere.

The school is predicted to be 35 students. As per the SOP 2021, a peak daily flow per student is 70 L/day/student [15 gal/day/student]. The total peak daily rate is 2450 L/day [525 gal/day].

Actual size of system components is the responsibility of the system installer and will be determined prior to obtaining permits based on the proposed house size and design.

V. INFILTRATION COMPONENT SIZING

Based on the site assessment, the following types of soil-based effluent treatment and dispersal systems are not appropriate for the proposed parcel:

- Lagoons due to limited distance to property boundaries,
- Open discharge due to limited distance to property boundaries and area density and
- LFH at-grade systems except in forested areas where LFH layers of 50 mm [2"] or deeper can be demonstrated.

Treatment fields receiving primary (Level 1) or secondary (Level 2) treated effluent or treatment mounds receiving primary (Level 1) or secondary (Level 2) treated effluent are suitable for the proposed lots. Suitability of any given proposed PSTS is subject to the design judgement of the installer and the standard of practice in effect at the time of installation. Soils can vary throughout a parcel and such variation can affect the suitability of land for PSTS.

For the purposes of this report, the infiltration component assumes the following:

- Pressure distributed treatment fields receiving primary treated (Level 1) effluent.
- The required vertical separation to a restricting condition for a treatment field is 1.5 m [5 ft] from trench bottom. Given the soil profile observed on these lots, this can be achieved.

Footprints for such systems are shown on Figure 4 and on Table 1. Footprints are approximate and will depend on dwelling size and type of PSTS ultimately chosen by the owner and installer based on detailed soil analysis at the time of the design, as well as other factors. Other designs and arrangements are possible for the proposed infiltration components. Decisions relating to a final design are the responsibility of the landowner, their system installer, and the safety codes officer (SCO) inspecting the installation.

VI. SUSTAINABILITY OF PRIVATE SEWAGE

If installed by a qualified installer as recommended in this report, and properly operated and maintained, the proposed lots can support viable PSTSs for the long term.

VII. CONCLUSIONS

If installed and maintained using accepted best practices, there is more than adequate space on the proposed lots to install compliant and functioning PSTSs.

If you require anything further, please contact the undersigned.

Yours truly,

Responsible member for
OSPREY ENGINEERING INC.
APEGA Permit to Practice No. P10743

Michael A. Kitchen, P.Eng.
Alberta Municipal Affairs, Certificate of Competency **PS 8926**, Private Sewage Installer; Group I
President

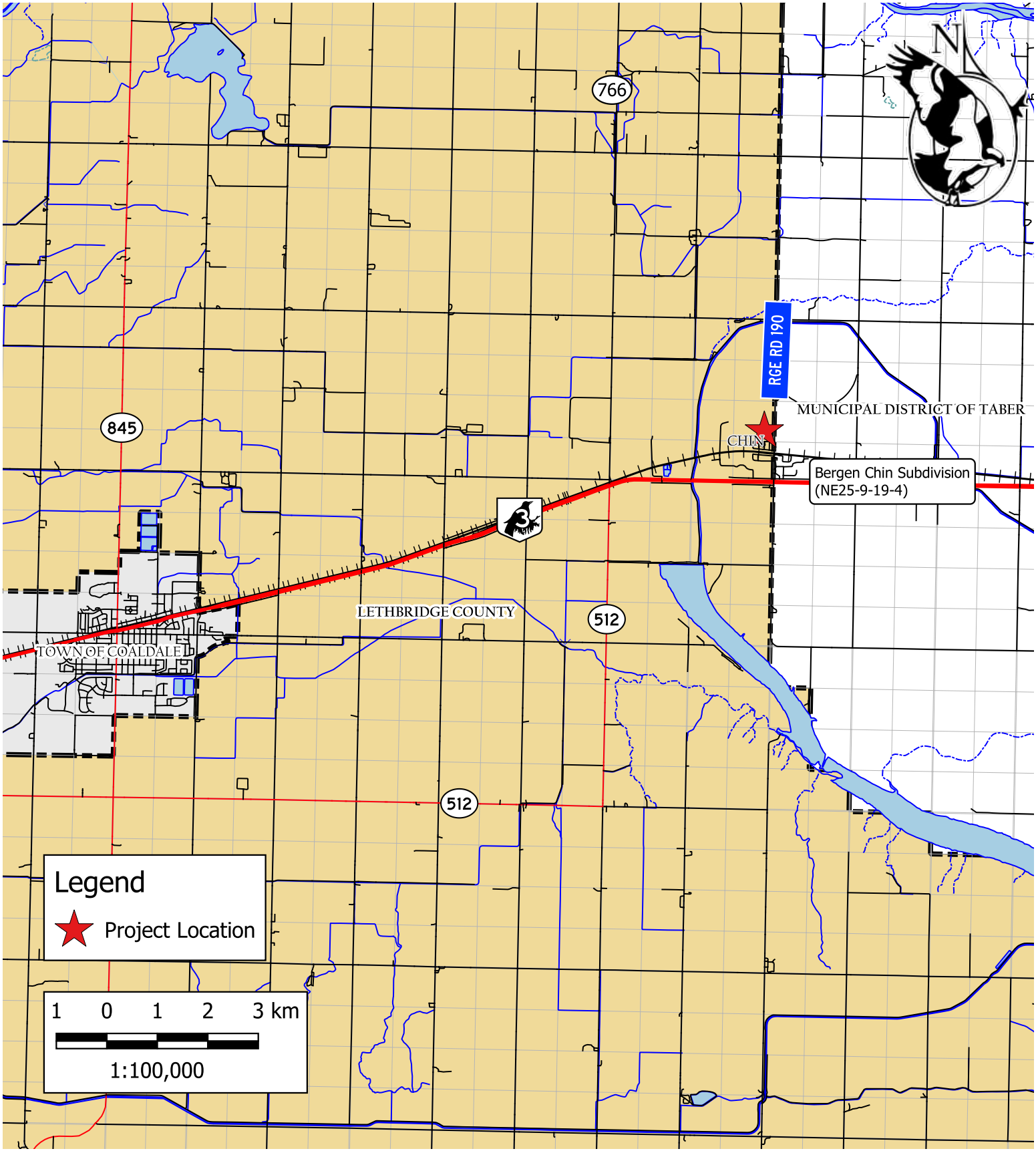
MAK/

Encl.

cc.

FIGURES

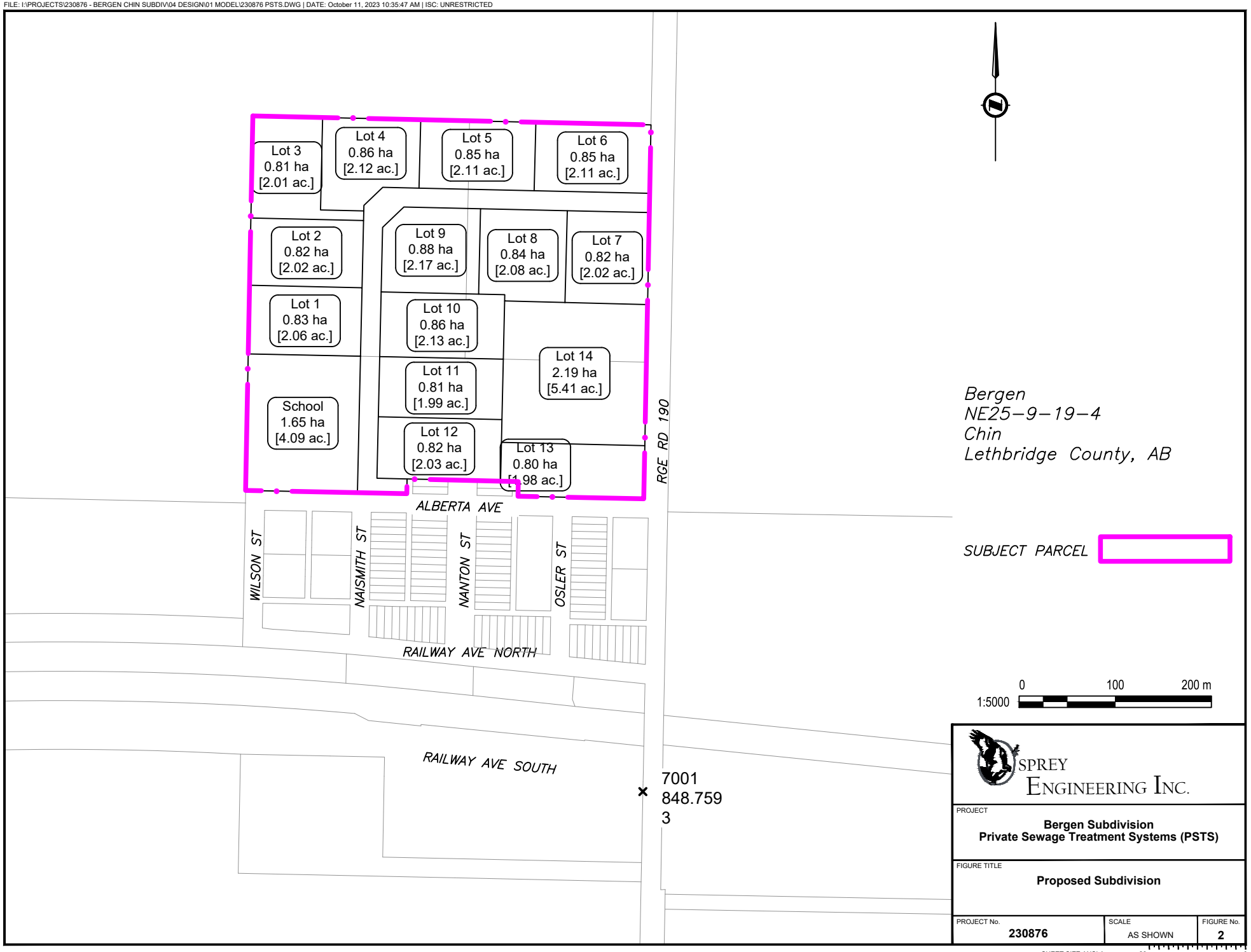
The following figures are referenced in the report.



SPREY ENGINEERING INC.

Bergen Chin Subdivision
Private Sewage Treatment Systems (PSTS)
Assessment

Figure 1 - Location



SPREY ENGINEERING INC.

PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Proposed Subdivision

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	2

SHEET SIZE ANSI A
20 mm
0

SW36–9–19–4
1 parcel

SE36–9–19–4
1 parcel

SW31–9–18–4
1 parcel

CANAL

NE25–9–19–4
3 parcels (EX)
13 parcels (PROP)

RGE RD 190

NW25–9–19–4
2 parcels

NW30–9–18–4
1 parcel

ALBERTA AVE

WILSON ST

NAISMITH ST

NANTON ST

OSLER ST

RAILWAY AVE NORTH

RAILWAY AVE SOUTH

7001
848.759
3

SW25–9–19–4
3 parcels

SW30–9–18–4
4 parcels

SE25–9–19–4
~89 parcels

5510
850.593
IP

CROWSNEST HWY

HWY 3

0 200 400 m
1:10 000

SUBJECT PARCEL

Bergen
NE25–9–19–4
Chin
Lethbridge County, AB

OSPREY ENGINEERING INC.

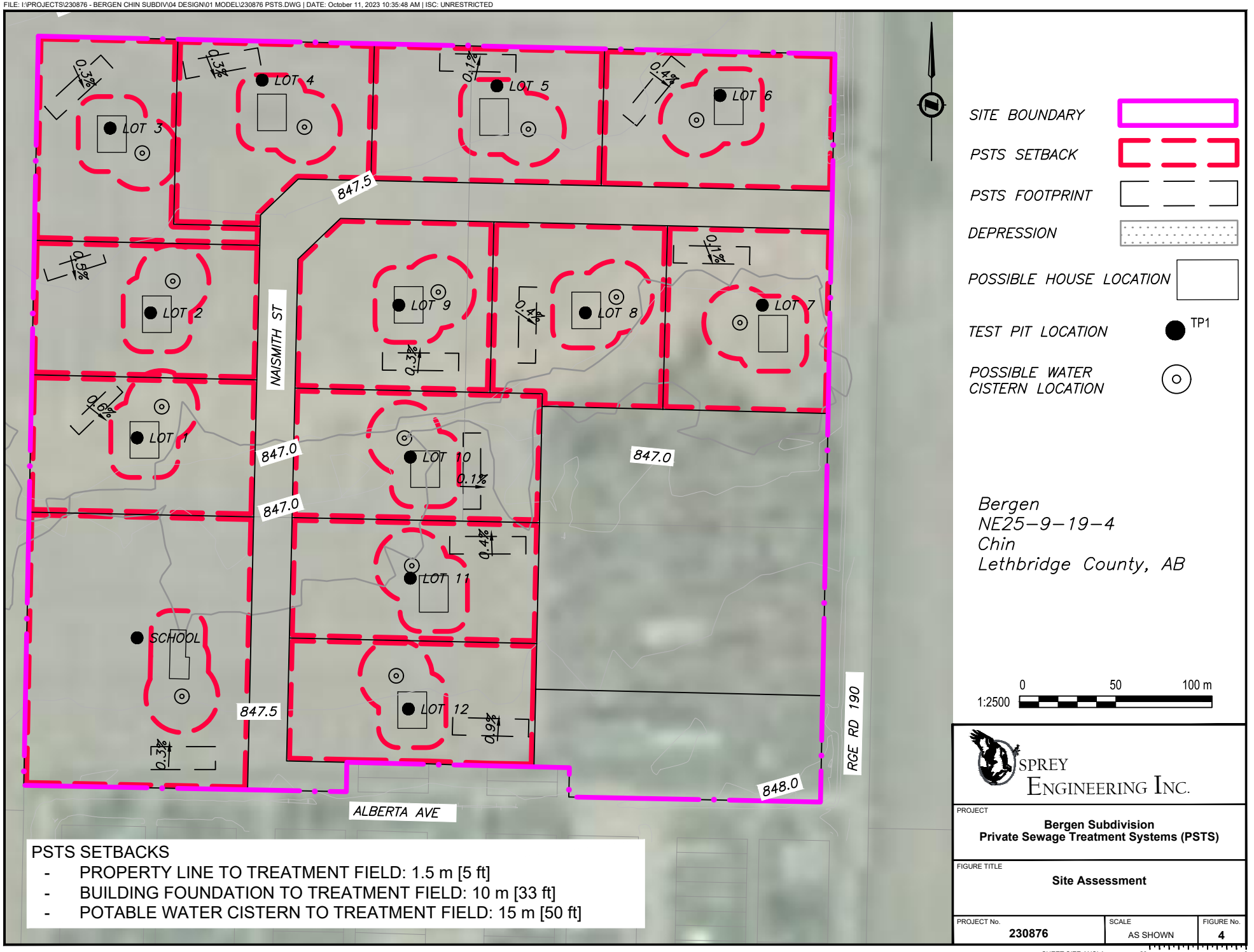
PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Area Density

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	3

SHEET SIZE ANSI B 20 mm 0

FILE: I:\PROJECTS\230876 - BERGEN CHIN SUBDIV\04 DESIGN\01 MODEL\230876 PSTS.DWG | DATE: October 11, 2023 10:35:48 AM | ISC: UNRESTRICTED



PSTS SETBACKS
- PROPERTY LINE TO TREATMENT FIELD: 1.5 m [5 ft]
- BUILDING FOUNDATION TO TREATMENT FIELD: 10 m [33 ft]
- POTABLE WATER CISTERN TO TREATMENT FIELD: 15 m [50 ft]

SPREY ENGINEERING INC.

PROJECT
Bergen Subdivision
Private Sewage Treatment Systems (PSTS)

FIGURE TITLE
Site Assessment

PROJECT No.	SCALE	FIGURE No.
230876	AS SHOWN	4

SHEET SIZE ANSI A

	Proposed Lot 1	Proposed Lot 2	Proposed Lot 3	Proposed Lot 4	Proposed Lot 5
Texture	Very: loam	Very: loam	Moderate to good: clay loam	Moderate to good: clay loam	Moderate to good: clay loam, and loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m
Depth to Water Table	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Very	Very	Very	Very	Very
Recommended System Type	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 1 - TP	Lot 2 - TP	Lot 3 - TP	Lot 4 - TP	Lot 5 - TP
Limiting soil type	Loam, granular (grade 2) structure	Loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure		Clay loam, granular (grade 2) structure
Applicable Loading Rates	HLR: 22.0 L/m²/day [0.45 gal/ft²/day]	HLR: 22.0 L/m²/day [0.45 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions
Approximate System footprint	31.7 m × 6.4 m [104.0 ft × 21.0 ft]	31.7 m × 6.4 m [104.0 ft × 21.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]

	Proposed Lot 6	Proposed Lot 7	Proposed Lot 8	Proposed Lot 9	Proposed Lot 10
Texture	Moderate to good: clay loam	Moderate to good: sandy clay loam, and clay loam	Moderate to good: sandy clay loam, and loam	Moderate to good: clay loam	Moderate to good: clay loam, and loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: blocky (grade 2) structure	Moderate: blocky (grade 2) structure	Moderate: blocky (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Moderate: well drained above 1.8 m	Moderate: well drained above 2.0 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Moderate: suitable above 1.8 m	Moderate: suitable above 2.0 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m	Very: suitable soil to >2.5 m
Depth to Water Table	Moderate: evidence of seasonally saturated soils below 1.8 m	Moderate: evidence of seasonally saturated soils below 2.0 m	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Moderate to very	Moderate to very	Very	Very	Very
Recommended System Type	Shallow treatment field receiving primary treated effluent	Shallow treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 6 - TP	Lot 7 - TP	Lot 8 - TP	Lot 9 - TP	Lot 10 - TP
Limiting soil type	Clay loam, granular (grade 2) structure	Sandy clay loam, granular (grade 2) structure	Sandy clay loam, blocky (grade 2) structure	Clay loam, blocky (grade 2) structure	Clay loam, blocky (grade 2) structure
Applicable Loading Rates	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions within < 60 inches	LLR: N/A, no restricting conditions within < 60 inches	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions	LLR: N/A, no restricting conditions
Approximate System footprint	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]

	Proposed Lot 11	Proposed Lot 12	Proposed School Lot
Texture	Moderate: clay loam	Moderate: clay loam	Moderate to good: clay loam
Structure	Moderate to well: granular (grade 2) structure	Moderate: granular (grade 2) structure	Moderate: granular (grade 2) structure
Hydraulic Capability of Soil (Drainage)	Moderate: well drained above 2.0 m	Moderate: well drained above 2.0 m	Very: well drained to >2.5 m
Depth of Suitable Soil	Moderate: suitable soil above 2.0 m	Moderate: suitable soil above 2.0 m	Very: suitable soil to >2.5 m
Depth to Water Table	Moderate - evidence of saturated soils below 2.0 m	Moderate - evidence of saturated soils below 2.0 m	Very: no evidence of water table or saturated soils
Topography	Very: very slight slope to flat	Very: very slight slope to flat	Very: very slight slope to flat
Flooding	Very: moderate to good surface drainage. No surface water within parcel	Very: moderate to good surface drainage. No surface water within parcel	Moderate: depression within parcel could be subject for pooling water. Area not suitable for PSTS. See Figure 4
Density	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section	Moderate - surrounding <30 parcels per ¼ section
Encumbrances	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS	Very: more than one suitable site for a PSTS
Parcel Size	Moderate: sufficient parcel size	Moderate: sufficient parcel size	Moderate: sufficient parcel size
Surface Water	Very: none within parcel	Very: none within parcel	Very: none within parcel
Overall	Moderate	Moderate	Very
Recommended System Type	Shallow treatment field receiving primary treated effluent	Shallow treatment field receiving primary treated effluent	Treatment field receiving primary treated effluent
Test Pit	Lot 11 - TP	Lot 12 - TP	School - TP
Limiting soil type	Clay loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure	Clay loam, granular (grade 2) structure
Applicable Loading Rates	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]	HLR: 13.2 L/m²/day [0.27 gal/ft²/day]
	LLR: N/A, no restricting conditions within <60"	LLR: N/A, no restricting conditions within <60"	LLR: N/A, no restricting conditions
Approximate System footprint	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	39.6 m × 9.1 m [130.0 ft × 30.0 ft]	33.5 m × 11.9 m [110.0 ft × 39.0 ft]

APPENDIX A – SOIL PROFILES

The following pages contain the soil profile from the site assessment conducted by Osprey Engineering Inc. on 28 August 2023. Samples of soil from the most-limiting soil horizons were taken from the test pits and submitted to Down to Earth Labs of Lethbridge. Laboratory soil texture results are included. Based on the observed conditions, conclusions were made as to allowable soil loading rates and sizes of dispersal areas needed for the treatment fields.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395699 m	5513599 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 1	O.BLC	Glacial Till	Good	20 in.	60 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	9-51	L	Lab	10YR 6/3	none	none	Granular	2	Friable	Dry	0%
Ck	51-100	L	Lab	10YR 5/3	none	none	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 51 inches. Weak to strong effervescence throughout. Minor white precipitates below 51 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395706 m	5513664 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 2	O.BLC	Glacial Till	Good	25 in.	45 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-8	L	HT	10YR 5/4	none	none	Granular	2	Friable	Dry	0%
Bm	8-33	L	Lab	10YR 6/3	none	none	Blocky	2	Friable	Dry	3%
Bm	33-40	L	Lab	10YR 4/4	none	none	Granular	2	Friable	Dry	1%
Ck	40-95	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	1%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 40 inches. Strong effervescence below 8 inches. Minor white precipitates from 8 inches to 40 inches. Minor orange precipitates below 33 inches. Coarse fragments are < 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395685 m	5513760 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 3	O.BLC	Glacial Till	Good	5 in.	40 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-10	CL	Lab	10YR 4/4	none	none	Blocky	2	Friable	Dry	0%
Bm	10-27	CL	HT	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Bm	27-35	CL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	15%
Ck	35-100	CL	HT	10YR 4/4	none	none	Granular	2	Friable	Dry	2%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 35 inches. Strong effervescence below 10 inches. Minor white precipitates from 10 inches to 27 inches and 35 inches to 100 inches. Minor orange precipitates below 35 inches. Minor coal fragments below 45 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395764 m	5513785 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 4	O.BLC	Glacial Till	Good	20 in.	40 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	CL	HT	10YR 4/4	none	none	Blocky	2	Friable	Dry	0%
Bm	9-26	CL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Bm	26-33	CL	HT	10YR 5/3	none	none	Granular	2	Friable	Dry	15%
Ck	33-52	CL	Lab	10YR 4/4	none	none	Granular	2	Friable	Dry	2%
Ck	52-100	CL	HT	10YR 4/4	none	none	Granular	2	Friable	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 33 inches. Strong effervescence below 9 inches. Minor white precipitates from 9 inches to 26 inches and 52 inches to 100 inches. Minor orange precipitates from 26 inches to 52 inches. Minor coal fragments from 33 inches to 52 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395886 m	5513782 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 5	O.BLC	Glacial Till	Good	25 in.	60 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-13	L	HT	10YR 5/3	none	none	Blocky	2	Friable	Dry	0%
Bm	13-32	L	Lab	10YR 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	32-38	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	15%
Ck	38-52	CL	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	2%
Ck	52-100	CL	Lab	10YR 5/3	none	none	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 33 inches. Strong effervescence below 9 inches. Minor white precipitates from 9 inches to 26 inches and 52 inches to 100 inches. Minor orange precipitates from 26 inches to 52 inches. Minor coal fragments from 33 inches to 52 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				396002 m	5513777 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 6	O.BLC	Glacial Till	Good	5 in.	35 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-7	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	0%
Bm	7-31	CL	HT	2.5Y 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	31-45	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	5%
Ck	45-75	CL	HT	10YR 4/2	none	none	Blocky	2	Friable	Dry	1%
Ck	75-100	CL	HT	10YR 4/4 & 10YR 5/8	none	few, fine, faint	Blocky	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, blocky (grade 2) structure. Few, fine, faint mottles.
Depth to Seasonally Saturated Soil	75 inches	Depth to restrictive Soil Layer	75 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 45 inches. Strong effervescence below 7 inches. Minor white precipitates from 7 inches to 75 inches. Minor orange precipitates from 31 inches to 75 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				396024 m	5513668 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 7	O.BLC	Glacial Till	Good	15 in.	30 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-9	CL	Lab	10YR 5/3	none	none	Blocky	3	Friable	Dry	0%
Bm	9-25	CL	HT	10YR 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	25-77	SCL	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Ck	77-90	COSL	HT	2.5Y 5/4 & 10YR 5/8	none	few, fine, faint	Granular	2	Loose	Dry	25%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Coarse sandy loam, granular (grade 2) structure. Few, fine, faint mottles.
Depth to Seasonally Saturated Soil	77 inches	Depth to restrictive Soil Layer	77 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Very few roots below 25 inches. No roots below 77 inches. Weak to strong effervescence from 0 inches to 77 inches. Minor white precipitates from 9 inches to 25 inches. Coarse fragments are < 1 inch to 4 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395932 m	5513664 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 8	O.BLC	Glacial Till	Good	20 in.	55 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-13	L	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	13-26	SCL	Lab	2.5Y 6/3	none	none	Blocky	2	Friable	Dry	0%
Bm	26-50	SCL	HT	2.5Y 5/4	none	none	Blocky	2	Friable	Dry	0%
Ck	50-61	L	Lab	10YR 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	61-105	L	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	5%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Sandy clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 61 inches. Weak to strong effervescence throughout. Minor white precipitates from 26 inches to 50 inches. Minor orange precipitates below 61 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395835 m	5513668 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 848 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 9	O.BLC	Glacial Till	Good	15 in.	65 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-12	L	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	12-21	CL	Lab	10YR 4/3	none	none	Blocky	3	Friable	Dry	0%
Bm	21-32	CL	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	32-45	CL	HT	2.5Y 5/4	none	none	Granular	2	Friable	Dry	0%
Ck	45-63	CL	HT	10YR 5/3	none	none	Granular	2	Loose	Dry	0%
Ck	63-105	CL	Lab	2.5Y 4/3	none	none	Granular	2	Loose	Dry	3%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 45 inches. No roots below 63 inches. Weak to strong effervescence throughout. Minor white precipitates from 21 inches to 45 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395841 m	5513589 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 10	O.BLC	Glacial Till	Good	30 in.	50 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	L	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	6-19	CL	HT	10YR 5/4	none	none	Blocky	3	Friable	Dry	0%
Bm	19-33	CL	Lab	10YR 4/3	none	none	Blocky	2	Friable	Dry	0%
Ck	33-45	L	HT	10YR 5/4	none	none	Blocky	2	Friable	Dry	0%
Ck	45-61	L	Lab	10YR 5/3	none	none	Granular	2	Friable	Dry	0%
Ck	61-110	CL	HT	10YR 4/3	none	none	Granular	2	Loose	Dry	3%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, blocky (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 45 inches. Moderate to strong effervescence below 19 inches. Minor white precipitates below 33 inches. Minor orange precipitates below 61 inches. Coarse fragments are 1 inch to 2 inches, sub-rounded.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395841 m	5513526 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 11	O.BLC	Glacial Till	Good	5 in.	50 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	CL	Lab	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	6-21	CL	HT	2.5Y 6/3	none	none	Blocky	3	Friable	Dry	0%
Bm	21-43	CL	HT	2.5Y 4/3	none	none	Granular	2	Friable	Dry	5%
Ck	43-76	CL	Lab	10YR 4/4	none	none	Granular	2	Loose	Dry	1%
Ck	76-105	CL	HT	10YR 4/3 & 10YR 5/8	none	few, fine, distinct	Granular	2	Loose	Dry	1%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, granular (grade 2) structure. Few, fine, distinct mottles.
Depth to Seasonally Saturated Soil	76 inches	Depth to restrictive Soil Layer	76 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 43 inches. No roots below 76 inches. Weak to strong effervescence throughout. Minor white precipitates from 21 inches to 76 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395840 m	5513458 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 846 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
Lot 12	O.BLC	Glacial Till	Good	15 in.	35 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-8	CL	HT	10YR 4/3	none	none	Granular	3	Friable	Dry	0%
Bm	8-22	CL	Lab	2.5Y 6/3	none	none	Blocky	3	Friable	Dry	0%
Bm	22-43	CL	Lab	2.5Y 5/4	none	none	Granular	2	Friable	Dry	5%
Ck	43-82	CL	HT	10YR 3/4	none	none	Granular	2	Loose	Dry	1%
Ck	82-105	CL	HT	10YR 4/4 & 10YR 5/8	none	few, medium, distinct	Granular	2	Loose	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	Clay loam, granular (grade 2) structure. Few, medium, distinct mottles.
Depth to Seasonally Saturated Soil	82 inches	Depth to restrictive Soil Layer	82 inches
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	Few roots below 43 inches. No roots below 82 inches. Weak to strong effervescence throughout. Minor white precipitates from 22 inches to 82 inches. Coarse fragments are 1 inch to 3 inches, sub-rounded. Can be a treatment field if lateral depth is 12 inches.

230876 - Bergen Chin Subdivision	28-Aug-23

Legal Land Location								Test Pit GPS Coordinates (UTM Zone 12N)	
LSD-1/4	Sec	Twp	Rge	Mer	Lot	Block	Plan	Easting	Northing
NE	25	9	19	4				395699 m	5513495 m

Vegetation notes:	Crops	Overall site slope %	1%	
		Slope position of test pit:	mid	Elevation 847 m

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
SCHOOL TP	O.BLC	Glacial Till	Good	25 in.	55 in.

Horizon	Depth (in.)	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistency	Moisture	% Coarse Fragments
Ap	0-6	CL	HT	10YR 4/3	none	none	Granular	2	Friable	Dry	0%
Bm	6-20	CL	HT	10YR 6/3	none	none	Blocky	2	Friable	Dry	3%
Bm	20-52	CL	Lab	10YR 4/3	none	none	Granular	2	Friable	Dry	1%
Ck	52-100	CL	Lab	10YR 3/3	none	none	Granular	2	Friable	Dry	0%

Depth to Groundwater	none found	Restricting Soil Layer Characteristic	none found
Depth to Seasonally Saturated Soil	none found	Depth to restrictive Soil Layer	none found
Site Topography	hummocky	Depth to Highly Permeable Layer Limiting Design	none found

Key Soil Characteristics applied to system design effluent loading	Clay loam, granular (grade 2) structure
Weather Condition notes:	Hot, sunny, dry
Comments: such as root depth and abundance or other pertinent observations:	No roots below 52 inches. Weak to strong effervescence throughout. Minor white precipitates below 6 inches. Coarse fragments are 1 inch to 4 inches, sub-rounded.

Down To Earth Labs Inc.

The Science of Higher Yields

Osprey Engineering Inc

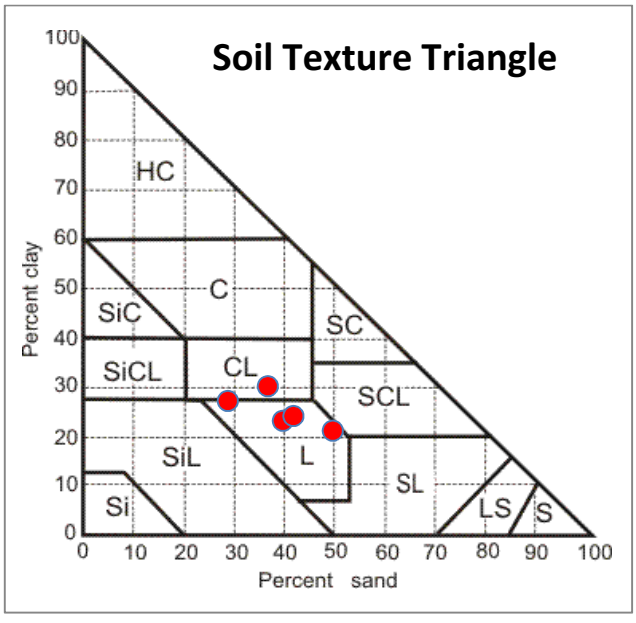
3510 6th Ave North
Lethbridge, AB T1H 5C3
403-328-1133
www.downtoearthlabs.com
info@downtoearthlabs.com

Report #: 159426
Report Date: 2023-09-05
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

		Sample ID:	230831K014	230831K015	230831K016	230831K017	230831K018
		Cust. Sample ID:	Lot 1- S1	Lot 1- S2	Lot 2- S1	Lot 2- S2	Lot 3- S1
Analyte	**Units**		20	60	25	45	5
Sand	%		39.9	49.9	28.9	42.0	36.9
Silt	%		37.2	29.2	44.2	34.1	33.2
Clay	%		22.9	20.9	26.9	23.9	29.9
Soil Texture	-		Loam	Loam	Loam	Loam	Clay Loam



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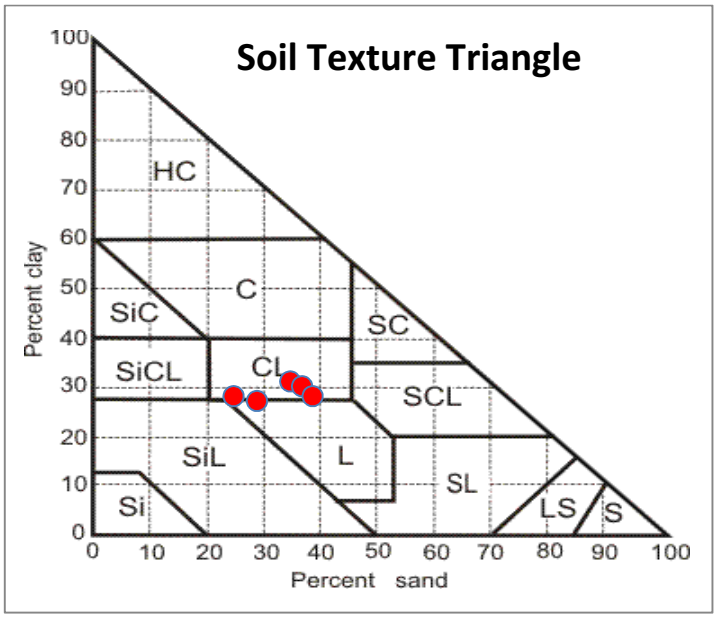
Test Done: ST

Project : Bergen

PO:

Analyte	Units	Sample ID: 230831K019 Cust. Sample ID: Lot 3- S2 40	230831K020 Lot 4- S1 20	230831K021 Lot 4- S2 40	230831K022 Lot 5- S1 25	230831K023 Lot 5- S2 60
Sand	%	34.9	24.9	37.0	29.0	38.9
Silt	%	34.2	47.2	33.1	44.1	33.2
Clay	%	30.9	27.9	29.9	26.9	27.9
Soil Texture	-	Clay Loam	Clay Loam	Clay Loam	Loam	Clay Loam



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Received: 2023-08-31
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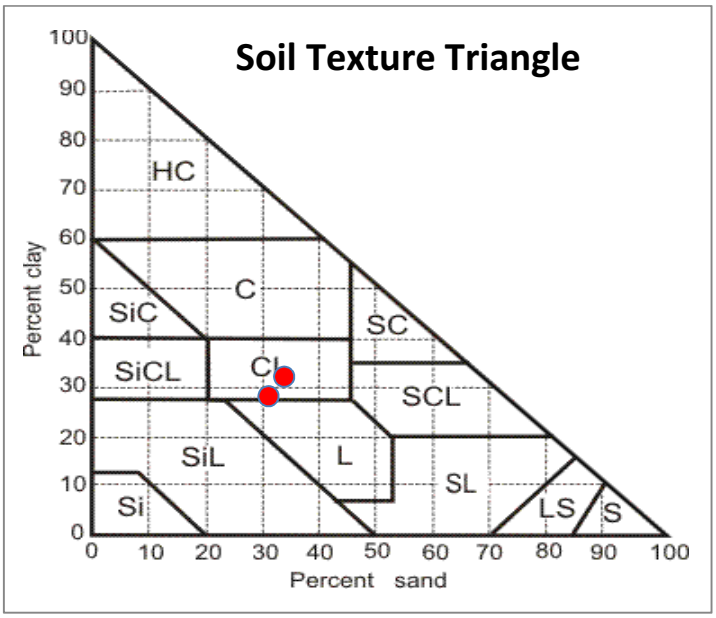
Test Done: ST

Project : Bergen

PO:

		Sample ID:	230831K024	230831K025
		Cust. Sample ID:	Lot 6- S1	Lot 6- S2
Analyte	**Units**		5	35
Sand	%		31.2	34.0
Silt	%		40.9	34.1
Clay	%		27.9	31.9
Soil Texture	-		Clay Loam	Clay Loam



Raygan Boyce - Chemist

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Project : Bergen

PO:

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Lethbridge, AB T1H 5C3
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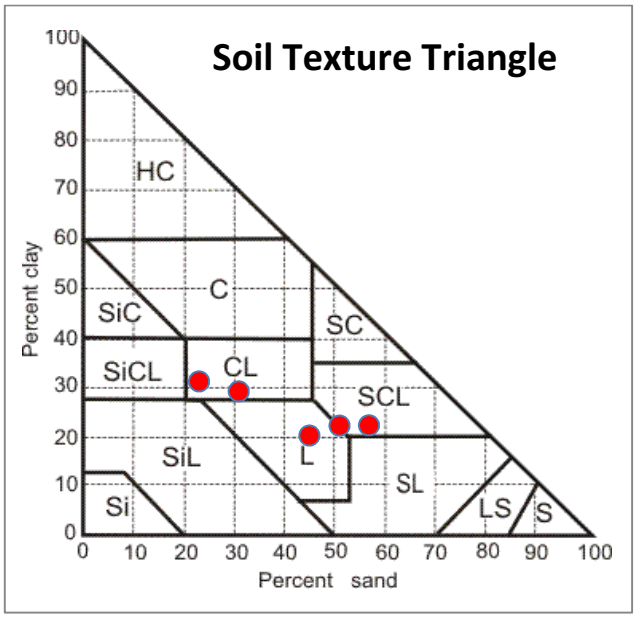
Sample ID:		230831L001	230831L002	230831L003	230831L004	230831L005
Cust. Sample ID:		Lot 7- S1	Lot 7- S2	Lot 8- S1	Lot 8- S2	Lot 9- S1
Analyte	**Units**	15	30	20	55	15
Sand	%	31.1	57.1	51.2	45.2	23.2
Silt	%	40.0	20.9	26.9	34.9	45.9
Clay	%	28.9	22.0	21.9	19.9	30.9
Soil Texture	-	Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Loam	Clay Loam



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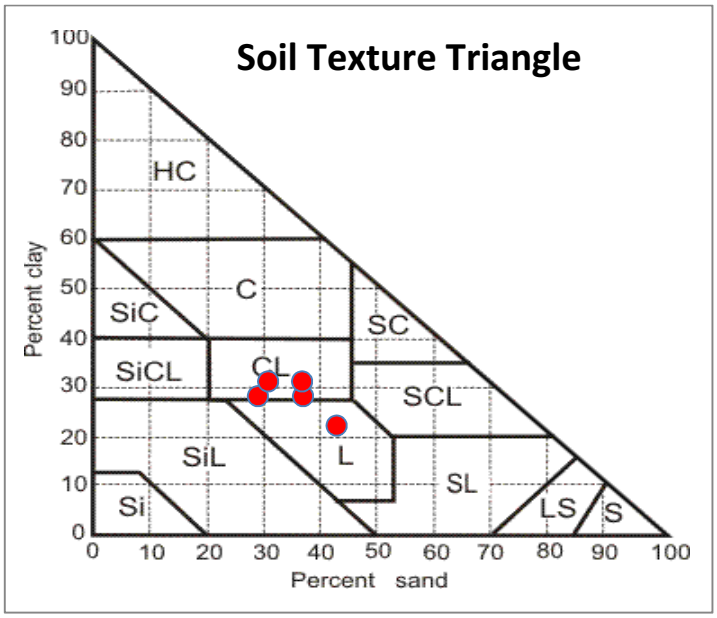
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

Sample ID:		230831L006	230831L007	230831L008	230831L009	230831L010
Cust. Sample ID:		Lot 9- S2	Lot 10- S1	Lot 10- S2	Lot 11- S1	Lot 11- S2
Analyte	**Units**	65	30	50	5	50
Sand	%	37.2	29.2	43.1	31.0	37.0
Silt	%	34.9	42.9	35.0	38.1	32.1
Clay	%	27.9	27.9	21.9	30.9	30.9
Soil Texture	-	Clay Loam	Clay Loam	Loam	Clay Loam	Clay Loam



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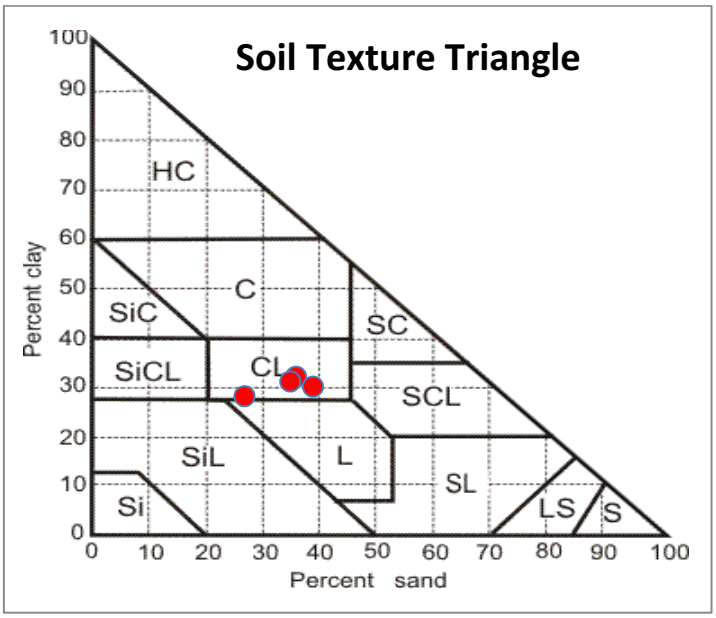
Report #: 159427
Report Date: 2023-09-05
Received: 2023-08-31
Completed: 2023-09-05
Test Done: ST

Project : Bergen

PO:

Sample ID:		230831L011	230831L012	230831L013	230831L014
Cust. Sample ID:		Lot 12- S1	Lot 12- S2	School TP- S1	School TP- S2
Analyte	**Units**	15	35	25	55
Sand	%	27.0	36.1	35.1	39.1
Silt	%	45.1	32.0	34.0	31.0
Clay	%	27.9	31.9	30.9	29.9
Soil Texture	-	Clay Loam	Clay Loam	Clay Loam	Clay Loam



Raygan Boyce - Chemist

APPENDIX B – WELL INFORMATION

The following records are from the Alberta Well Information Database (Alberta Environment and Parks, 2023) for the area within Section 25-9-19-4. It must be noted that well locations are often not described exactly, and the locations noted in this database are often for the centroid of the parcel, legal subdivision (LSD) or quarter-section in which the well is located.

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 106250
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1984/09/12

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KIENTOPP, WILLIAM					

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	25	9	19	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 49.760440 Longitude -112.448856
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Not Applicable

Proposed Well Use
Domestic & Stock

Type of Work
Chemistry

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 0.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1984/09/11		45.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
47.00 ft			

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	47.00

Surface Casing (if applicable)

Size OD : 0.00 in
Wall Thickness : 0.000 in
Bottom at : 0.00 ft

Well Casing/Liner

Size OD : 0.00 in
Wall Thickness : 0.000 in
Top at : 0.00 ft
Bottom at : 0.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)

Perforated by

Annular Seal

Placed from 0.00 ft to 0.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type

Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings
Bottom Fittings

Pack

Type
Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
UNKNOWN DRILLER

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 106250
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1984/09/12

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KIENTOPP, WILLIAM					

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	25	9	19	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 49.760440 Longitude -112.448856
How Location Obtained: Map

Elevation ft
How Elevation Obtained: Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate 0.00 igpm
Recommended Pump Intake Depth (From TOC) 0.00 ft
Pump Installed
Type
Depth ft
Make
H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS)
Depth ft
Gas
Depth ft
Well Disinfected Upon Completion
Geophysical Log Taken
Remedial Action Taken
Submitted to ESRD

Sample Collected for Potability
Submitted to ESRD Yes

Additional Comments on Well

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1984/09/11	12:00 AM	45.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal

Type
Removal Rate igpm
Depth Withdrawn From 0.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
UNKNOWN DRILLER

Copy of Well report provided to owner

Date approval holder signed

REFERENCES

Alberta Association of Municipal Districts & Counties in parthnership with Alberta Municipal Affairs. (2011). *The Model Process for Subdivision Approval and Private Sewage, The Suitability and Viability of Subdivisions Relying on Private Sewage Systems.* Edmonton: Alberta Association of Municipal Districts and Counties.

AltaLIS JV. (2020). Lidar15 Digital Elevation Model. Edmonton, Alberta, Canada.

Government of Alberta. (2023). *Alberta Soil Information Viewer*. Retrieved from Government of Alberta: https://soil.agric.gov.ab.ca/agrasidviewer/

Government of Alberta. (2023). *Groundwater Information Centre*. Retrieved from Government of Alberta: https://groundwater.alberta.ca

Rural Municipalities of Alberta. (2011). *Model Process for Subdivision Approval and Private Sewage.* Nisku: Rural Municipalities of Alberta.

Safety Codes Council. (2021). *Alberta Private Sewage Systems Standard of Practice.* Edmonton: Government of Alberta.

APPENDIX D

Osprey Engineering Storm Water Report

Chin ASP Conceptual Stormwater Management Plan (Revised)

Site details:

Legal Description:	Blocks A, B & E, Plan 899 AA, NE25-9-19-4
Municipal Address:	North Side of Alberta Avenue, Hamlet of Chin
Municipality:	Lethbridge County, AB

Client: Douglas Bergen and Associates Ltd.
Project: 230876
Date: 19 December 2023

OSPREY ENGINEERING INC.
BOX 1367 · BLACK DIAMOND, ALBERTA · T0L 0H0 CANADA
TEL.: 403.933.2226 · EMAIL: ospreyeng@gmail.com

PROFESSIONAL AUTHENTICATION

This professional work product was produced by or under the direct supervision of the persons noted in compliance with Osprey Engineering Inc.'s professional practice management plan. If errors or omissions are suspected or found, please contact the author or authenticating professional forthwith.
This report is to be used by the client/s noted and the authority having jurisdiction for the purpose/s noted.
Osprey Engineering Inc. accepts no responsibility for the work of others.
Osprey Engineering Inc. accepts no responsibility for others' conclusions derived from this report.

Authenticating professional:

Responsible member for
OSPREY ENGINEERING INC.
Association of Professional Engineers and Geoscientists of Alberta Permit to Practice No. **P10743**

Michael A. Kitchen, P.Eng.
President

EXECUTIVE SUMMARY

The Chin Area Structure Plan proposes amendments to land use for a 15.94 ha [39.41 acre] (more or less) area north of Alberta Avenue and west of Range Road 9-0 in the Hamlet of Chin, Lethbridge County. The parcel is adjacent to the corporate limit of the Municipal District of Taber. The intent is to allow subdivision of:

- 12 country residential lots of approximately 0.8 ha [2 acres] each
- 1 school lot of approximately 1.4 ha [3.3 acres] plus a pond area of approximately 0.3 ha [0.8 acres]
- The remainder may be further subdivided with an additional 0.8 ha [2 acre] (approximately) parcel leaving a 2.2 ha [5.4 acre] parcel containing an existing house and auxiliary buildings.

The area is in flat to very gently rolling topography with a sizeable depression located centrally within the subject parcel and in adjacent land to the west. The area is drained by a poorly-defined swale with a very flat longitudinal slope (0.4 m/km).

As the level of development proposed is not intense, increase in hard surface does not result in measurable impact to flows, runoff volume or maximum depth of water in the depressions. Vegetation and soil logs do not indicate these features are wet for any length of time. As such, no ponds were recommended. However, as Lethbridge County has insisted on a pond being installed, such has been provided as noted in this revised report. While not necessary for overall stormwater management, the pond does allow more advantageous ditch grading and culvert design for the extension of Naismith Street.

Given this the following recommendations were made regarding development of the subject parcel:

1. As prescribed by Lethbridge County, a pond will be constructed in the southwest portion of the subject parcel, north of the proposed school lot:
    a. The pond shall have an approximate storage volume (below the existing depression's bottom) of approximately 1620 m^3.
    b. The pond shall have side slopes not exceeding 5H:1V.
    c. A pad shall be provided to install a pump to dewater the pond when necessary. Discharge shall be directed to grassed areas near the swale. Recommended rate of discharge is 9 L/s [143 USgpm], which would allow full drawdown in less than 96 hours.
    d. The pond shall have a landscaped bottom with deep topsoil to encourage evapotranspiration.
    e. No liner is specified to encourage infiltration.
2. Buildings adjacent to the depression should be constructed such that main floor elevation and entrances are well above flood elevation. A minimum freeboard of 0.6 m to main floor elevation above the 100-year maximum depth of ponding is recommended. For the subject parcel, this is an elevation of **847.70 m**.
3. That the flows potentially crossing the extension of Naismith Street be duly considered. Design of equalization culverts should of adequate size to ensure upstream flows are passed with minimal headwater. Tailwater must be duly considered. The road should allow for an emergency overflow elevation below the main floor elevation noted above.

TABLE OF CONTENTS

TABLE OF FIGURES

I. BACKGROUND

The Chin Area Structure Plan proposes amendments to land use for a 15.94 ha [39.41 acre] (more or less) area north of Alberta Avenue and west of Range Road 9-0 in the Hamlet of Chin, Lethbridge County. The parcel is adjacent to the corporate limit of the Municipal District of Taber. The intent is to allow subdivision of:

- 12 country residential lots of approximately 0.8 ha [2 acres] each
- 1 school lot of approximately 1.4 ha [3.3 acres] plus a pond area of approximately 0.3 ha [0.8 acres]
- The remainder may be further subdivided with an additional 0.8 ha [2 acre] (approximately) parcel leaving a 2.2 ha [5.4 acre] parcel containing an existing house and auxiliary buildings.

A public road (extension of Naismith Street) is proposed to extend north and turn east to connect to Range Road 9-0.

The topography of the area is flat to very gently rolling with slopes on the order of less than 0.5% to 2%. A depression roughly bisects the subject area from east to west. This is drained by a poorly defined swale which follows the low area westward to west-southwest. The swale ends at the Canadian Pacific Railway approximately 2 km west-southwest (approximately 300 m east of the St. Mary River Irrigation District Canal). Over its 2.32 km length, the average longitudinal slope of this swale is less than 0.4 m/km [0.04%], this several areas of adverse slope. A high point exists in the swale approximately 400 m west of the subject parcel at an elevation of 846.95 m. Depressions exist below this elevation to an approximate elevation of 846.5 m. Soil logs performed by Osprey in September 2023 do not indicate continued or frequent saturation. As such, flooding these areas is likely minor and infrequent.

The depressions within and immediately west of the subject parcel receive runoff from the entire Chin hamlet west of Range Road 9-0 and a large area of irrigated cropland to the north. The total area tributary to the depressions is approximately 98.63 ha.

A. General Information

Table 1 provides details specific to this site.

Table 1 – General Details

Legal Description	Blocks A, B & E, Plan 899 AA
ATS Reference	NE25-9-19-4
Drainage Area	98.63 ha
Outfall	Surface drainage (swale) at CPR
Discharges to	St. Mary River Irrigation District

B. Study Area and Surrounding Development

The study area consists of the land tributary to the depression within and immediately west of the subject parcel.
Surrounding development is:

- Agricultural (irrigated crop land) to the north, east and west and
- Hamlet to the south.

C. Previous Reports and Designs

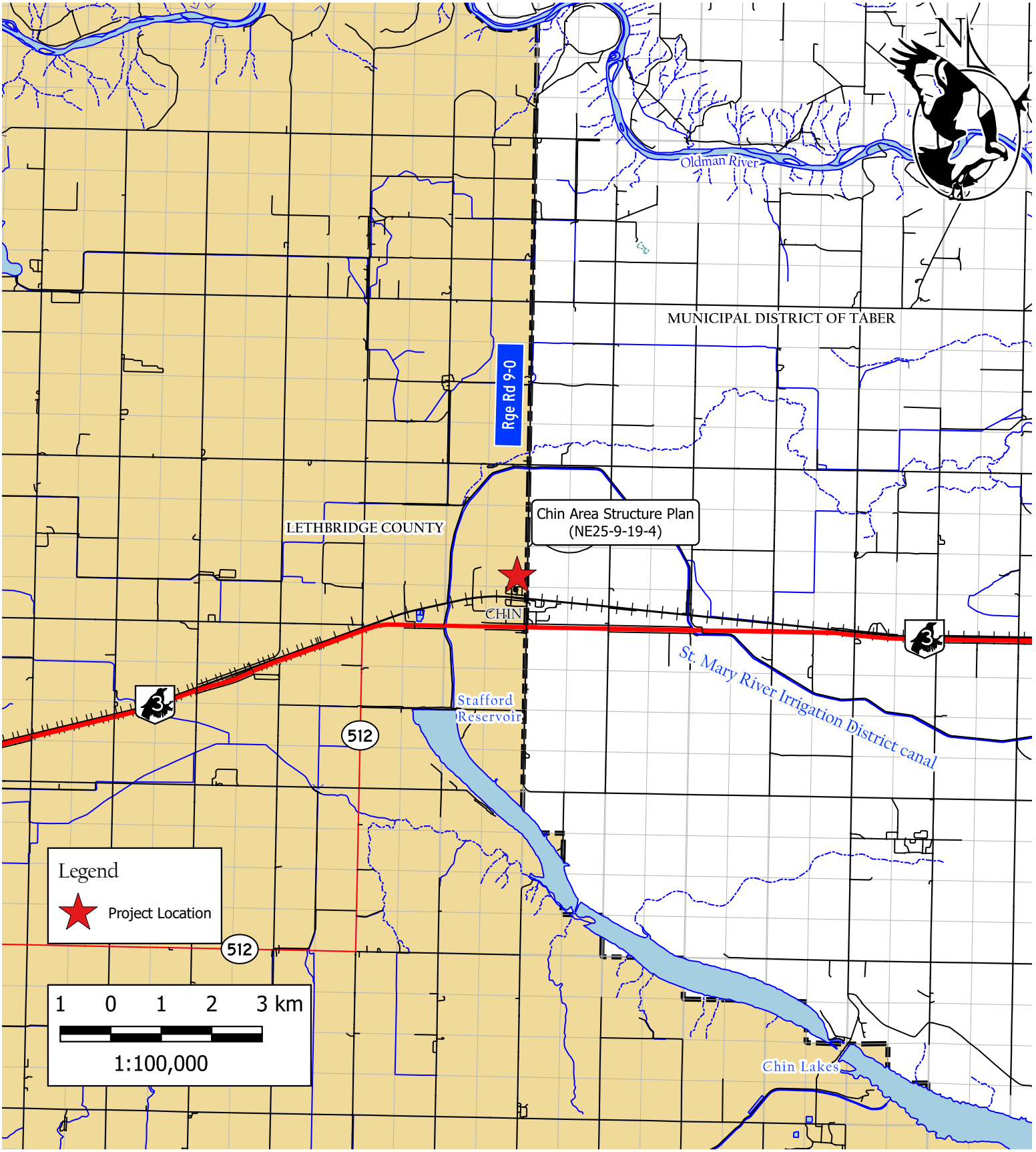
No previous reports are noted regarding surface or storm drainage pertinent to the subject parcel or surroundings.

D. Report Purpose and Limitation

Osprey Engineering Inc. was engaged by the proponent to provide a stormwater management plan for the proposed development. Specifically, the following details were required:

- Determine existing and post-development runoff rates from the subject parcel.
- Design best management practices to address impacts of development of the subject parcel on surface drainage.

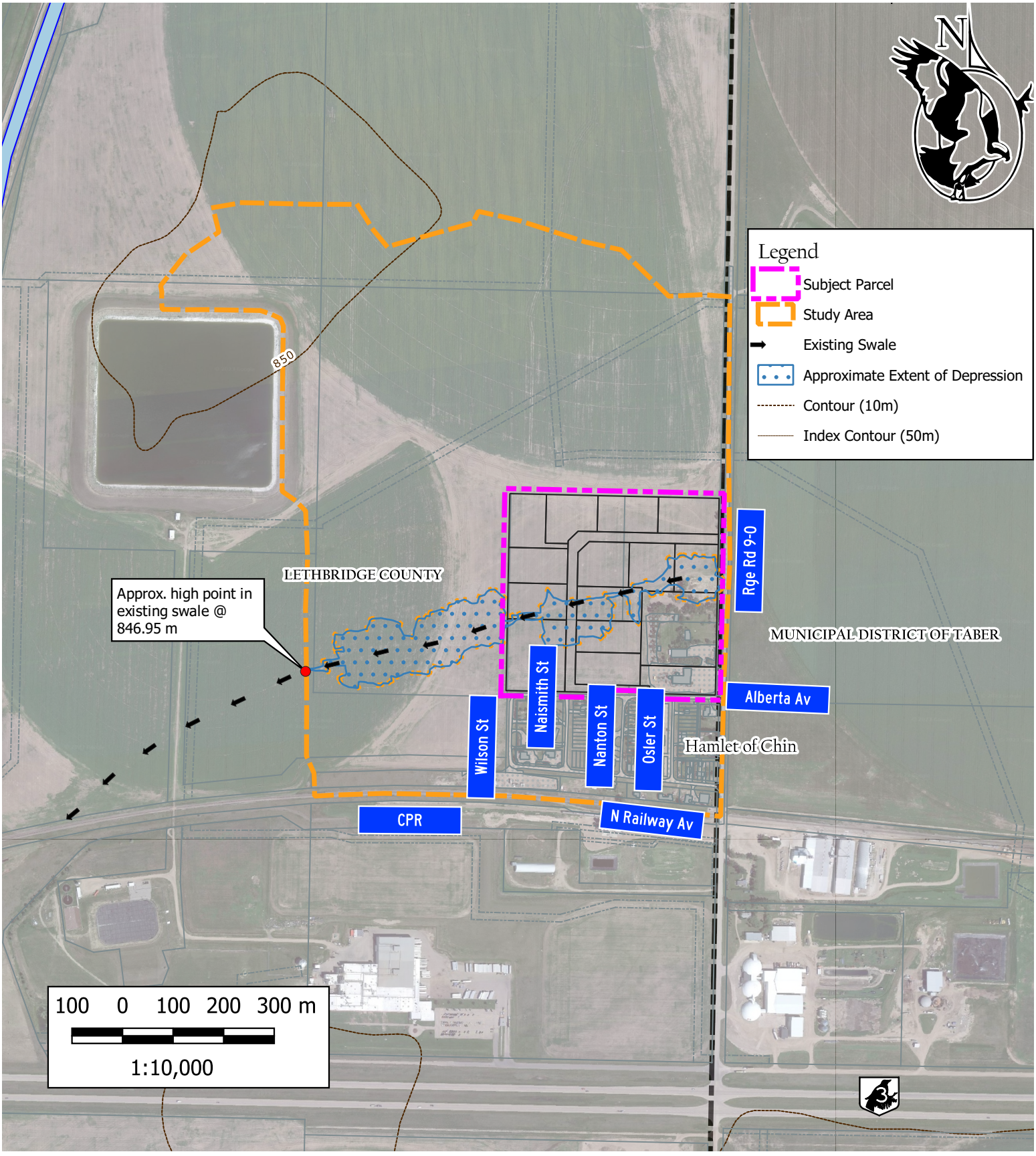
This report and the conclusions contained herein are intended for the use of the proponent and the Lethbridge County for the design of storm drainage works. Any use or extrapolation of the report's conclusions beyond the intent stated is neither supported nor warranted by Osprey Engineering Inc.



SPREY
ENGINEERING INC.

Chin ASP
Conceptual Stormwater Management
Plan

Figure 1 – Location



OSPREY ENGINEERING INC.

Chin ASP
Conceptual Stormwater Management Plan

Figure 2 – Area Context

II. METHODOLOGY AND ASSUMPTIONS

This stormwater management plan and its associated analyses were consistent with the following documents:

- *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* (Alberta Environment and Parks, 2013)
- *Municipal Policies and Procedures Manual* (Alberta Environment and Parks, 2001)
- *Stormwater Management Guidelines for the Province of Alberta* (Alberta Enviroment and Parks, 1999)

Reference is made to *Design Standards* (City of Lethbridge, 2021).

A. Models Used

Analysis of the proposed storm drainage system was performed using EPA-SWMM5 (version 5.2.024) (United States Environmental Protection Agency, 2023). EPA-SWMM allows seasonal variation of hydraulic conductivity parameters using a multiplier in its climate module (Rossman & Huber, 2016).

B. Precipitation and Scenarios

Both continuous and single-event models were used in simulating the operation of the storm drainage system. The following describes the precipitation simulated:

- Continuous Simulation: A continuous model using immediately available climate data for Lethbridge for the years 1960-1995 (36 years). (Note: a longer data set is being procured from Environment Canada).
- Single-event: the single-event storm is that recommended by the City of Lethbridge as detailed in Table 2.

Table 2 – Single Event Design Storm (City of Lethbridge, 2021)

Return period (T)	100 years
Time to peak (r)	0.3
Duration	24 hr
IDF Parameters ($i_T = \frac{a}{(b+t)^c}$)	a=1019.20 b=0 c=0.731
Rainfall (mm)	89 mm

The following scenarios were investigated:

1. Existing: subject area and surroundings as existing (derived from ground survey and publicly available data including air photos).
2. Post-development: subject area as proposed to be developed per proponent's plans. Surrounding area as existing.
3. Post-development with pond: subject area as proposed with pond as prescribed by Lethbridge County.

C. Allowable Discharge from Development

No specific targets have been provided with respect to runoff rates or volumes from the subject parcel.

D. Hydrology

Storm drainage area (subcatchment) boundaries are shown on Figure 3. Table 3 details the

specific hydrologic assumptions made for each subcatchment in EPA-SWMM. Assumptions common to all subcatchments are detailed in Table 4.

Table 3 – Subcatchment Parameters

Subcatchment ID	Runoff Drains to (ID)	Area (ha)	Width (m)	Flowpath Length (m)	Slope (%)	Imperviousness (%)
Existing (Scenario 1)						
S1010	SU101	3.54	354	100	0.37	100.0
S1011	S1010	10.32	516	200	1.06	1.0
S1012	S1010	35.73	893	400	1.80	0.0
S1020	SU102	2.27	227	100	0.49	100.0
S1021	S1020	15.81	790	200	1.23	17.6
S1022	S1020	30.96	774	400	0.68	0.5
Post-development (Scenario 2)						
S1010	SU101	3.54	354	100	0.4	100.0
S1011	S1010	10.32	516	200	1.1	1.0
S1012	S1010	35.73	893	400	1.8	0.1
S1020	SU102	2.27	227	100	0.5	100.0
S1021	S1020	15.81	790	200	1.2	19.7
S1022	S1020	30.96	774	400	0.7	3.4
Post-development with pond (Scenario 3)						
S1010	SU101	3.54	354	100	0.4	100.0
S1011	S1010	10.32	516	200	1.1	1.0
S1012	S1010	35.73	893	400	1.8	0.1
S1020	SU102	2.27	227	100	0.5	100.0
S1021	SU102a	15.81	790	200	1.2	19.7
S1022	SU102a	30.96	774	400	0.7	3.4

Table 4 – General Hydrologic Assumptions

Parameter	Value	Source
Surface roughness (Manning's n)	Impervious = 0.015 Pervious = 0.25	Pervious assumes lawn or pasture (American Society of Civil Engineers, 1992)
Depression storage	Imperv.: 1.6 mm Pervious: 7.5 mm (absorbent landscaping, 300 mm topsoil)	Impervious is as per developed areas, on-site pervious assumes absorbent landscaping: 0.3 m loamy topsoil, minimum.
Sub-area routing	Outlet	Routes both pervious and impervious surfaces directly inlet nodes or downstream catchment
Soil characteristics (Green-Ampt)	Loam K = 3.4 mm/hr ψ = 89 mm IMD = 0.35	(Rossman & Huber, 2016)

1. Imperviousness

Assumed imperviousness for different cover types are as noted:

- Roofs, asphalt, concrete: 100%
- Gravel: 50%
- Each new country residential lot assumes 800 m² of hard surface,
- The school lot is assumed as per designs provided.

Overall imperviousness for each subcatchment was derived using an area-weighted average based on the proposed sited development plan provided by the owner.

2. Evaporation

Monthly evaporation assumed the values typical for Lethbridge and area per Table 5.

Table 5 – Monthly Evaporation for Lethbridge (mm/day) (Government of Alberta, 2013)

January	February	March	April	May	June
0	0	1	2.5	3.9	4.7
July	August	September	October	November	December
5.4	4.3	2.4	1	0.2	0

No evaporation is assumed in single-event modelling.

E. Depression Storage

The large depressions noted were modeled explicitly as noted in Table 6 and Table 7.

Table 6 – Stage Storage Assumed for West Depression (SWMM Node SU101)

Elevation (m AGD)	Depth (m)	Surface Area (m^2)	Volume Detained (m^3)	
846.50	0.00	0		
847.00	0.50	35,420	8,855	

Table 7 – Stage Storage Assumed for East Depression (SWMM Node SU102)

Elevation (m AGD)	Depth (m)	Surface Area (m^2)	Volume Detained (m^3)	
846.50	0.00	0		
847.00	0.50	22,670	5,668	

1. Seepage and Infiltration

Infiltration from the depressions are assumed to be similar to the soil conditions noted for the subcatchments (see Table 4).

F. Proposed Pond

The pond prescribed by Lethbridge County is assumed to be as per Table 8. The pond is located such that it will capture runoff from the existing swale and will fill as part of the larger depression. The pond is assumed to operate as a primarily dry facility. Side slopes are to be not greater than 5H:1V. Pond shall be grassed or similarly vegetated.

Table 8 – Stage Storage for Pond (SWMM Node SU102a)

Elevation (m AGD)	Depth (m)	Surface Area (m^2)	Volume Detained (m^3)	
845.00	0.00	480		Bottom (approx.)
846.50	1.50	1,680	1,620	Bottom of ex. depression
847.00	2.00	22,670	7,708	Overflow

1. Pond Discharge

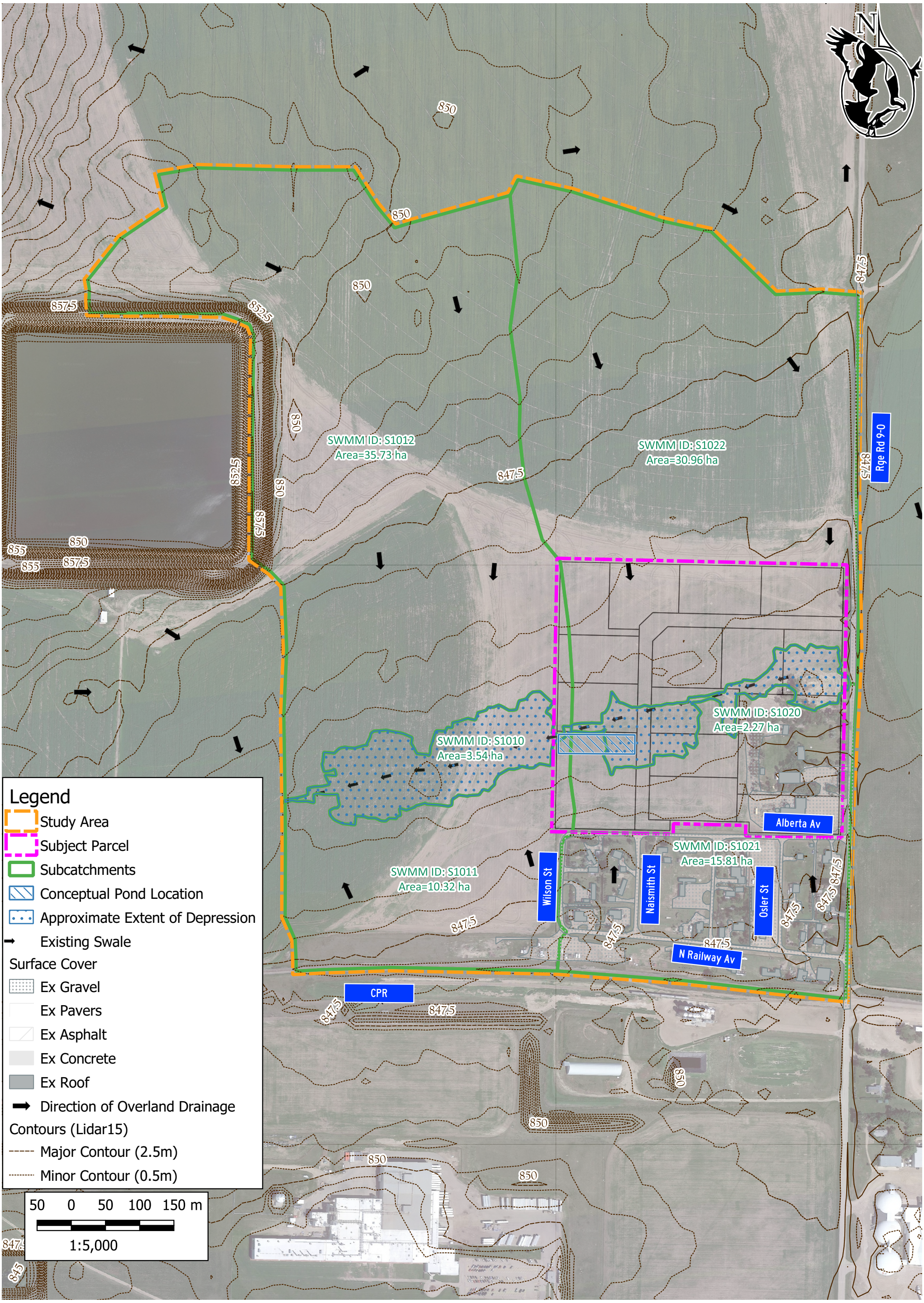
The pond will have a pump to ensure it can be drained from full within 4 days. Specific pump details assumed are as follows:

- Average discharge is 9 L/s [143 USgpm].
- Pump on is at 0.4 m depth [elev. 845.4 m AGD].
- Pump off is at 0.3 m depth [elev. 845.3 m AGD].
- Given the climate and soil conditions, water not pumped will infiltrate or evapotranspire.

Discharge is assumed to be to dry land tributary to the existing swale.
Overflow is by gravity overland to the existing swale.

G. Model Topology

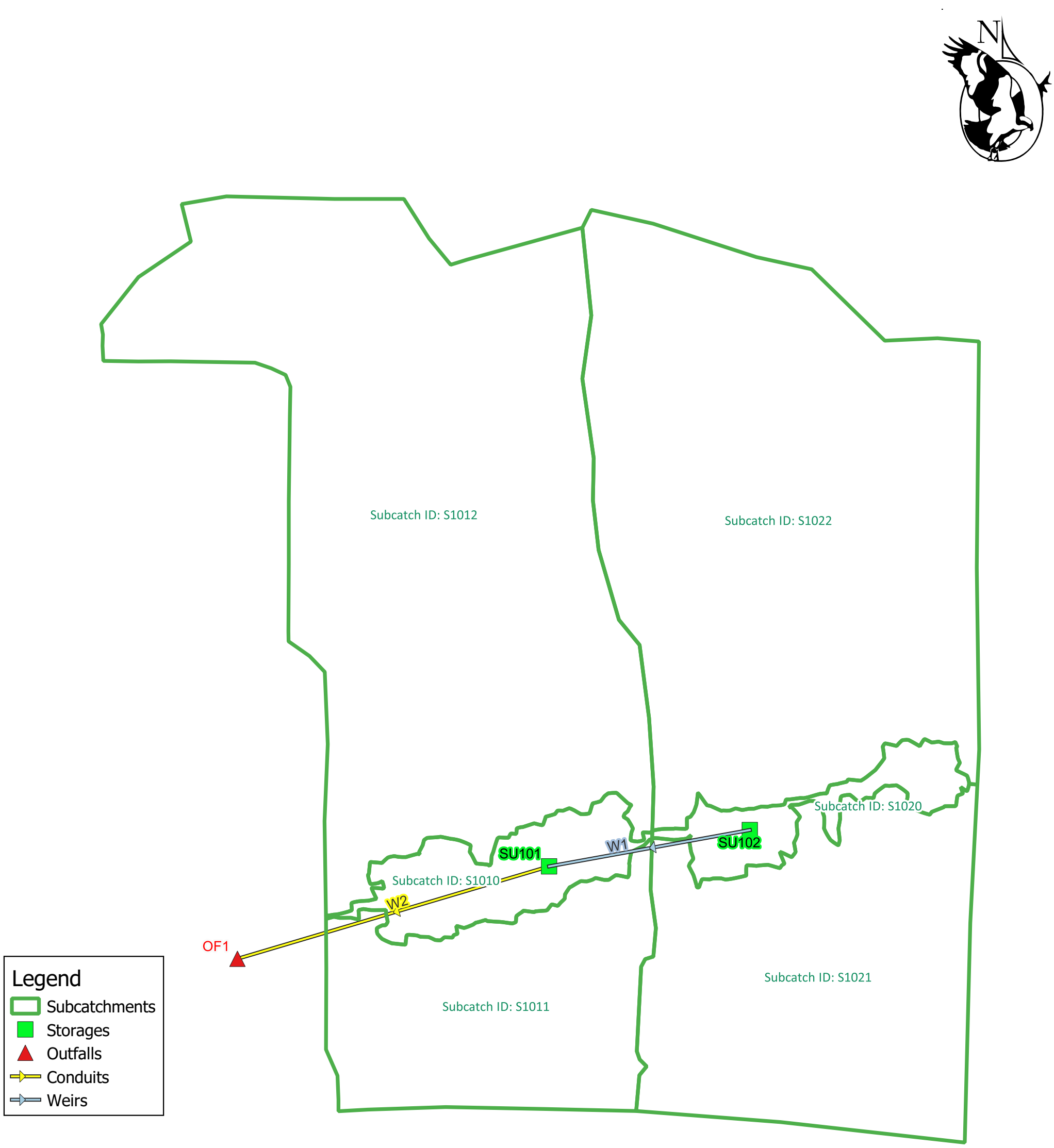
A schematic representation of the SWMM5 model is provided as Figure 4 (scenarios 1 and 2) and Figure 5 (Scenario 3).



OSPREY ENGINEERING INC.

Chin ASP
Conceptual Stormwater Management Plan

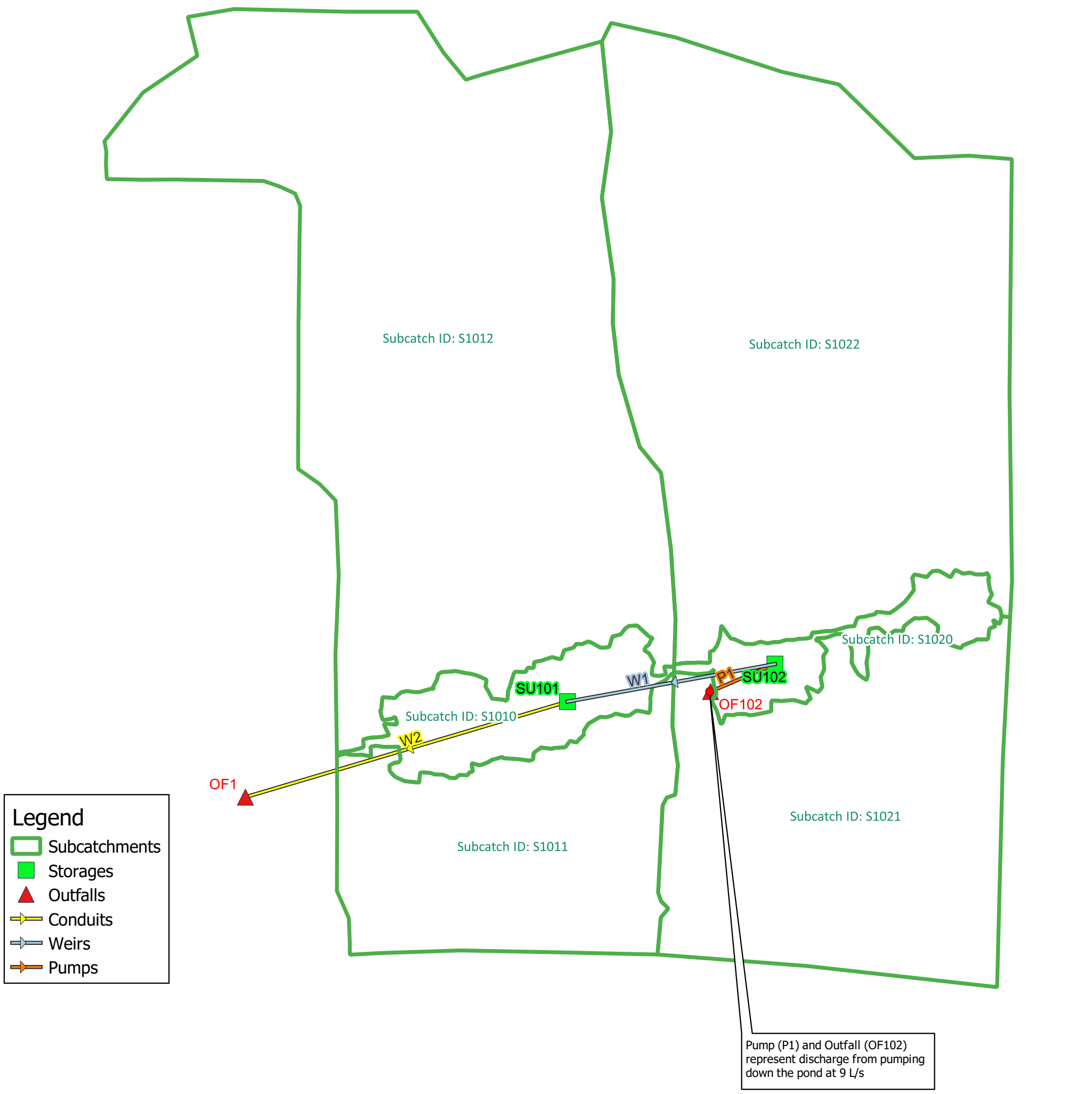
Figure 3 - Storm Drainage Areas



OSPREY ENGINEERING INC.

Chin ASP
Conceptual Stormwater Management Plan

Figure 4 - SWMM5 Model Schematic



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Conceptual Stormwater Management Plan

Figure 5 - SWMM5 Model Schematic (Scenario 3)

III. RESULTS

The following summarizes the results of the analyses performed.

A. Major System Boundary Conditions

Major system outflows are as shown on Table 8. As can be seen, the change in runoff rate is minimal and overall volumes of runoff are quite low, as would be expected given the relatively low level of development here.

Table 9 – Major System Outflows

Location	Area (ha)	Flow rate (m^3/s)	URR (L/s/ha)	Depth (mm)	Annual Volume (mm)	Volume (m^3)	Storm
1. Existing	98.63	1.380	14.0	42.4	1.2	41,865	Continuous
2. Post-development	98.63	1.413	14.3	43.7	1.2	43,099	Continuous
3. Post-development with pond	98.63	1.308	13.3	39.1	1.1	38,585	Continuous
1. Existing	98.63	0.652	6.6	12.7	n/a	12,515	100 year, 24 hour
2. Post-development	98.63	0.687	7.0	13.3	n/a	13,116	100 year, 24 hour
3. Post-development with pond	99.63	0.537	5.4	10.4	n/a	10,393	100 year, 24 hour

B. Surface Detention

Table 9 and Table 10 shows the depths expected in the surface traplows. As can be seen, there is very little difference between existing and post-development levels. The pond does provide some additional reduction in offsite flows and water depths over existing conditions.

Table 10 – Depression Storage (Continuous)

Traplow Number	Spill Elevation (m)	Spill Depth (m)	Volume Detained (m^3)	100-year Elevation (m)	100-year Depth (m)	100-year Volume (m^3)	Scenario
West Depression (SU101)	847.00	0.50	8,855	847.26	0.76	20,320	1. Existing
West Depression (SU101)	847.00	0.50	8,855	847.26	0.76	20,468	2. Post-development
West Depression (SU101)	847.00	0.50	8,855	847.25	0.75	19,990	3. Post-development with pond
East Depression (SU102)	847.00	0.50	5,668	847.14	0.64	9,191	1. Existing
East Depression (SU102)	847.00	0.50	5,668	847.14	0.64	9,329	2. Post-development
East Depression (SU102)	847.00	2.00	7,708	847.13	2.13	10,934	3. Post-development with pond

Table 11 – Depression Storage (100 year, 24 hour Design Storm)

Traplow Number	Spill Elevation (m)	Spill Depth (m)	Volume Detained (m^3)	100-year Elevation (m)	100-year Depth (m)	100-year Volume (m^3)	Scenario
West Depression (SU101)	847.00	0.50	8,855	847.18	0.68	16,484	1. Existing
West Depression (SU101)	847.00	0.50	8,855	847.19	0.69	16,702	2. Post-development
West Depression (SU101)	847.00	0.50	8,855	847.17	0.67	15,705	3. Post-development with pond
East Depression (SU102)	847.00	0.50	5,668	847.1	0.6	8,106	1. Existing
East Depression (SU102)	847.00	0.50	5,668	847.1	0.6	8,274	2. Post-development
East Depression (SU102)	847.00	2.00	7,708	847.08	2.08	9,580	3. Post-development with pond

C. Overland Flows

The site drainage does not feature any significant gutter, swales or ditches. Runoff is primarily sheet or shallow concentrated flow. Depths and velocities will not exceed AEP guidelines.

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis performed, the following conclusions are made:

1. The proposed development does not impact runoff to a measurable degree.
2. That there is concern regarding occasional inundation in the depressions within and adjacent to the subject parcel.

Based on the above, the following recommendations are made with respect to development of the subject parcel:

1. As prescribed by Lethbridge County, a pond will be constructed in the southwest portion of the subject parcel, north of the proposed school lot:
    a. The pond shall have an approximate storage volume (below the existing depression's bottom) of approximately 1620 m^3.
    b. The pond shall have side slopes not exceeding 5H:1V.
    c. A pad shall be provided to install a pump to dewater the pond when necessary. Discharge shall be directed to grassed areas near the swale. Recommended rate of discharge is 9 L/s [143 USgpm], which would allow full drawdown in less than 96 hours.
    d. The pond shall have a landscaped bottom with deep topsoil to encourage evapotranspiration.
    e. No liner is specified to encourage infiltration.
2. Buildings adjacent to the depression should be constructed such that main floor elevation and entrances are well above flood elevation. A minimum freeboard of 0.6 m to main floor elevation above the 100-year maximum depth of ponding is recommended. For the subject parcel, this is an elevation of **847.7 m.**
3. That the flows potentially crossing the extension of Naismith Street be duly considered. Design of equalization culverts should of adequate size to ensure upstream flows are passed with minimal headwater. Tailwater must be duly considered. The road should allow for an emergency overflow elevation below the main floor elevation noted above.

APPENDIX A

The following pages contain the report files for the SWMM5 models of each scenario considered.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Chin ASP - Predevelopment - 100y24h Design Storm

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 3
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Leth_100y24hr	Leth_100y24hr	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Leth_100y24hr	SU101
S1011	10.32	515.93	0.97	1.0610	Leth_100y24hr	S1010
S1012	35.73	893.16	0.00	1.7990	Leth_100y24hr	S1010
S1020	2.27	226.83	100.00	0.4880	Leth_100y24hr	SU102
S1021	15.81	790.47	17.57	1.2280	Leth_100y24hr	S1020
S1022	30.96	773.97	0.52	0.6810	Leth_100y24hr	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	846.50	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 07/01/2023 00:00:00
Ending Date 07/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 15.00 sec

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	11.849	120.146
Evaporation Loss	0.225	2.281
Infiltration Loss	8.330	84.460
Surface Runoff	3.311	33.568
Final Storage	0.000	0.000
Continuity Error (%)	-0.136	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	3.311	33.107
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.251	12.515
Flooding Loss	0.000	0.000
Evaporation Loss	0.090	0.898
Exfiltration Loss	1.970	19.701
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.022	

****
Highest Flow Instability Indexes
****

All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 15.00 sec
Average Time Step : 15.00 sec
Maximum Time Step : 15.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 1.00
% of Steps Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	120.15	358.96	0.00	0.00	479.11	0.00	479.11	16.98	3.09	1.000
S1011	120.15	0.00	2.07	88.13	1.10	30.15	30.15	3.11	0.52	0.251
S1012	120.15	0.00	2.19	91.20	0.00	26.90	26.90	9.61	1.27	0.224
S1020	120.15	590.89	0.00	0.00	711.04	0.00	711.04	16.13	2.09	1.000
S1021	120.15	0.00	3.14	78.65	20.01	38.73	38.73	6.12	1.22	0.322
S1022	120.15	0.00	2.44	94.28	0.59	23.51	23.51	7.28	0.75	0.196

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.02	0.23	846.93	0 11:01	0.23
SU101	STORAGE	0.26	0.68	847.18	0 10:52	0.68
SU102	STORAGE	0.20	0.60	847.10	0 09:11	0.60

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	0.652	0 11:01	0	12.5	0.000
SU101	STORAGE	3.094	3.094	0 07:15	17	26.3	-0.000
SU102	STORAGE	2.088	2.088	0 07:30	16.1	16.1	-0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	3.577	0.4	2.3	50.1	16.484	1.9	0 10:52	0.753
SU102	1.481	0.3	1.8	40.5	8.106	1.4	0 09:11	0.804

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	18.38	0.131	0.652	12.515
System	18.38	0.131	0.652	12.515

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	0.652	0 11:01	0.07	0.13	0.46
W1	WEIR	0.740	0 09:11			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Oct 5 15:06:05 2023
Analysis ended on: Thu Oct 5 15:06:05 2023
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.3)

Chin ASP - Predevelopment - Cont

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 3
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Raingage	I:\Data\SWMM\Climate Data\YQLhlyO3Rainfall.txt		

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Raingage	SU101
S1011	10.32	515.93	0.97	1.0610	Raingage	S1010
S1012	35.73	893.16	0.00	1.7990	Raingage	S1010
S1020	2.27	226.83	100.00	0.4880	Raingage	SU102
S1021	15.81	790.47	17.57	1.2280	Raingage	S1020
S1022	30.96	773.97	0.52	0.6810	Raingage	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	846.50	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 04/01/1960 00:00:00
Ending Date 11/01/1995 00:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 60.00 sec

****
Rainfall File Summary
****

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
3033880	04/22/1960	10/21/1995	60 min	6717	637	0

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	860.069	8720.600
Evaporation Loss	12.791	129.693
Infiltration Loss	783.530	7944.540
Surface Runoff	63.921	648.125
Final Storage	0.000	0.000
Continuity Error (%)	-0.020	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	63.921	639.220
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	4.186	41.865
Flooding Loss	0.000	0.000

Evaporation Loss	2.885	28.852
Exfiltration Loss	56.847	568.481
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.004	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	1.00
% of Steps Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	8720.60	1739.77	0.00	0.00	10460.37	0.00	10460.37	370.69	3.33	1.000
S1011	8720.60	0.00	66.86	8503.41	57.18	152.00	152.00	15.68	0.86	0.017
S1012	8720.60	0.00	39.15	8553.91	0.00	128.67	128.67	45.97	2.21	0.015
S1020	8720.60	3117.75	0.00	0.00	11838.35	0.00	11838.35	268.53	3.08	1.000
S1021	8720.60	0.00	568.15	7921.54	1013.92	235.60	235.60	37.25	1.69	0.027
S1022	8720.60	0.00	55.57	8558.26	30.29	108.12	108.12	33.47	1.32	0.012

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.00	0.31	847.01	12191 00:29	0.31
SU101	STORAGE	0.00	0.76	847.26	12191 00:21	0.76
SU102	STORAGE	0.00	0.64	847.14	12190 22:41	0.63

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	1.380	12191 00:29	0	41.9	0.000
SU101	STORAGE	3.332	3.332	8126 11:01	371	402	0.004
SU102	STORAGE	3.083	3.083	8126 11:01	269	269	0.010

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	0.020	0.0	4.3	85.3	20.320	2.3	12191 00:21	1.417
SU102	0.013	0.0	4.3	84.0	9.191	1.6	12190 22:41	1.072

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	0.03	0.134	1.380	41.865
System	0.03	0.134	1.380	41.865

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	1.380	12191 00:29	0.08	0.27	0.61
W1	WEIR	1.049	12190 22:41			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Oct 5 08:32:28 2023
Analysis ended on: Thu Oct 5 08:32:38 2023
Total elapsed time: 00:00:10

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Chin ASP - Post-development - 100y24hr Design Storm

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 3
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Leth_100y24h	Leth_100y24h	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Leth_100y24h	SU101
S1011	10.32	515.93	0.97	1.0610	Leth_100y24h	S1010
S1012	35.73	893.16	0.10	1.7990	Leth_100y24h	S1010
S1020	2.27	226.83	100.00	0.4880	Leth_100y24h	SU102
S1021	15.81	790.47	19.74	1.2280	Leth_100y24h	S1020
S1022	30.96	773.97	3.39	0.6810	Leth_100y24h	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	846.50	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units .... CMS
Process Models:
  Rainfall/Runoff .... YES
  RDII .... NO
  Snowmelt .... NO
  Groundwater .... NO
  Flow Routing .... YES
  Ponding Allowed .... NO
  Water Quality .... NO
Infiltration Method ...... MODIFIED_GREEN_AMPT
Flow Routing Method ...... KINWAVE
Starting Date 07/01/2023 00:00:00
Ending Date 07/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step .... 15.00 sec

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	11.849	120.146
Evaporation Loss	0.233	2.364
Infiltration Loss	8.258	83.727
Surface Runoff	3.376	34.229
Final Storage	0.000	0.000
Continuity Error (%)	-0.145	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	3.376	33.759
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.312	13.116
Flooding Loss	0.000	0.000
Evaporation Loss	0.090	0.901
Exfiltration Loss	1.975	19.749
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.023	

****
Highest Flow Instability Indexes
****

All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 15.00 sec
Average Time Step : 15.00 sec
Maximum Time Step : 15.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 1.00
% of Steps Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	120.15	359.43	0.00	0.00	479.58	0.00	479.58	16.99	3.09	1.000
S1011	120.15	0.00	2.07	88.13	1.10	30.15	30.15	3.11	0.52	0.251
S1012	120.15	0.00	2.20	91.14	0.11	26.95	26.95	9.63	1.27	0.224
S1020	120.15	618.88	0.00	0.00	739.03	0.00	739.03	16.76	2.20	1.000
S1021	120.15	0.00	3.28	77.40	22.50	39.89	39.89	6.31	1.28	0.332
S1022	120.15	0.00	2.63	92.65	3.84	24.98	24.98	7.73	0.80	0.208

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.02	0.24	846.94	0 10:59	0.24
SU101	STORAGE	0.26	0.69	847.19	0 10:50	0.69
SU102	STORAGE	0.20	0.60	847.10	0 09:09	0.60

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	0.687	0 10:59	0	13.1	0.000
SU101	STORAGE	3.094	3.094	0 07:15	17	26.9	-0.000
SU102	STORAGE	2.199	2.199	0 07:30	16.8	16.8	-0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	3.596	0.4	2.2	49.0	16.702	1.9	0 10:50	0.788
SU102	1.490	0.3	1.7	39.1	8.274	1.5	0 09:09	0.851

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	18.46	0.137	0.687	13.116
System	18.46	0.137	0.687	13.116

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	0.687	0 10:59	0.07	0.14	0.47
W1	WEIR	0.787	0 09:09			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Oct 5 14:36:56 2023
Analysis ended on: Thu Oct 5 14:36:57 2023
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Chin ASP - Predevelopment - Cont

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 3
Number of links 2
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Raingage	I:\Data\SWMM\Climate Data\YQLhlyO3Rainfall.txt		

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Raingage	SU101
S1011	10.32	515.93	0.97	1.0610	Raingage	S1010
S1012	35.73	893.16	0.10	1.7990	Raingage	S1010
S1020	2.27	226.83	100.00	0.4880	Raingage	SU102
S1021	15.81	790.47	19.74	1.2280	Raingage	S1020
S1022	30.96	773.97	3.39	0.6810	Raingage	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	846.50	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 04/01/1960 00:00:00
Ending Date 11/01/1995 00:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 60.00 sec

****
Rainfall File Summary
****

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
3033880	04/22/1960	10/21/1995	60 min	6717	637	0

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	860.069	8720.600
Evaporation Loss	16.612	168.441
Infiltration Loss	779.260	7901.242
Surface Runoff	64.396	652.941
Final Storage	0.000	0.000
Continuity Error (%)	-0.023	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	64.396	643.969
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	4.310	43.099
Flooding Loss	0.000	0.000

Evaporation Loss	2.904	29.038
Exfiltration Loss	57.180	571.806
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.004	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	1.00
% of Steps Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	8720.60	1743.68	0.00	0.00	10464.28	0.00	10464.28	370.82	3.33	1.000
S1011	8720.60	0.00	66.86	8503.41	57.18	152.00	152.00	15.68	0.86	0.017
S1012	8720.60	0.00	42.02	8550.77	5.68	129.05	129.05	46.11	2.21	0.015
S1020	8720.60	3321.02	0.00	0.00	12041.62	0.00	12041.62	273.14	3.18	1.000
S1021	8720.60	0.00	634.54	7844.80	1138.06	246.11	246.11	38.91	1.73	0.028
S1022	8720.60	0.00	141.79	8463.14	196.68	117.65	117.65	36.42	1.39	0.013

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.00	0.31	847.01	12191 00:25	0.31
SU101	STORAGE	0.00	0.76	847.26	12191 00:18	0.76
SU102	STORAGE	0.00	0.64	847.14	12190 22:39	0.64

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	1.413	12191 00:25	0	43.1	0.000
SU101	STORAGE	3.335	3.338	8126 11:01	371	405	0.004
SU102	STORAGE	3.184	3.184	8126 11:01	273	273	0.011

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	0.020	0.0	4.3	85.0	20.468	2.3	12191 00:18	1.450
SU102	0.014	0.0	4.2	83.2	9.329	1.6	12190 22:39	1.112

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	0.03	0.120	1.413	43.099
System	0.03	0.120	1.413	43.099

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	1.413	12191 00:25	0.08	0.28	0.62
W1	WEIR	1.089	12190 22:39			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Thu Oct 5 13:26:33 2023
Analysis ended on: Thu Oct 5 13:26:43 2023
Total elapsed time: 00:00:10

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Chin ASP - Post-development w pond - 100yr24hr Design Storm

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 4
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Raingage	Leth_100y24hr	INTENSITY	5 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Raingage	SU101
S1011	10.32	515.93	0.97	1.0610	Raingage	S1010
S1012	35.73	893.16	0.10	1.7990	Raingage	S1010
S1020	2.27	226.83	100.00	0.4880	Raingage	SU102
S1021	15.81	790.47	19.74	1.2280	Raingage	S1020
S1022	30.96	773.97	3.39	0.6810	Raingage	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
OF102	OUTFALL	0.00	0.00	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	845.00	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
P1	SU102	OF102	TYPE4 PUMP			
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 07/01/2023 00:00:00
Ending Date 07/07/2023 00:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 15.00 sec

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	11.849	120.146
Outfall Runon	0.292	2.959
Evaporation Loss	0.281	2.848
Infiltration Loss	8.486	86.047
Surface Runoff	3.391	34.384
Final Storage	0.000	0.000
Continuity Error (%)	-0.141	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	3.391	33.911
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	1.331	13.312
Flooding Loss	0.000	0.000
Evaporation Loss	0.078	0.780
Exfiltration Loss	1.977	19.769
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.006	0.057
Continuity Error (%)	-0.018	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 15.00 sec
Average Time Step : 15.00 sec
Maximum Time Step : 15.00 sec
% of Time in Steady State : 0.00
Average Iterations per Step : 1.00
% of Steps Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	120.15	359.43	0.00	0.00	479.58	0.00	479.58	16.99	3.09	1.000
S1011	120.15	0.00	2.07	88.13	1.10	30.15	30.15	3.11	0.52	0.251
S1012	120.15	0.00	2.20	91.14	0.11	26.95	26.95	9.63	1.27	0.224
S1020	120.15	625.62	0.00	0.00	745.77	0.00	745.77	16.92	2.21	1.000
S1021	120.15	18.46	6.29	91.88	23.25	40.85	40.85	6.46	1.29	0.295
S1022	120.15	0.00	2.63	92.65	3.84	24.98	24.98	7.73	0.80	0.208

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.02	0.22	846.92	0 11:13	0.22
OF102	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU101	STORAGE	0.26	0.67	847.17	0 11:03	0.67
SU102	STORAGE	0.97	2.08	847.08	0 09:30	2.08

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	0.537	0 11:13	0	10.4	0.000
OF102	OUTFALL	0.000	0.009	0 05:55	0	2.92	0.000
SU101	STORAGE	3.094	3.094	0 07:15	17	24	-0.000
SU102	STORAGE	2.210	2.210	0 07:30	16.9	16.9	-0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	3.500	0.4	2.5	54.3	15.705	1.8	0 11:03	0.635
SU102	1.818	0.7	1.1	39.8	9.580	3.6	0 09:30	0.700

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	18.00	0.111	0.537	10.393
OF102	62.56	0.009	0.009	2.919
System	40.28	0.120	0.546	13.312

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	0.537	0 11:13	0.06	0.11	0.43
P1	PUMP	0.009	0 05:55		1.00	
W1	WEIR	0.589	0 09:30			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****

Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump Curve Low	% Time Off Pump Curve High
P1	62.56	1	0.00	0.01	0.01	2.919	6726.67	0.0	5.0

Analysis begun on: Fri Dec 15 14:17:12 2023
Analysis ended on: Fri Dec 15 14:17:12 2023
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.2 (Build 5.2.4)

Chin ASP - Post-development w pond - Cont

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 6
Number of nodes 4
Number of links 3
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Raingage	I:\Data\SWMM\Climate Data\YQLhly03Rainfall.txt		

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1010	3.54	354.37	100.00	0.3700	Raingage	SU101
S1011	10.32	515.93	0.97	1.0610	Raingage	S1010
S1012	35.73	893.16	0.10	1.7990	Raingage	S1010
S1020	2.27	226.83	100.00	0.4880	Raingage	SU102
S1021	15.81	790.47	19.74	1.2280	Raingage	S1020
S1022	30.96	773.97	3.39	0.6810	Raingage	S1020

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF1	OUTFALL	846.70	0.50	0.0	
OF102	OUTFALL	0.00	0.00	0.0	
SU101	STORAGE	846.50	5.00	0.0	
SU102	STORAGE	845.00	5.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
W2	SU101	OF1	CONDUIT	50.0	0.5000	0.2500
P1	SU102	OF102	TYPE4 PUMP			
W1	SU102	SU101	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
W2	TRIANGULAR	0.50	45.00	0.25	180.00	1	5.05

****
Analysis Options
****
Flow Units ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... MODIFIED_GREEN_AMPT
Flow Routing Method ..... KINWAVE
Starting Date 04/01/1960 00:00:00
Ending Date 11/01/1995 00:00:00
Antecedent Dry Days 0.0
Report Time Step 01:00:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 60.00 sec

****
Rainfall File Summary
****

Station ID	First Date	Last Date	Recording Frequency	Periods w/Precip	Periods Missing	Periods Malfunc.
3033880	04/22/1960	10/21/1995	60 min	6717	637	0

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	860.069	8720.600
Outfall Runon	9.983	101.221
Evaporation Loss	17.502	177.459
Infiltration Loss	788.115	7991.023
Surface Runoff	64.636	655.373
Final Storage	0.000	0.000
Continuity Error (%)	-0.023	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	64.636	646.368
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000

External Inflow	0.000	0.000
External Outflow	13.841	138.415
Flooding Loss	0.000	0.000
Evaporation Loss	2.340	23.400
Exfiltration Loss	48.455	484.556
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	60.00 sec
Average Time Step	:	60.00 sec
Maximum Time Step	:	60.00 sec
% of Time in Steady State	:	0.00
Average Iterations per Step	:	1.00
% of Steps Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1010	8720.60	1743.68	0.00	0.00	10464.28	0.00	10464.28	370.82	3.33	1.000
S1011	8720.60	0.00	66.86	8503.41	57.18	152.00	152.00	15.68	0.86	0.017
S1012	8720.60	0.00	42.02	8550.77	5.68	129.05	129.05	46.11	2.21	0.015
S1020	8720.60	3426.76	0.00	0.00	12147.36	0.00	12147.36	275.54	3.19	1.000
S1021	8720.60	631.45	690.80	8404.89	1211.65	261.28	261.28	41.31	1.74	0.028
S1022	8720.60	0.00	141.79	8463.14	196.68	117.65	117.65	36.42	1.39	0.013

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF1	OUTFALL	0.00	0.30	847.00	12191 00:45	0.30
OF102	OUTFALL	0.00	0.00	0.00	0 00:00	0.00
SU101	STORAGE	0.00	0.75	847.25	12191 00:37	0.75
SU102	STORAGE	0.03	2.13	847.13	12190 22:54	2.13

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF1	OUTFALL	0.000	1.308	12191 00:45	0	38.6	0.000
OF102	OUTFALL	0.000	0.009	54 04:14	0	99.8	0.000
SU101	STORAGE	3.335	3.335	8126 11:01	371	395	0.003
SU102	STORAGE	3.192	3.192	8126 11:01	276	276	0.001

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m³	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m³	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SU101	0.019	0.0	4.3	85.9	19.990	2.3	12191 00:37	1.344
SU102	0.022	0.0	2.3	52.9	10.934	4.1	12190 22:54	1.003

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	0.02	0.157	1.308	38.585
OF102	0.99	0.009	0.009	99.829
System	0.50	0.166	1.317	138.415

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
W2	CONDUIT	1.308	12191 00:45	0.08	0.26	0.60
P1	PUMP	0.009	54 04:14		1.00	
W1	WEIR	0.971	12190 22:54			0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

****
Pumping Summary
****

Pump	Percent Utilized	Number of Start-Ups	Min Flow CMS	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr	Power Usage Kw-hr	% Time Off Pump Low	% Time Off Curve High
P1	0.99	233	0.00	0.01	0.01	99.829	229915.88	0.0	0.3

Analysis begun on: Fri Dec 15 14:17:12 2023
Analysis ended on: Fri Dec 15 14:17:24 2023
Total elapsed time: 00:00:12

REFERENCES

Alberta Enviroment and Parks. (1999). *Stormwater Management Guidelines for the Province of Alberta.* Edmonton, AB: Government of Alberta.

Alberta Environment and Parks. (2001). *Municipal Policies and Procedures Manual.* Edmonton: Government of Alberta.

Alberta Environment and Parks. (2013). *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.* Edmonton, AB: Government of Alberta.

American Society of Civil Engineers. (1992). *Design & Construction of Urban Stormwater Systems.* New York: ASCE.

City of Lethbridge. (2021). *Design Standards.* Lethbridge: City of Lethbridge.

Government of Alberta. (2013). *Evaporation and Evapotranspiration in Alberta.* Edmonton: Government of Alberta.

Rossman, L. E., & Huber, W. C. (2016). *Storm Water Management Model Reference Manual Volume I – Hydrology (Revised).* Cincinnati: United States Environmental Protection Agency.

United States Environmental Protection Agency. (2023, February 12). Stormwater Management Model, Version 5, Build 5.2.3.

APPENDIX E

Property Ownership

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 647 658	899AA;7;1,2	26D73B .

LEGAL DESCRIPTION
PLAN 899AA
BLOCK 7
LOTS 1 AND 2
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;19;9;25;E

MUNICIPALITY: LETHBRIDGE COUNTY

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
26D73B .	20/04/1921			NOT EST-557DA

OWNERS

HER MAJESTY THE QUEEN IN RIGHT OF ALBERTA
OF C/O THE MINISTER OF SUSTAINABLE RESOURCE DEVELOPMENT
9915-108 STREET
EDMONTON
ALBERTA T5K 2C9
(DATA UPDATED BY: CHANGE OF ADDRESS 091061650)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS

NO REGISTRATIONS

TOTAL INSTRUMENTS: 000

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

ORDER NUMBER: 48267274

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 647 640	899AA;6;31,32	77Z95 .

LEGAL DESCRIPTION
PLAN 899AA
BLOCK 6
LOTS 31 AND 32
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE
ATS REFERENCE: 4;19;9;25;E

MUNICIPALITY: LETHBRIDGE COUNTY

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
77Z95 .	10/04/1948			TAX FOR-7883EX

OWNERS

HER MAJESTY THE QUEEN IN RIGHT OF ALBERTA
AS REPRESENTED BY MINISTER OF MUNICIPAL AFFAIRS
OF 9925-107 ST
EDMONTON
ALBERTA

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER	DATE (D/M/Y)	PARTICULARS

NO REGISTRATIONS

TOTAL INSTRUMENTS: 000

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

ORDER NUMBER: 48267274

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

LAND TITLE CERTIFICATE

S

LINC	SHORT LEGAL	TITLE NUMBER
0020 786 380	899AA;A,B,E	181 100 853

LEGAL DESCRIPTION

PLAN 899AA
BLOCK "A", "B" AND "E"
EXCEPTING THEREOUT:

PLAN	BLOCK	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD WIDENING	"B"	8010974	0.124	0.31
ROAD WIDENING	"E"	8010974	0.071	0.17

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ATS REFERENCE: 4;19;9;25;E
ESTATE: FEE SIMPLE

MUNICIPALITY: LETHBRIDGE COUNTY

REFERENCE NUMBER: 171 065 962

REGISTERED OWNER(S)

REGISTRATION	DATE(DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
181 100 853	16/05/2018	TRANSFER OF LAND	$380,000	$380,000

OWNERS

PETER KLASSEN

AND
MARIA KLASSEN
BOTH OF:
BOX 99
PURPLE SPRINGS
ALBERTA T0K 1X0
AS JOINT TENANTS

(CONTINUED)

REGISTRATION
NUMBER DATE (D/M/Y) PARTICULARS

191 171 630 23/08/2019 MORTGAGE
MORTGAGEE - FARM CREDIT CANADA.
2ND FLOOR, 12040-149 ST NW
EDMONTON
ALBERTA
ORIGINAL PRINCIPAL AMOUNT: $500,000

TOTAL INSTRUMENTS: 001

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 6 DAY OF SEPTEMBER, 2023 AT 03:39 P.M.

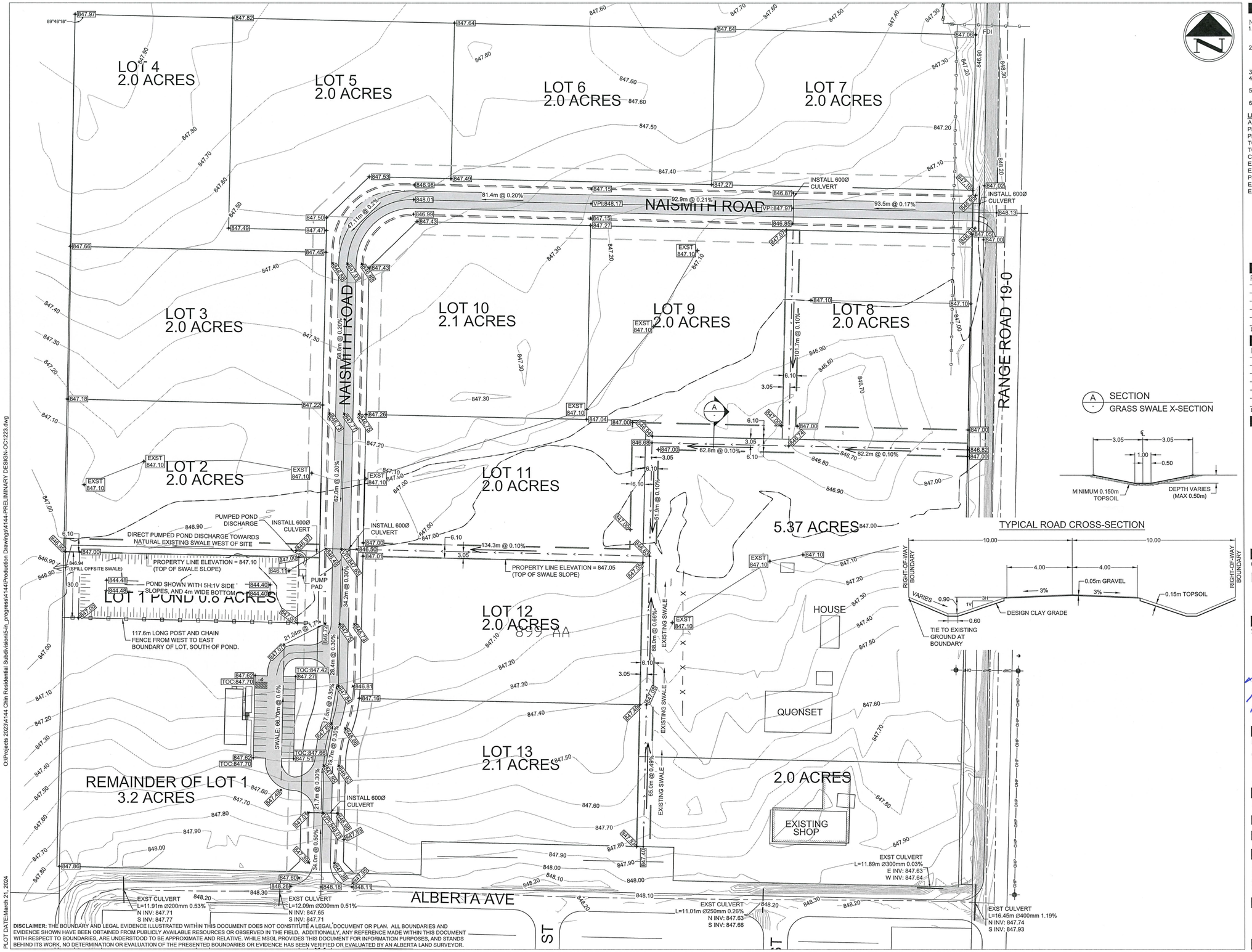
ORDER NUMBER: 48267274

CUSTOMER FILE NUMBER:

END OF CERTIFICATE

APPENDIX F

Preliminary Roadway and Drainage Design



NOTES:
1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND DATUMS PRIOR TO COMMENCEMENT OF WORK AND SHALL NOTIFY THIS OFFICE OF ANY ERRORS AND/OR DISCREPANCIES.
2. THIS DRAWING AND DESIGN REMAINS AT ALL TIMES THE EXCLUSIVE PROPERTY OF DOUGLAS J. BERGEN AND ASSOCIATES LTD. AND MAY NOT BE REPRODUCED IN PART OR IN WHOLE WITHOUT WRITTEN CONSENT.
3. SCALING OF THIS DRAWING IS NOT PERMITTED.
4. MODIFICATIONS AND VARIATIONS TO THIS DESIGN ARE NOT PERMITTED WITHOUT WRITTEN CONSENT.
5. LOT AREAS TO BE GRADED TO ABOVE ELEVATION 846.90 OUTSIDE OF SWALE AREAS.
6. GROUND ELEVATION AT ALL BUILDINGS TO BE AT 847.60 OR HIGHER.

LEGEND

APPROXIMATE PROPOSED PROPERTY LINE
PROPOSED DRAINAGE EASEMENT LINE
PROPOSED 6m EASEMENT
TOPOGRAPHIC TOE
TOPOGRAPHIC SHOULDER
CULVERT
EXISTING GROUND CONTOUR (0.10m) 847.50
EXISTING 847.0 PONDING LIMIT
PROPOSED GRAVEL ROAD
EXISTING GAS LINE
EXISTING OVERHEAD POWER LINE OHP

REVISION

DESCRIPTION	BY	DD/MM/YYYY

ISSUE

DESCRIPTION	BY	DD/MM/YYYY
ISSUED FOR APPROVAL	TV	21/03/2024
ISSUED FOR APPROVAL	TV	12/03/2024
ISSUED FOR APPROVAL	TV	18/12/2023
PARKING LOT SIZE REVISION	TV	20/10/2023
PRELIMINARY DESIGN	TV	13/10/2023

DOUGLAS J. BERGEN & ASSOCIATES LTD.
ARCHITECTURAL TECHNOLOGY
TEN KM EAST OF LETHBRIDGE ON HIGHWAY 512
BOX 1667 COALDALE ALBERTA T1M 1N5
P (403) 345-2116 F (403) 345-2125
www.bergenassociates.com

CONSULTANTS
HV CONSULTING LTD.

COALDALE, AB

SEAL

PERMIT TO PRACTICE
Signature
Date Mar 21, 2024
PERMIT NUMBER: P 10175
The Association of Professional Engineers and Geoscientists of Alberta

PROJECT TITLE
CHIN MEADOWS

CHIN, ALBERTA

DRAWING TITLE
ROADWAY AND DRAINAGE PRELIMINARY DESIGN

DATE	MARCH 21, 2024
PROJECT NO.	4144
SCALE	1:750 ON 24X36
DRAWN	TV

DRAWING NO.
FIGURE 12b

O:\Projects 2023\4144 Chin Residential Subdivision\5-in_progress\4144\Production Drawings\4144-PRELIMINARY DESIGN-OC1223.dwg
PLOT DATE:March 21, 2024