butte landing

AREA STRUCTURE PLAN

TITLE Butte Landing Area Structure Plan

BYLAW NO. XXXX

VERSION/DATE DRAFT - JANUARY 2024

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EXECUTIVE SUMMARY

The Butte Landing Area Structure Plan (ASP) provides a vision for future development of a ±4.13 ha (±10.22 ac) residential community located in southeast Picture Butte. This ASP offers a unique opportunity in a safe and engaging environment bound by Highway 843 to the west and the Piyami Coulee to the north and east.

The ASP and Land Use Redesignation for Butte Landing identifies the development parcels, defines the road network, and provides provisions for Municipal Reserve (public park space) within the public realm. The land uses and intensity of residential development described, enables a vibrant community that thrives and can evolve over time with the needs of its residents.

As the town continues to grow, this ASP works to build upon existing housing and amenities in the area while continuing to attract investments that enhance the quality of life for all residents. The ASP also facilitates the future delivery of needed housing that will support current and planned employment centres within the Town.

Informed by supporting engineering, transportation, and geotechnical studies, this ASP has analyzed and evaluated key attributes and constraints in the Plan Area. Through this analysis, the ASP outlines a community designed to provide all residents with orderly and efficient development while providing enhanced recreational opportunities and access to surrounding natural features.

Butte Landing looks to establish its own unique, and complete "sense of place" that will integrate seamlessly with the existing community.

The ASP for Butte Landing has been prepared to:

- Address the need for additional housing in the Town of Picture Butte;
- Meet the vision of the Municipal Development Plan (MDP);
- Enhance the natural features and location assets of the land; and
- Create a vibrant community that meets the needs of its residents in a unique and exciting manner.

The Butte Landing ASP also considers and implements strategic objectives and policies of higher-level plans including the South Saskatchewan Regional Plan (SSRP) and the Lethbridge County/Picture Butte Intermunicipal Development Plan (IDP).

1 INTRODUCTION

1.1 PLAN AREA

The Butte Landing Area Structure Plan (ASP) consists of ±4.13ha (±10.22ac) of land entirely located within one quarter section in southern Picture Butte. The majority of the Plan Area, ±3.72ha (±9.19ac) is entirely located within and along the western boundary of NW Section 34 (legally described as Plan 2311035, Block 3, Lot 2). The second lot, ±0.42 ha (±1.04 ac) is located on the west side of the Plan Area in the northwest corner of NW Section 34 (legally described as Plan 2311035, Block 3, Lot 1).

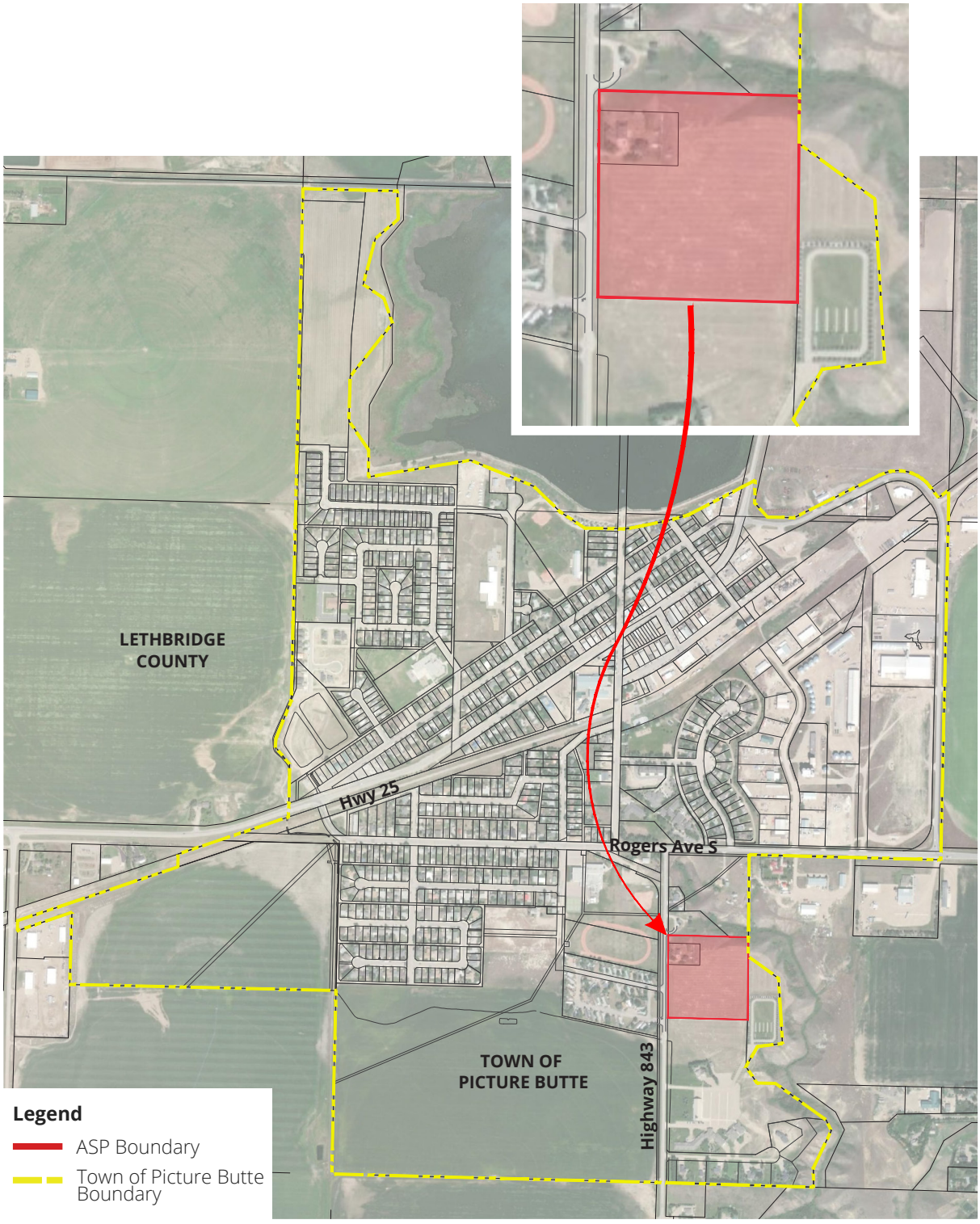
The lands are bounded by 3A Street S (Highway 843) to the west, residential lands to the north and east, and a cemetery forming part of the Netherlands Reformed Congregation Church to the south, as illustrated in **Map 1** (herein referred to as the 'Plan Area').

1.2 PURPOSE OF THE PLAN

The decision to proceed with this ASP reflects the need to update the policies and vision for the land east of Highway 843, previously approved for subdivision and subsequent development in 1980. Since this subdivision approval, servicing deficiencies were found in the approved layout, and thus the direction of the parcel has shifted. Due to this, the parcels were then consolidated to return the lands to their original state, with the exception of the additional parcel created for the existing residence in the northwest corner.

Through this ASP a more comprehensive and consolidated approach has been taken to consider and facilitate a future residential development based on current market factors. Due to growing demand for residential accommodation, the increasing costs within the real estate market, and employers requiring more skilled labour in the region, this ASP has been established to provide the framework required to consider planning, transportation, key infrastructure and servicing required, such as sanitary, storm, and water, to support residential growth in this area. This Plan works towards helping ensure a sufficient supply of planned residential lands are available for the projected increase to the population, while supporting a healthy, competitive residential land market that attracts investment and employment opportunities to Picture Butte. To accomplish these goals, this Plan outlines the general land use and servicing framework, along with a set of policies to guide future development through an implementation plan until such time as the ASP lands are fully built out.

Map 1 Plan Area Location



1.3 PLAN INTERPRETATION

1.3.1 Policy Interpretation

The ASP uses language that provides either specific or general policy direction. Where specific direction is used, such as the built form policies and the general policies, the ASP must be exactly followed. Where general direction is given, such as the Land Use Concept future development direction, flexibility should be used in the interpretation of the ASP.

Where the term '**shall**' or '**must**' is used in a statement, the direction the statement provides is mandatory; exceptions would require an amendment to the ASP.

Where the term '**should**' or '**may**' is used in a statement, the direction the statement provides is intended to be followed; however, the direction may be deviated from in order to address specific circumstances while still achieving the general intent of the statement.

Policies that use the words "**shall**" or "**must**" apply to all situations, without exception, usually in relation to a statement of action, legislative direction, or situation(s) where a desired result is required.

The word "**should**" is used to clarify the directional nature of an associated policy statement. Policies that use "should" are to be applied in all situations, unless it can be demonstrated to the satisfaction of the Development Authority that the policy is not reasonable, practical, or feasible in a given situation. Proposed alternatives will comply with the applicable policies and guidelines to the satisfaction of The Town of Picture Butte ('the Town') with regard to design and performance standards.

Policies that use the word "**may**" apply to situations that are permitted to occur as it relates to the overall objectives of ASP.

1.3.2 Plan Limitations

This ASP is a long-term planning document. As such, it promotes a vision for the Plan Area and includes policies and guidelines that work towards achieving that vision over time. The ASP may be amended from time to time, either in relation to a Town initiative or future land use applications.

Policies and guidelines in the ASP must not be interpreted as approvals for specific uses for individual sites. Site conditions or constraints, including environmental constraints, adjacency and compatibility of residential uses, and all other constraints must be assessed on a case-by-case basis through future planning applications and required technical studies, as determined by the Town during the Land Use, Subdivision, or Development Permit application stage.

1.3.3 Map Interpretation

Plan maps and any subsequent amendments shall be interpreted as identified below:

Unless otherwise specified in the ASP, boundaries or locations of any symbols or areas depicted on maps within the ASP and its appendices are approximate, not absolute, and must be interpreted as such. The locations of symbols are not intended to define exact locations, except where they coincide with clearly recognizable physical features or fixed boundaries, such as property lines or road or utility rights-of-way. The precise location of these boundaries, for the purpose of evaluating development proposals, will be determined by the Development Authority at the time of Land Use, Subdivision, and/or Development Permit application.

Measurements of distances or areas must not be taken from maps in the ASP or its appendices.

Land use areas, roadway alignments and classifications, and utility alignments may be subject to further study and may be further delineated at the Land Use or Subdivision stage in alignment with applicable policies in this Plan. Any major changes to the maps in this Plan and its appendices may require an amendment to the ASP at the Development Authority's discretion.

1.3.4 Photos & Imagery Interpretation

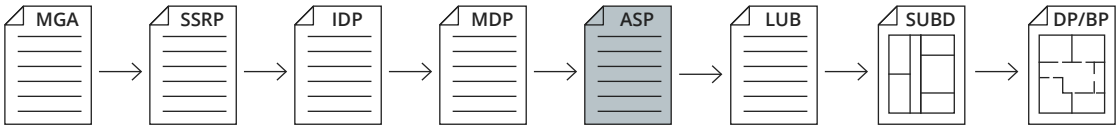
Photographs and precedent imagery contained within this ASP are provided for illustrative and reference purposes only and are not indicative of the final outcome, nor meant to limit the built form or specify the urban design in any way.

1.4 REGULATORY & PLANNING FRAMEWORK

The ASP has been prepared in accordance with applicable legislative requirements outlined in the Municipal Government Act (MGA) and overarching Town plans, such as the MDP, as well as other applicable Town policies and guiding documents.

In accordance with the MGA, all statutory plans passed by a municipality must be consistent with each other. Should a conflict or inconsistency arise between this ASP and the MDP, the MDP prevails to the extent of the conflict or inconsistency, unless otherwise noted.

The diagram below illustrates the planning hierarchy in Alberta (generally), and where an ASP fits in with the process, with each heading highlighted in bold throughout the text below:



What Guides the ASP?

The ASP has been prepared to be consistent with, and to support the goals, of higher-level legislation and plans including:

- The MGA and any associated regulations,
- The South Saskatchewan Regional Plan (**SSRP**), a southern Alberta regional plan based around the South Saskatchewan watershed,
- The Intermunicipal Development Plan (**IDP**), a local co-operative plan with Lethbridge County and Town of Picture Butte, and
- The Municipal Development Plan (**MDP**).

Other documents considered as part of developing this Plan include the Picture Butte Land Use Bylaw, and Town's Infrastructure Master Plan.

What Are the Requirements of an ASP?

As per the MGA, an ASP must describe:

- The sequence of development for the Plan Area,
- Land uses proposed for the Plan Area (generally, or with respect to specific parts of the Plan Area),
- Density of population proposed for the area either generally or with respect to specific parts of the area (where applicable),
- General location of major transportation routes and public utilities, and
- Other matters Council may consider necessary.

What Comes After an ASP?

Following the adoption of an ASP, developers may prepare a Land Use Bylaw (**LUB**) amendment for application to the municipality to rezone specific lands, in alignment with the vision proposed in the ASP.

Once the land uses are confirmed/adopted by Council, the developer may proceed, if required, to the Subdivision stage. Finally, DP and Building Permit (**BP**) submissions are prepared and applied for, these applications provide the municipality the highest level of detail and serves as the final stage of municipal approvals required prior to construction and occupancy. Development proposals may be supported by additional servicing analysis or technical studies (e.g., Geotechnical, Biophysical Impact Assessment [BIA], Environmental Site Assessment [ESA], etc.), as required by the municipality.

2 PLAN AREA & CONTEXT

2.1 SITE CONTEXT

The Plan Area is located in the southeast corner of the Town of Picture Butte, comprising of ±4.13ha (±10.22ac). The ASP is located within one quarter section and is generally defined by Highway 843 to the west and the Piyami Coulee and Lethbridge County boundary to the east, with one (1) existing single detached dwelling located within the Plan Area (identified on **Map 2**). Surrounding developments including a number of adjacent residential developments, the Maple Estate Mobile Home Park, the Netherlands Reformed Congregation and the Bethesda Home for Seniors, do not form part of this ASP.

Agricultural pursuits are observed to be the predominant land use utilized within the southern half of the Town, more specifically south of Rogers Ave S, although the area has been identified within the MDP for urbanization and development through the adoption of ASPs. An underground coal mine owned by Northern Coal Co. Ltd (Mine Number 1414) is located north of the Plan Area, however, this mine has been abandoned and is no longer active.

Map 2 Site Context

2.2 MUNICIPAL DEVELOPMENT PLAN

The MDP is the guiding policy document for the Plan Area, which guides the planning, transportation and associated considerations of the area (illustrated on **Map 3**). Relevant policies include:

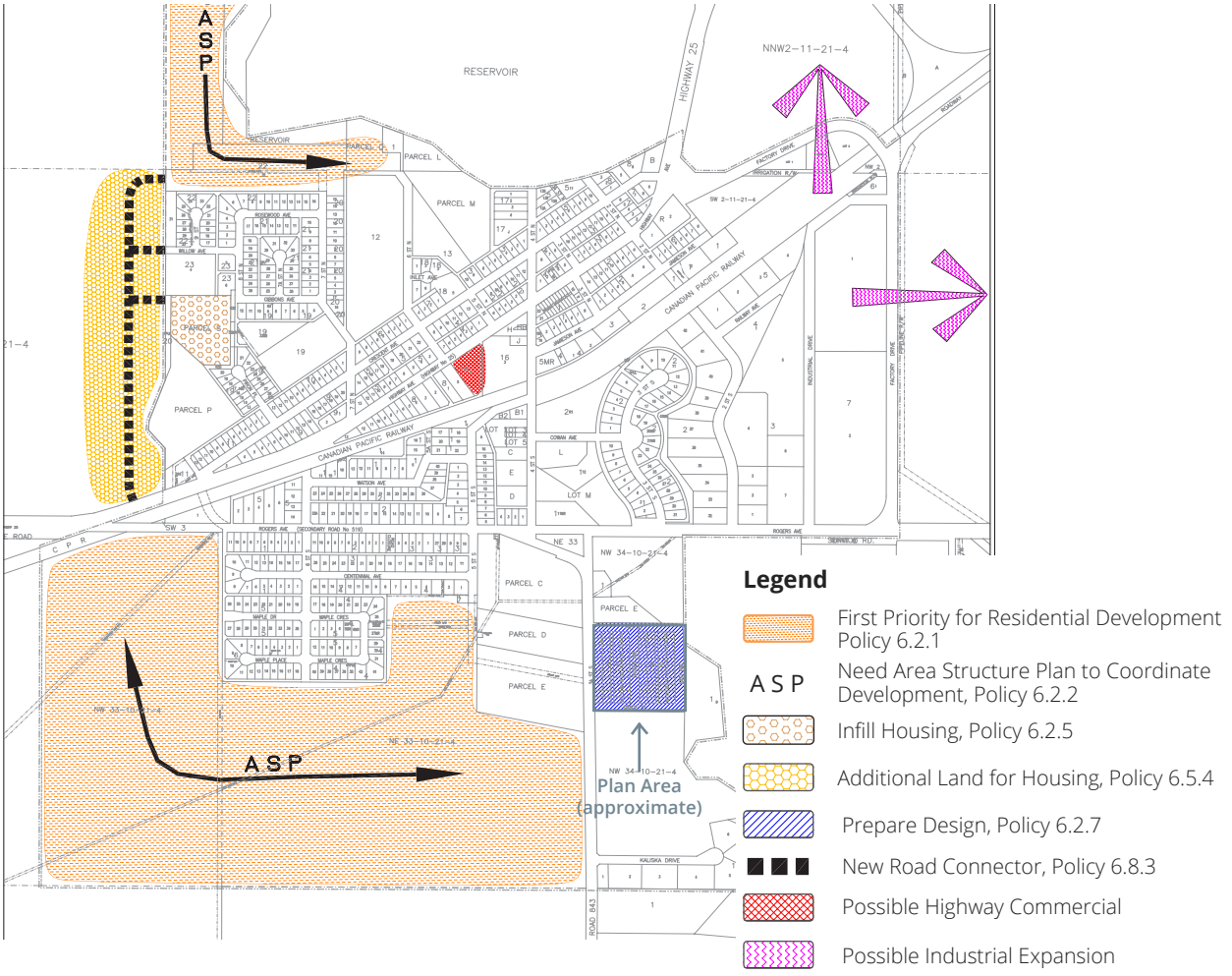
7.1.1 The priority for housing in the future should be:

- *continue toward the south,*
- *infill the northwest,*
- *the area south and west, as shown on Guide Map 4.*

7.1.3 Developers should be encouraged to provide a diversity of housing types. A variety of housing may be promoted in areas of town such as:

- *in new area structure plans being adopted by council,*
- *on sites where existing houses are to be redeveloped,*
- *on larger sites that may become available such as the hospital site or the former water reservoir site,*
- *area of land east of the manufactured home park – the town owns some of this land.*

Map 3 MDP - Guide Map (Map 4)



7.1.4 Council should consider being more active in the provision of multi-dwelling housing developments by either entering into some private-public partnership or actually develop projects. Particular interest for council may be to provide low-maintenance, higher density housing aimed at older segments of the population.

7.1.7 The approval authorities should use its discretion to relax development standards when considering applications that would result in a considerable improvement to an existing lot that requires redevelopment.

Currently, the Town primarily consists of single family dwellings which do not provide sufficient variation in purchase or rental pricing, maintenance requirements and may not suitable or allow for flexibility to an aging population. As noted within the MDP, a concern for the Town is that "in the future, the lack of multi-unit accommodation will affect the ability of the town to accommodate a diverse labour force and a variety of age groups" (Section 4.2). Development enabled by this ASP will contribute to the desired diversity of housing types, consisting of town home, multiplex and multi-unit dwellings, which contributes to the goals of the MDP being met.

2.3 PLAN AREA FEATURES

2.3.1 Natural Features

The Plan Area is characterized by flat prairie lands, with moderate water holding capacity and texture soils. Utilized for hay production with a partial development on the northwest corner, the site generally drains towards the northeast corner which abuts the side slopes of the Oldman River tributary Coulee (Piyami Coulee). A Slope Stability Assessment was completed to establish developable area within the site and resulted in the determination of a minimum development setback distance reflective of 16m from the top of bank (illustrated on **Map 4**).

The topography is generally flat (897.5m to 899.7m) with minor variation throughout the site. The subsurface of the Plan Area is generally comprised of a surficial layer of topsoil, underlain by native clay and clay till deposits.

2.3.2 Historic Resources

Under the Historic Resources Act (HRA), historic resources include archaeological and paleontological sites, Indigenous traditional use sites, historic structures, and geological or natural resources. The Plan Area is identified within the Listing of Historic Resources as lands with the potential to include undiscovered archaeological and paleontological historic resources (categorized as 5a, p).

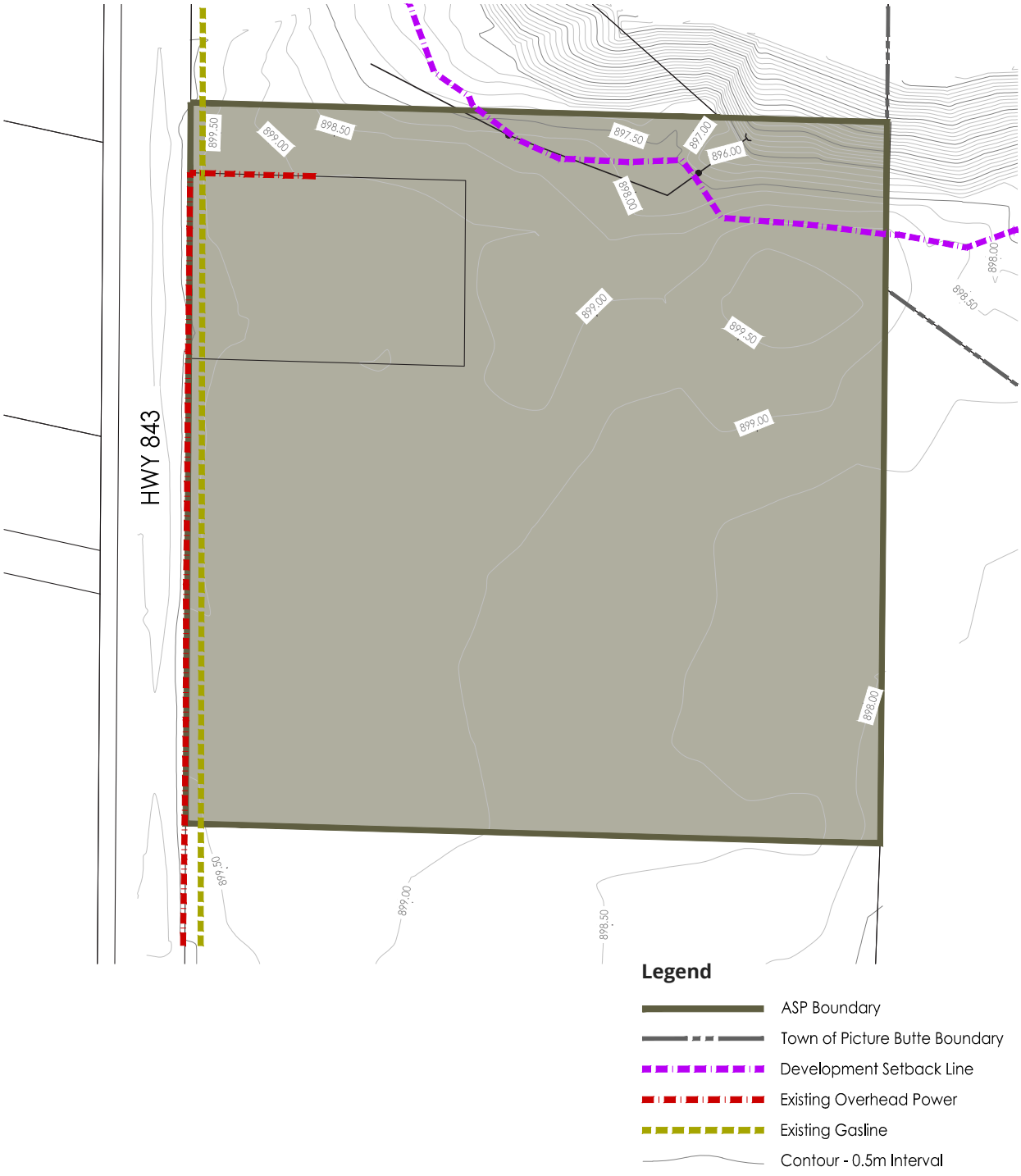
An approval under the HRA has been provided by Alberta Culture, Multiculturalism, and Status of Women (CMSW) for the development proposed in this ASP. Further review though a Historic Resources Impact Analysis (HRIA) is not required.

2.3.3 Existing Land Use and Development

The Plan Area is currently zoned under the LUB as Urban Reserve (UR) land use district (illustrated on **Map 5**). This district is utilized as a temporary land use to maintain areas identified by the Town for urban developments, prior to planning documents and servicing being in place. The Plan Area is characterized by vacant agricultural land, with the exception of the existing single detached dwelling. All future zoning applications and subdivision (if required) within the Plan Area shall be developed in accordance with the direction and intent of the Municipal Development Plan and the Land Use Bylaw.

Uses adjacent to the Plan Area include a mix of agricultural, residential, and public service uses, including the Maple Estate Mobile Home Park, Picture Butte Memorial Cemetery, Netherlands Reformed Congregation, Bethesda Home for Seniors and the Picture Butte High School.

Map 4 Natural Features



Map 5 Existing Land Use

Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Residential - R1
- Large Lot Residential - R3
- MAanufactured Home - R2
- Public - P
- Urban Reserve - UR

3 PLAN CONSIDERATIONS

This section provides a summary of notable Plan Area attributes and constraints that may require special attention for future development within the Plan Area. This is not meant to be an exhaustive list. Those developing in the Plan Area must practice due diligence in the development process as it relates to all future planning considerations, inclusive of those identified within this section. The information outlined within this section may be subject to change and should be verified at the time of land use, Subdivision, or DP stage as new information arises and further development occurs within the Plan Area. Reports completed for the ASP include:

- *Geotechnical Evaluation and Slope Stability Analysis* (2023)
- *Historical Resources Act* Clearance (2023)
- *Butte Landing ASP Transportation Impact Assessment* (2023)
- *Phase 1 Environmental Site Assessment (2023)*

Copies of completed reports and studies may be obtained by request to the Town, referencing the report title.

4 LAND USE CONCEPT

4.1 VISION

Butte Landing is designed to establish a unique neighbourhood within the Town of Picture Butte that can accommodate much needed permanent and temporary housing options through a fully serviced community. Designed to connect with the vibrant natural environment, this ASP brings community members together while integrating high-quality private spaces with public recreational outdoor spaces. The unique landscape and topography also allow for attractive building integration and open spaces that respond to natural slopes and creates connectivity opportunities to the broader community. The Plan Area is well situated and identified for residential growth and integrates with the surrounding developments seamlessly to create a cohesive sense of community in the area.

4.2 DEVELOPMENT FRAMEWORK

There are a number of elements that will shape the future development of the Plan Area, each playing a role in shaping when and how the ASP is developed. Full build out of the Plan Area will likely take a number of years and is highly dependent on market demand, available financing and ownership type. The ASP provides a general configuration and the approximate boundaries of the land use areas. However, if a proposed development is sought in the Plan Area that is not consistent with the ASP, it may be considered so long as it remains consistent with the overall vision of the ASP.

Furthermore, the ASP focuses on the following elements as key to achieving a balanced and integrated neighbourhood:

- Balance the overall mix of residential uses in the Town to create a multi-generational community;
- Integrate the open space to compliment the residential housing units and the surrounding area; and
- Provide for a density and mix of housing types that organizes the development parcels and integrates open space to achieve safe and logical connections within the site and, where possible, to adjacent neighbourhoods.

4.3 LAND USE AREAS

The Land Use Concept Plan (illustrated on **Map 6**), has been developed through careful analysis of the opportunities and constraints applicable to the Plan Area, in addition to the needs of the Town, the public, and adjacent public service uses through proactive engagement with key stakeholders and Town departments.

The ASP provides general land use areas and a primary roadway network alignment and is intended to positively integrate with existing developments surrounding the Plan Area. Density considered within the Plan Area is utilized to support variations in housing options for a sustainable and growing municipality. This diversity is proposed to accommodate the needs of a variety of residents in all stages of their lives (singles, young families, and seniors).

When contemplated through the Land Use Bylaw, one secondary suite may be considered within a dwelling unit to the discretion of the Development Authority in accordance with the Land Use Bylaw. Secondary suites, are described as a self-contained residence with two or more rooms and includes a kitchen, living, sleeping and sanitary facility, meeting all requirements as per the Building Code.

The land use areas of the ASP are intended to be flexible and evolve with potential Land Use Bylaw changes over time. Any minor refinements to the exact land use boundary area may be made without an amendment to this ASP so long as the overall vision of the ASP are maintained. Current and future land use areas with respect to location and size will be confirmed at land use, Subdivision, or Development Permit stage (whichever applies, under the discretion of the Development Authority), to provide flexibility and adaptability to market conditions at the appropriate time.

Residential

Located centrally within the Plan Area, illustrated on **Map 6**, the residential land use within this ASP provides the opportunity to accommodate multi-unit residential densities that work to achieve the targeted density as identified by the Town. This housing typology includes but is not limited to town home, multiplex and multi-unit dwellings, however, opportunities may exist for other housing types and densities overtime. By utilizing reduced individual lot footprints the Plan Area is able to reduce infrastructure requirements and create servicing efficiencies through design of the site.

Future Residential

At time of report preparation, the future residential area is characterized by an existing single detached dwelling. To ensure that this area is maintained until the time in which it is needed for multi-unit development, it has been separated from the primary residential lands to ensure sequencing of development is followed within the Plan Area. Development within the Future Residential area may continue to operate as a single detached dwelling until such time as insufficient lands are available within the ASP to accommodate further development.

Future development of these lands is intended to provide a flexible expansion for future development through concentrated higher density residential development. This housing typology includes but is not limited to multiplex, multi-unit dwellings and apartment buildings.

4.4 PLAN STATISTICS

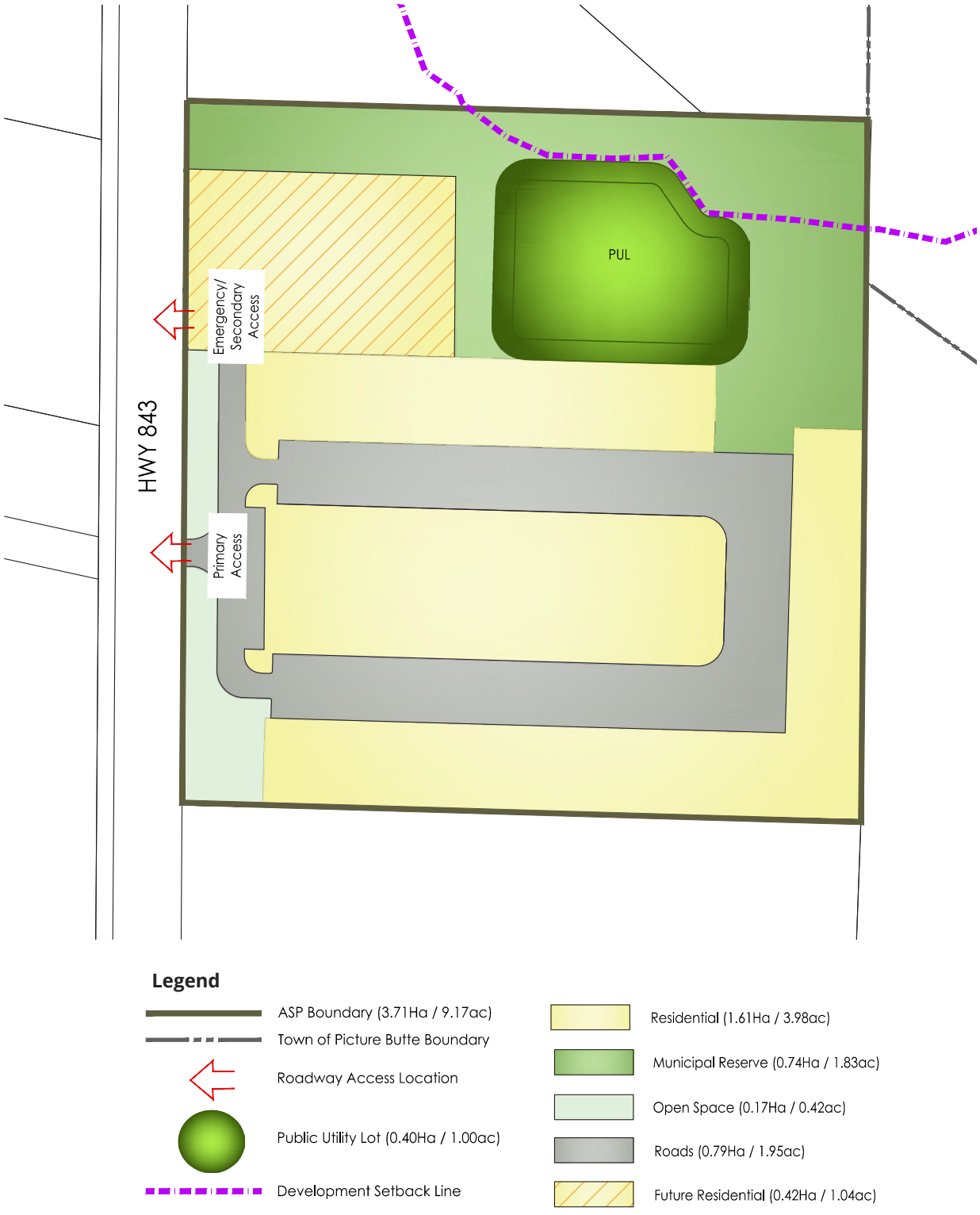
This plan is looking to establish a successful community through sustainable growth while continuing to maintain a strong sense of Town values and citizen involvement through appropriate amounts of growth. All calculations including reference to population density have been calculated to consider the highest potential population within the Plan Area.

PLAN AREAS

Land Use Type	Gross Area		%	Estimated Dwelling Units	Estimated Population*
Residential *(Multi unit)*	±1.61 ha	±3.98 ac	±39%	80	216
Future Residential *(Multi unit)*	±0.42 ha	±1.04 ac	±10%	48	130
Municipal Reserve	±0.91 ha	±2.25 ac	±22%		
Roads	±0.79 ha	±1.95 ac	±19%		
Stormwater Management Facility	±0.40 ha	±1.00 ac	±10%		
Total	**±4.13 ha**	**±10.22 ac**	**100%**	**128**	**346**

** Assumed an average of 2.7 people per household, as per Census data.*

Map 6 Land Use Concept



4.5 INTERMUNICIPAL COORDINATION

The ASP lands are entirely contained within the Intermunicipal Development Plan (IDP) between the Town of Picture Butte and Lethbridge County. This plan identifies areas of mutual interest within the Town and establishes policies and processes of shared information and referrals between the municipalities. The Plan Area is referred to within this document, more specifically, within Planning Area 3 and Special Planning Area 3A. Relevant policies include:

6.6.3 Planning Area 3 is an area foreseen to be further planned for, subdivided and developed in consultation between the County and Town, and in consideration of the planning and development standards as outlined in this Plan.

6.6.4 Sub-planning Area 3A is identified as potentially suitable for business, highway commercial type land use just to the south of Highway 519. The south portion of Area 3A may also be considered for mixed land use or grouped country residential use if appropriately planned and with consideration of transitioning to existing grouped country residential uses to the south. The area identified in sub-planning Area 3A as a "Special Planning Area" will require an Area Structure Plan to be prepared prior to any subdivision or at the redesignation stage for development proposals.

6.6.5 For land within the Town on the west side of the municipal boundary and coulee draw, also within sub-planning Area 3A, highway commercial and residential uses may be considered with additional planning undertaken.

6.6.8 Storm water management and drainage considerations, especially along the highway, must be addressed as part of the area structure plan preparation and subsequent development of lands.

The IDP identifies the Plan Area for further development of residential uses through the creation of an ASP. This ASP has considered and appropriately placed the density to align with future developments and considered the transition to future commercial uses in the north and existing residential uses to the west in alignment with the goals of the IDP. Additionally, the density proposed will contribute to the success of a highway commercial district by having a higher number of residents in the area. Through this development we are working to support the long-term interest of the County and Town through an efficient development pattern that achieves a balance of land uses compatible with the area.

4.6 RESERVES

Municipal Reserves (MR) and Environmental Reserves (ER) are lands dedicated to the Town as public land during the subdivision process. MR is dedicated to enhance the community by providing land for parks, schools, and recreational amenities, as required. ER supports the protection of the natural environment by preventing development in hazardous areas such as ravines, floodways, or coulees.

The determination of exact reserve allocation and analysis of MR owing within the Plan Area should be addressed at time of Subdivision in accordance with the provisions of the MGA and refer to any/all applicable Town policies or Deferred Reserve caveats registered on title at time of application. MR has been collected in full on Lot 1 (±1.04ac). The remaining MR within Lot 2 (±9.19ac) is contemplated under a Deferred Reserve Caveat registered on title. This caveat describes MR owing within the remaining portion of the Plan Area within Lot 2. MR is expected to be provided through the dedication of land or by the payment of cash-in-lieu at subdivision stage.

Any MR dedication required within the Plan Area is anticipated to be accomplished within the open space located centrally within the residential land use area or to the north. Additional areas may be considered for dedication of MR without requiring an amendment to this plan reviewed at time of DP.

5 TRANSPORTATION

5.1 TRANSPORTATION NETWORK

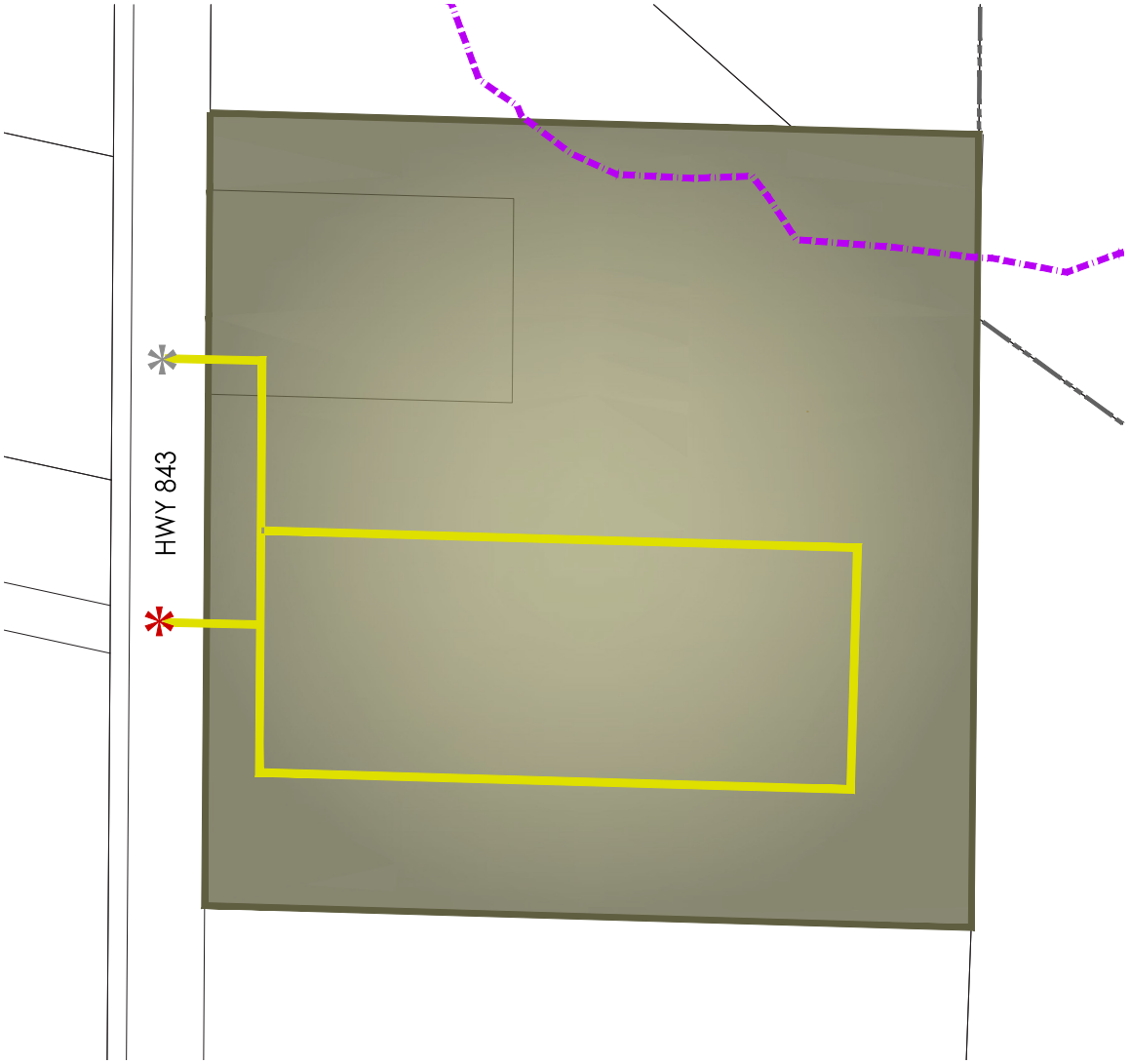
To support the residential development proposed by this ASP, a Transportation Impact Assessment (TIA) was prepared to evaluate the adequacy and impact to the study area intersections and road links in order to accommodate the opening day and long-term (20 year) traffic horizons. The TIA also considered and determined if any roadway improvements are required to incorporate the proposed development.

The transportation network for the Plan Area (illustrated on **Map 7**) is designed to accommodate anticipated traffic volumes at full build out in an efficient, safe, and effective manner. The internal transportation system has been configured as a circular roadway that connects to a primary access point on Highway 843, with a secondary access located to the north. Access and internal transportation system will allow for two traffic and allow for two points of emergency access to the development.

The connection to Highway 843 will be a Type 1 intersection given the low traffic volumes, posted speeds, and the urbanization occurring in the area. To the discretion of Alberta Transportation, this intersection will align with the existing intersection utilized by the Maple Estates Mobile Home Park to the west, converting the existing 3-leg intersection to a 4-leg intersection at the existing location, limiting the number of access points to the highway. This intersection will have a stop control on the westbound movements, and free flow on Highway 843. The development is anticipated to produce a relatively small amount of traffic, so no further improvements to Highway 843 are anticipated due to additional development traffic.

The developer shall be responsible to provide a publicly dedicated road network and all servicing infrastructure to municipal standards. If future development proposals involve a type of bareland condominium subdivision plan, the developer may propose alternative road and infrastructure standards for consideration by the Town. Additionally, if required and at the developers expense, a Development Agreement shall be entered into with the municipality to address the terms and requirements of providing the necessary municipal infrastructure for the development and any roadway or intersection improvements.

Map 7 Transportation Network



Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Local Road
- Primary Access
- Secondary/Emergency Access
- Development Setback Line

6 SERVICING

6.1 GENERAL

A servicing strategy for the ASP has been developed based upon municipal servicing standards and with reference to the Town of Picture Butte's Infrastructure Master Plan (IMP) 2017 (ISL Engineering and Land Services). Water and sanitary servicing is readily available for the Plan Area. Stormwater management for this parcel is part of a larger municipal strategy, as outlined in the IMP. The following sections outline the servicing strategy for the Plan Area, including interim and permanent scenarios for stormwater management, and provides a summary of the estimated flows and volumes that will be received by downstream conveyance and treatment infrastructure. All calculations including reference to population density have been calculated to consider the highest potential population within the Plan Area.

6.2 SHALLOW UTILITIES

Electrical, Gas and Telecommunication services are available from Highway 843. Servicing strategies for these utilities will be completed at the time of subdivision during detailed engineering design, in accordance with all municipal standards.

Developers, at their expense, shall be responsible for the installation of all required shallow utilities and streetlights within the Plan Area through a single utility Right of Way.

6.3 WATER

The Town's existing water distribution system and the proposed internal distribution system including hydrants is identified on **Map 8**. A 200mm diameter looped waterline within the Plan Area, connecting to the 250mm diameter line existing in Highway 843, is proposed. The proposed water servicing and fire suppression is based on an estimated population between 346 to 467 people and the following assumptions:

Average Day Demand	177m³/day
Maximum Day Demand	355m³/day
Peak Hour Demand	16 L/s
Maximum Day Demand + Fireflow	87 L/s

Assumed water volumes and flow rates have been derived from the IMP data: Average Day Demand (ADD) 380 L/p/d; Maximum Day Demand 2 x ADD; Peak Hour Demand 4 x ADD; Fire flow Residential 83 L/s.

Municipal confirmation that downstream infrastructure has the capacity to convey and treat water to the proposed development shall be required for Subdivision and/or Development Permit approvals.

6.4 SANITARY

The Town's existing sewage conveyance system and the proposed internal conveyance system is identified on **Map 9**. A 200mm conveyance sewer connecting to a 375mm diameter line existing in the NW corner of the parcel is proposed. This area is serviced by an existing lift station. The proposed sanitary servicing is based on a full build out scenario with the maximum estimated population of 467 people, a service area of 4.13ha, and the following assumptions:

Average Day Sewage Generation	159m³/day
Peak Dry Weather Flow (DWFx4)	7.3 L/s
Inflow and Infiltration (I&I)	1.2 L/s
Peak Wet Weather Flow	8.5 L/s

Assumed sewage volumes and flow rates have been derived from the IMP data: Dry Weather Flow (DWF) 340 L/p/d; Wet Weather I&I 0.28L/s/Ha.

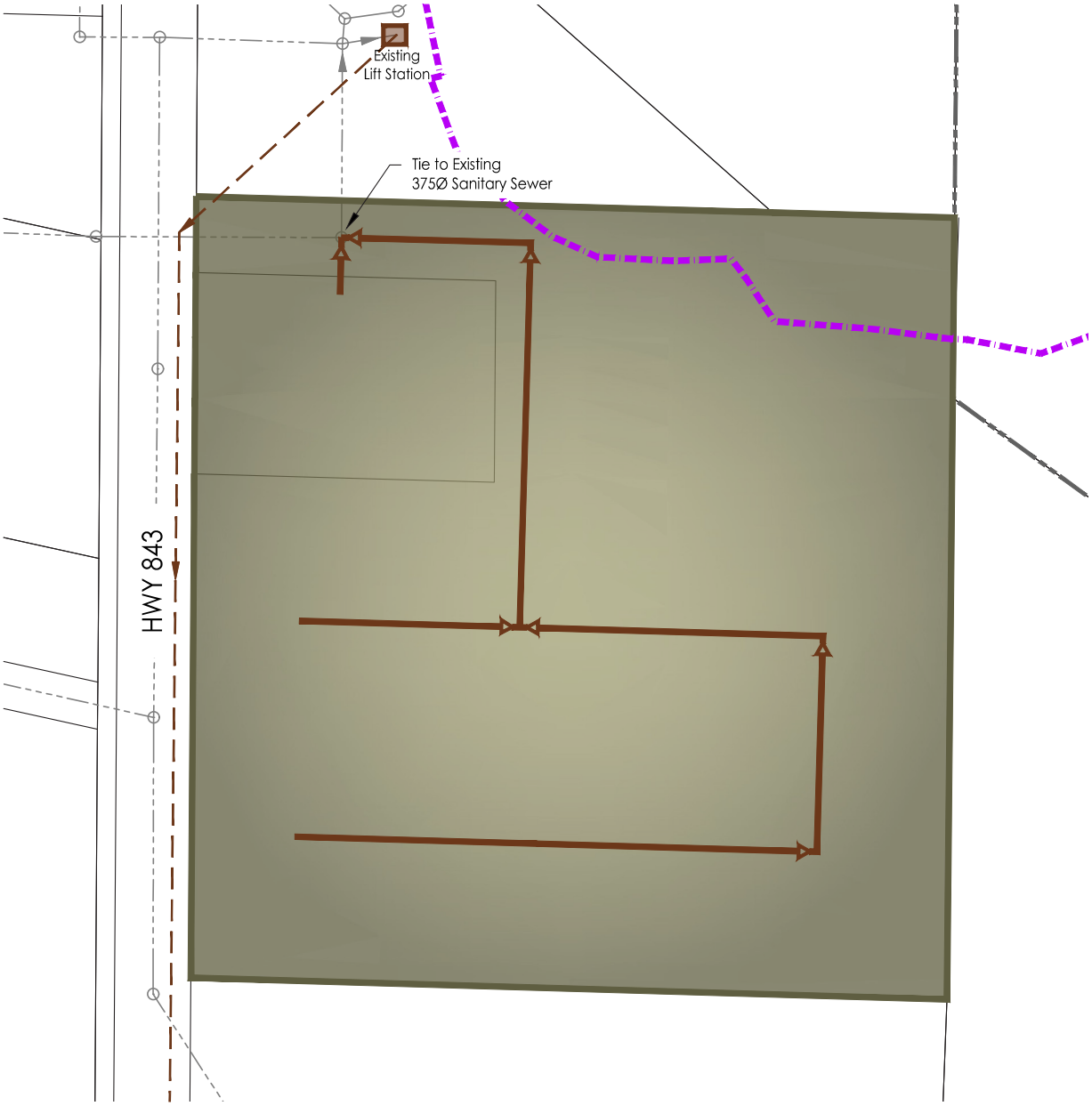
Subdivision and Development Permits may only proceed following Municipal confirmation that downstream infrastructure has the capacity to convey and treat wastewater from the proposed development.

Map 8 Water Servicing

Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Proposed Watermain
- Proposed Hydrant
- Existing Watermain
- Existing Hydrant
- Development Setback Line

Map 9 Sanitary Servicing



Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Proposed Gravity Sewer
- Existing Forcemain
- Existing Gravity Sewer
- Development Setback Line

6.5 STORMWATER

The ASP is in a future southerly drainage catchment as defined in the IMP that has allocated a 1.16 L/s/Ha release rate to a new Piyami Coulee outfall. It is assumed that construction of this future stormwater trunk system and regional ponds is not a near term development project for the municipality, as identified on **Map 10**. The Plan Area has been identified as a priority location for urban growth within the Town and is situated at the northerly margin of this drainage catchment, the following servicing options would allow for near term development.

Option 1

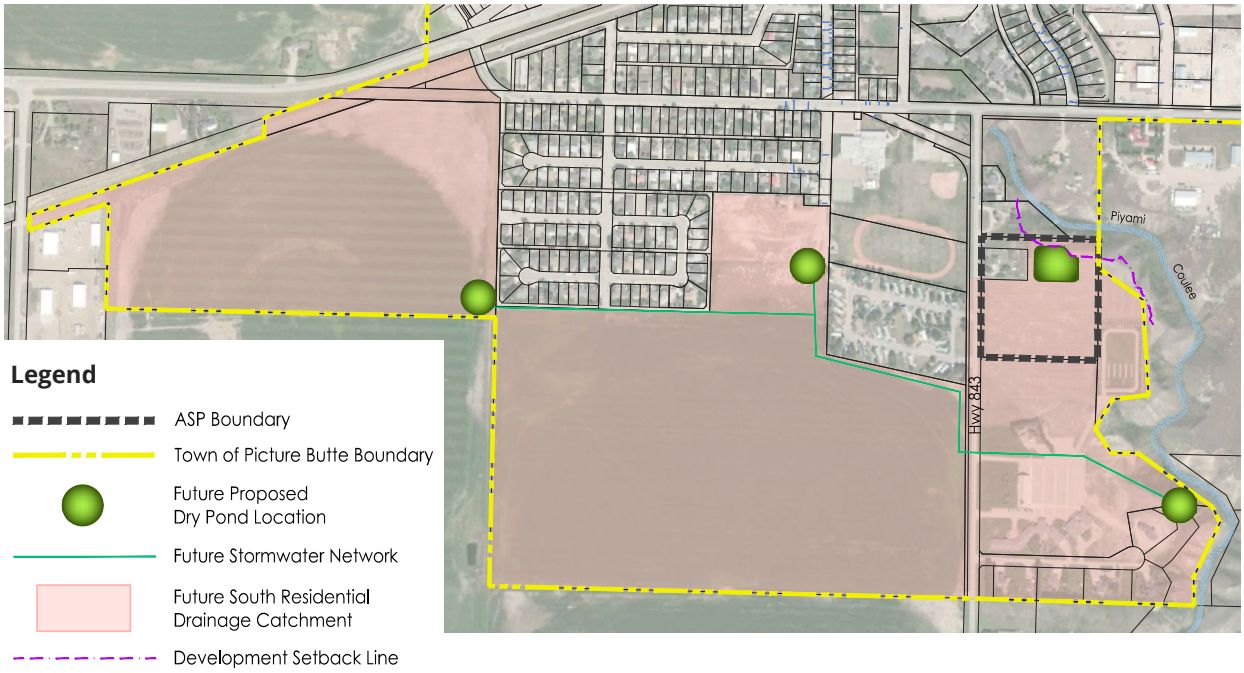
A new outfall to Piyami Coulee will be designed and constructed (subject to regulatory approval) as illustrated on **Map 11**. Under this scenario, a dry pond will accommodate pre-development drainage levels and will discharge to the Piyami Coulee with appropriate treatment and erosion control measures

Option 2

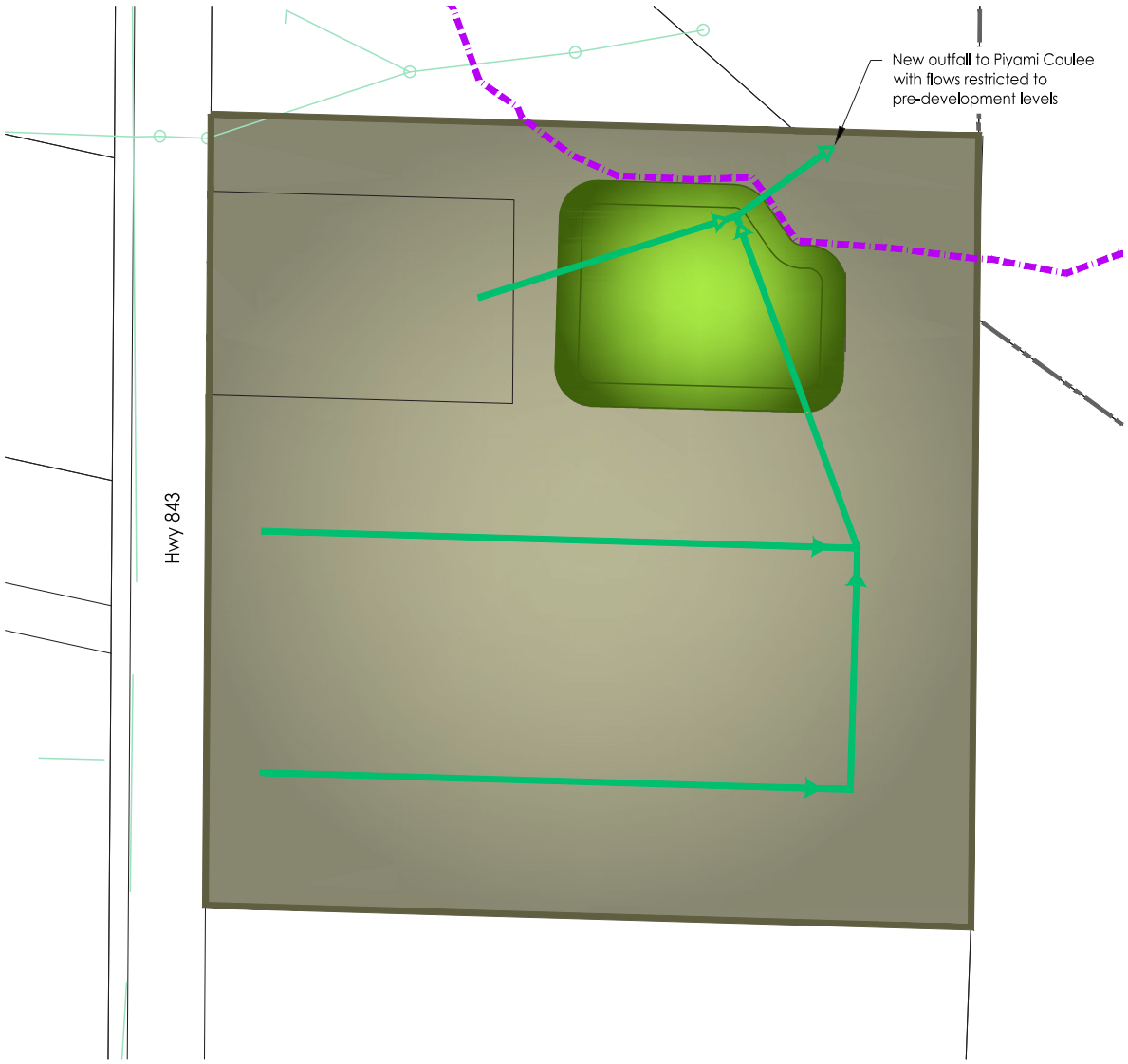
The development will be connected to the existing outfall as illustrated on **Map 12** along the north boundary of the Plan Area. Under this scenario, drainage from the dry pond will be restricted to a prescribed release rate that is confirmed by the municipality and utilizes a portion of the residual capacity of the existing outfall. The approval of a new outfall under the Water Act would not be required, however, water diversion from existing drainage patterns would still require Water Act approval.

Regardless of the outfall option that is chosen for the development, Butte Landing will incorporate a stormwater management system that conveys, treats, and attenuates urban development flows to pre-development conditions using a minor storm sewer system and a major storm system that manages surface run-off during extreme rainfall events. All parcel and lot grading plans shall conform with the overall stormwater management plan as required by the Town at the subdivision or development stage.

Map 10 South Residential Drainage Strategy



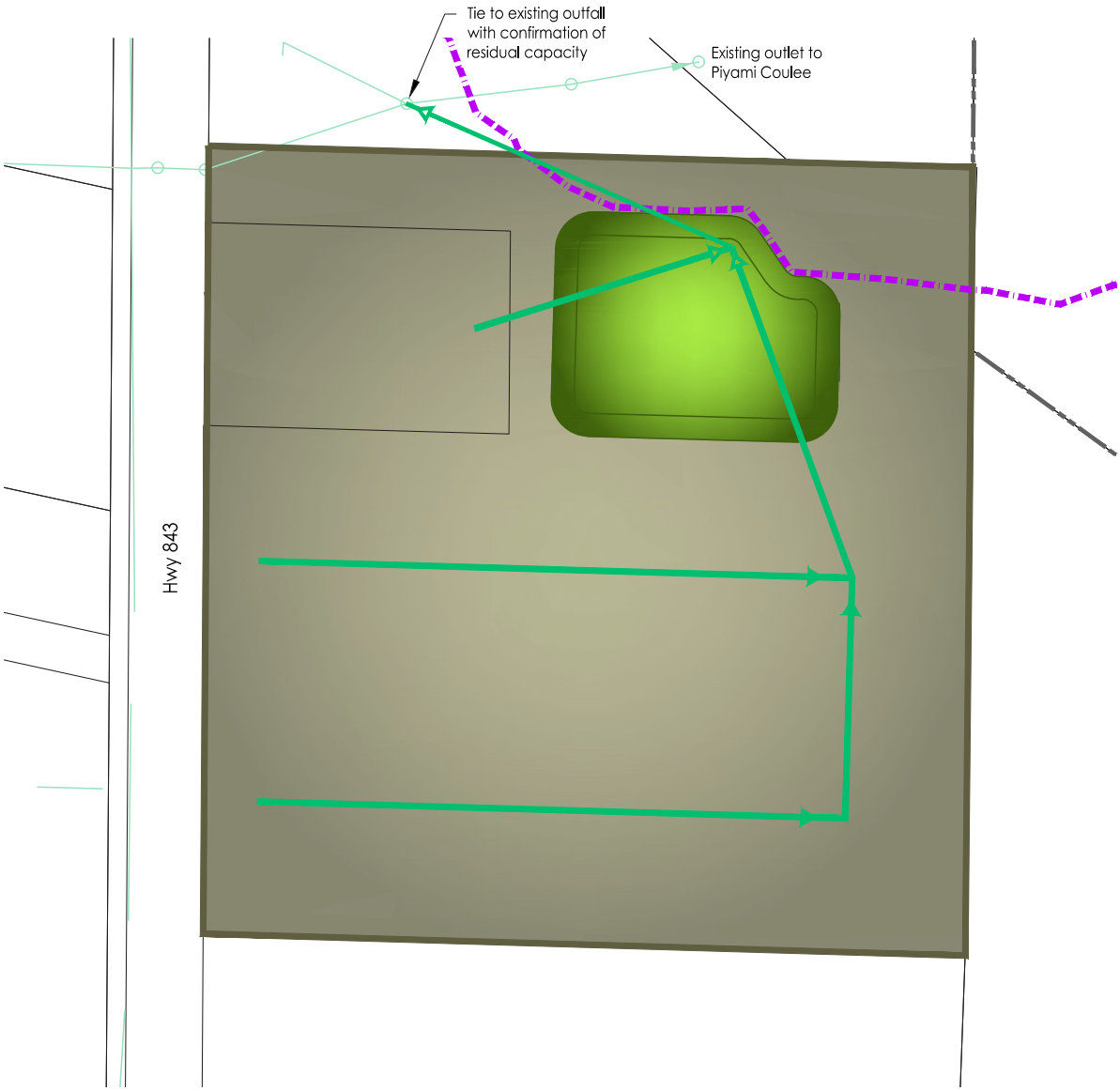
Map 11 Stormwater Servicing - Option 1



Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Proposed Storm Sewer
- Existing Storm Sewer
- Stormwater Management Facility
- Development Setback Line

Map 12 Stormwater Servicing - Option 2



Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Proposed Storm Sewer
- Existing Storm Sewer
- Stormwater Management Facility
- Development Setback Line

7 IMPLEMENTATION

The ASP outlines the vision for growth in the community and provide guidance with regard to infrastructure, land use, subdivision, and development. The purpose of this section is to describe how this vision will be implemented and provide detail on the sequencing of development.

Following ASP adoption, implementation of Butte Landing will proceed through land use re-designation, subdivision and detailed engineering, the construction of infrastructure and a multi-unit development through to occupancy. It is the intent that all on-site utilities and roads will be under the direct control of a condo/strata corporation and that the municipality's ownership and maintenance of infrastructure will be limited to future improvements within the ASP boundary.

At the time of subdivision or development the Town will require a detailed site plan which all include the delineation of required parking spaces, driveways and roads, amenity areas, and utility right of ways.

7.1 PHASING

The development envisioned in this ASP will occur in phases as identified on **Map 13**. A summary of integral infrastructure improvements in support of phased development are identified below.

Phase 1 development will require:

- Completion of Primary and Secondary Emergency site access points. The secondary access will be limited to emergency vehicles only and will not be open to public use until full build out of the development occurs.
- Completion of Stormwater Management Facility, Outflow Controls, Off-site Storm Sewer and Water Act Approvals.
- Completion of one water connection to the 250mm water main in Highway 843 with suitable terminations for flushing.
- Completion of sewer connection to 375mm sanitary sewer in the NW of the Plan Area.

Phase 2 development will require:

- Extension of all infrastructure east with suitable terminations of utilities and vehicle turnarounds.

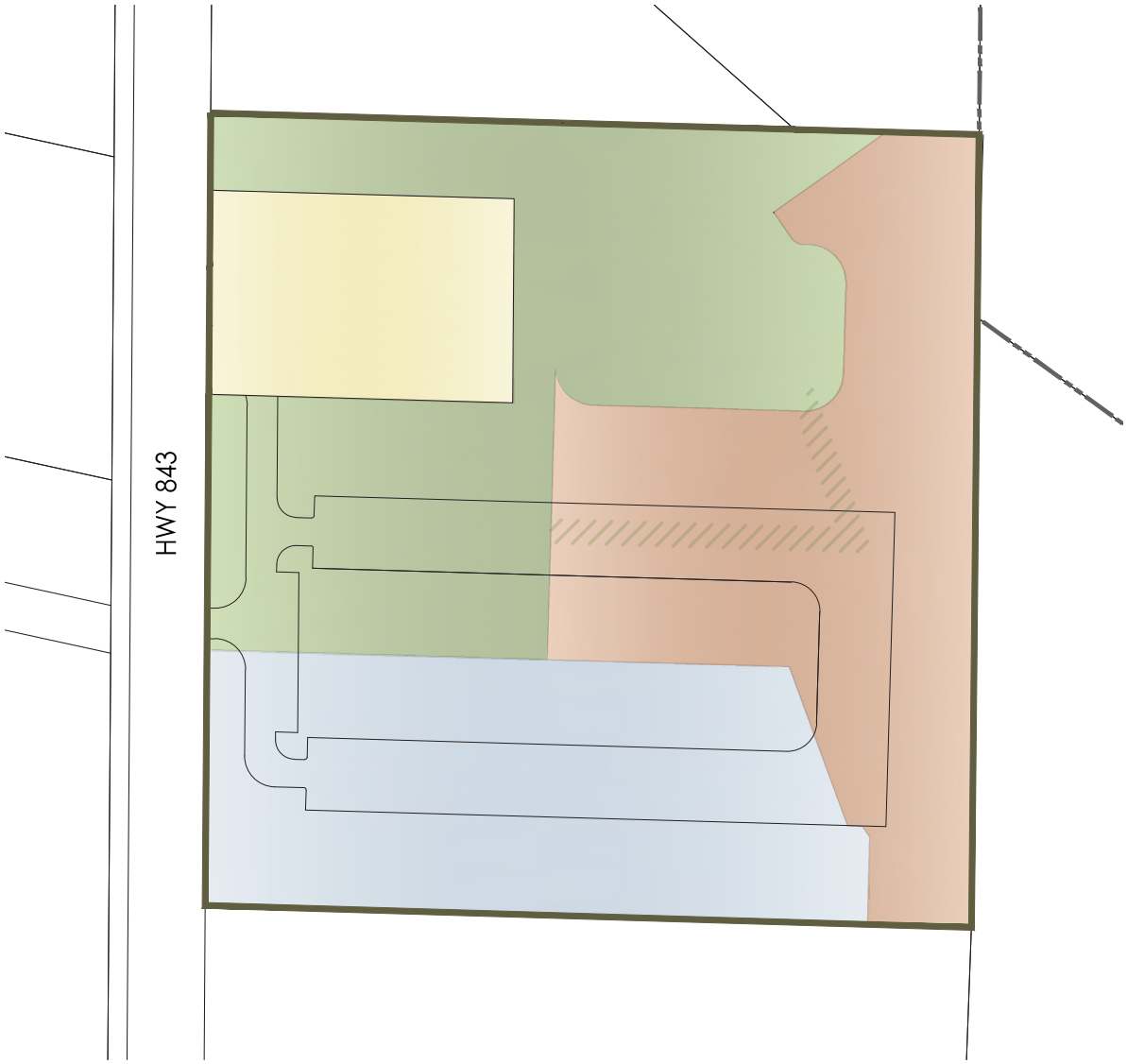
Phase 3 development will require:

- Extension of all infrastructure west with final water line looping to the 250mm water main in Highway 843.

Phase 4 development will require:

- Extension of all utilities from Phase 1 into the remaining lands of the Plan Area.
- Reconstruction of the secondary emergency access into an urbanized community access point.

Map 13 Phasing & Implementation Plan



Legend

- ASP Boundary
- Town of Picture Butte Boundary
- Phase 1
- Phase 1 Offsite Storm
- Phase 2
- Phase 3
- Phase 4

APPENDICES

The following appendices do not form part of the statutory portion of the ASP. The intent of the appendices is to provide supplementary information for interpretation of components within the ASP, and additional information with respect to certain policy sections of the ASP.

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Appendix A: Conceptual Site Layout

Appendix B: Geotechnical Evaluation and Slope Stability Analysis (2023)

Appendix C: Historical Resources Act Clearance (2023)

Appendix D: Transportation Impact Analysis (2023)

Appendix E: Phase 1 Environmental Site Assessment (2023)

10 0 50 100m

SCALE 1:1500

ASP Boundary

Town of Picture Butte Boundary

The purpose of this section is to provide an illustration of potential building locations within the Residential lands. This development staging is conceptual in nature and may not reflect actual buildout.

MAP A1 | BUTTE LANDING - AREA STRUCTURE PLAN

Conceptual Site Layout

Stantec

116549067
January 17, 2024

PREPARED FOR: OAK POINT INC.

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2024/01/23 1:55 PM By: Van Maanen, Marvin

TETRA TECH

Geotechnical Evaluation and Slope Stability Analysis
Oak Pointe Residential Subdivision
Picture Butte, Alberta



PRESENTED TO
Stantec Consulting Ltd.

AUGUST 2023
ISSUED FOR USE
FILE: ENG.LGEO04650-01

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Photo 8 Historical Instability on Slope North of Site – Facing East.

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Appendix B Borehole Logs
Appendix C Design and Construction Guidelines

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Stantec Consulting Ltd., and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Stantec Consulting Ltd., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by Tetra Tech Canada Inc. (Tetra Tech) for the proposed Oak Pointe residential subdivision development, to be located within the town of Picture Butte, Alberta (Figure 1). The site legal address is described as Legal Subdivision 13, Section 34, Township 04, Range21, West of the fourth Meridian.

The scope of work for the geotechnical evaluation was outlined in a proposal (Tetra Tech File No. PENG.LGEO04650-01) issued to Mr. Marvin Van Maanen, of Stantec Consulting Ltd. (Stantec), on June 7, 2023. The objective of this evaluation was to determine the general subsurface stratigraphy and groundwater conditions in the area of the proposed development and to provide general recommendations for the geotechnical aspects of design and construction for the project.

Authorization to proceed with the evaluation was provided by Mr. Van Maanen, of Stantec, by a signed Services Agreement on June 13, 2023.

2.0 PROJECT DESCRIPTION AND SCOPE OF WORK

It is understood that the proposed residential subdivision will comprise 18, four-unit buildings for a total of 72 three-bedroom units with underground utilities, a stormwater dry pond, paved roadways, a mini storage facility, and a playground. The total planned area is approximately 3.72 hectares (ha.).

Shallow foundations with a floor slabs-on-grade system are typically considered for residential developments in southern Alberta. Alternatively, a deep pile foundation system, such as bored cast-in-place piles or screw piles, is also considered feasible; however, may not be as economically viable when compared to a shallow foundation system for the relatively light loaded residence structures.

The scope of work for this evaluation comprised the drilling of four (4) boreholes, a laboratory program to assist in classification of the subsurface soils, and this report providing the following design and construction recommendations:

- General site grading.
- Slope stability assessment and development setbacks.
- Construction of below-grade utilities.
- Shallow foundations and below-grade structures.
- Design and installation of floor slabs-on-grade system.
- Suitability of compacted clay liners.
- Design and construction of dry pond.
- Classification of site for seismic design.
- Volumetric changes of soil due to changes in moisture content and/or frost.
- Construction of subgrades, backfill materials, and compaction.
- Roadway subgrade preparation.
- Concrete type for structured elements in contact with soil.

3.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for this evaluation was carried out on June 20, 2023. A truck-mounted drill rig was contracted from Chilako Drilling Services Ltd. of Coaldale, Alberta. The rig was equipped with 150 mm diameter solid stem continuous flight augers. Tetra Tech's field representatives were Mr. Jackson Meadows and Daniel Linderman. Buried utility locating was carried out through Alberta One-Call.

Four (4) boreholes (23BH001 through 23BH004) were drilled across the site to depths of between 24.8 m and 6.6 m below the existing ground surface. The borehole locations are depicted on Figure 2. The borehole elevations were interpreted from the information provided by Stantec, with coordinates obtained by Tetra Tech using a handheld GPS. Borehole coordinates and elevations are shown on the borehole logs provided in Appendix B.

In all boreholes, disturbed grab samples were obtained at depth intervals of approximately 600 mm. Standard Penetration Tests (SPT) were completed at intervals of 1.5 m. All soil samples were visually classified in the field, and the individual soil strata and the interfaces 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.

Slotted 25 mm diameter polyvinyl chloride (PVC) standpipes were installed in each of the boreholes in order to monitor the groundwater levels. Auger cuttings were used to backfill around the standpipes and the boreholes were sealed at the ground surface with bentonite chips.

Soil classification tests, including natural moisture content, Atterberg Limits, and soluble sulphate content, were subsequently performed in the laboratory on samples collected from the boreholes to aid in the determination of engineering properties. The results of the laboratory tests are presented on the borehole logs in Appendix B.

4.0 SITE CONDITIONS

4.1 Surface Features

The site is located at prairie level within the southeast portion of the town limits of Picture Butte, Alberta, adjacent to Highway 843 to the west and the Picture Butte Memorial Cemetery to the southeast. The site is currently hay land with partial development on the northwest corner, approximately 3.72 ha. in area (Figure 2). The overall site drains towards the northeast corner which abuts sideslopes of an Oldman River tributary coulee (Photo 1 through Photo 4).

As part of the evaluation, Tetra Tech reviewed historical aerial photographs of the site and surrounding area. The following observations were noted:

- The site was relatively undeveloped agricultural land as far back as 1951(oldest aerial photographs available).
- Structures in the northwest corner of the project site were visible in the 1970 aerial photograph.
- Further development in the northwest corner of the project site and a berm/dam structure across the tributary coulee to the northwest of the site was visible in the 1978 aerial photograph. The berm/dam structure appears to be installed to handle seasonal water.
- The structures closest to the tributary were gone in the 1999 aerial photograph.

4.2 Mining Activity

Research was conducted by Tetra Tech to review the possible existence of mine workings within the boundary of the site, including publications by the Alberta Energy Regulator and various documents contained in Tetra Tech's library regarding the coal mining industry in Picture Butte. The literature indicated the presence of a mine located adjacent to the subject site to northwest of the surrounding area (Figures 2 and 3).

Based on Tetra Tech's review of these mining characteristics, given the depth of the coal mine workings and the distance from the site, it is considered unlikely that the proposed development would have significant adverse effects due to the presence of historical mine workings.

4.3 Soil Stratigraphy

The general subsurface stratigraphy of the project site generally comprised a surficial layer of topsoil, underlain by native clay and clay till deposits. The following subsections provide a summary of the stratigraphic units encountered at the specific borehole locations across the site. A more detailed description is provided on the borehole logs presented in Appendix B.

4.3.1 Topsoil

Topsoil was encountered at the borehole locations, with thicknesses of between 50 mm and 200 mm. Due to previous agricultural practices and depositional processes (i.e., wind), the topsoil layer is expected to vary in thickness. A detailed topsoil investigation may be required to determine stripping volumes.

4.3.2 Clay

A layer of clay was encountered at three (3) of the borehole locations under the topsoil layer (23BH002, 23BH003, and 23BH004), extending to depths of between 1.0 m and 1.8 m below grade level. The clay was generally described as silty, trace sand to sandy, damp to moist, very stiff, generally low to high plastic, and light brown or brown with occasional white precipitates. Moisture content tests taken on clay samples generally ranged between 9% and 17%.

A SPT "N" value within this layer indicated 12 blows per 300 mm penetration, indicative of a stiff to very stiff consistency.

4.3.3 Clay Till

Clay till was encountered beneath the clay layer, extending to the borehole termination depths. The clay till was generally described as silty, some sand, trace gravel, moist to very moist, low to medium plastic, stiff to very stiff, and brown with dark brown mottling, grey brown, and grey green, with coal and oxide specks. Occasional silt and sand pockets, and high plastic clay inclusions along with interbedded silt layers were encountered within the clay till. Moisture content tests taken on clay till samples ranged between 12% and 24%. Atterberg Limits testing (six tests) indicated Liquid Limits ranging between 24% and 30%, and Plastic Limits ranging between 13% and 15%; indicative of low to medium plasticity.

A medium to high plastic clay layer was encountered within the clay till in 23BH002 and 23BH003 with thickness of approximately 400 mm to 800 mm. Atterberg Limits testing (one test from 23BH002) indicated a Liquid Limit of 66% and a Plastic Limit of 25% indicative of high plasticity.

SPT "N" values within this layer ranged from 10 to 25 blows per 300 mm penetration, indicative of a stiff to very stiff consistency.

4.4 Groundwater Conditions

During the field drilling, no groundwater seepage or sloughing was encountered in the boreholes. The groundwater levels were measured on June 29, 2023, and on July 11, 2023. Table A summarizes the groundwater monitoring data.

Table A: Groundwater Monitoring Data – June 29 and July 11, 2023

Borehole Number	Depth of Standpipe (m)	Borehole Elevation (m)	Depth to Groundwater (m)		Groundwater Elevation (m)	
			June 29, 2023	July 11, 2023	June 29, 2023	July 11, 2023
23BH001	24.8	897.54	16.37	13.23	881.17	884.31
23BH002	24.8	899.25	15.32	11.98	883.93	887.27
23BH003	6.6	899.73	Dry	Dry	-	-
23BH004	6.6	899.23	Dry	Dry	-	-

5.0 RECOMMENDATIONS

The recommendations that follow provide varying options intended to aid in the development of project concepts and specifications. The recommendations are based on the understanding and condition that Tetra Tech will be retained to review the relevant aspects of the final design (drawings and specifications) and to conduct such field reviews as are necessary to ensure compliance with the geotechnical aspects of the National Building Code - 2019 Alberta Edition, the Town of Picture Butte Land Use Bylaw No. 841-18, the 2019 Lethbridge County Engineering Guidelines & Minimum Servicing Standards, this report, and the final plans and specifications. Tetra Tech accepts no liability for any use of this report in the event that Tetra Tech is not retained to provide these review services.

Specific recommendations that apply to this project are provided for site development, pavement structures, foundations and floor slab systems, stormwater management facilities (dry pond), and development setback lines with respect to the potential slope stability issues.

5.1 Site Development

5.1.1 Topsoil Depth

The initial topsoil stripping depth should be considered as being of particular importance with regard to site subgrade grading design elevations. Based on the findings of the field drilling program, the surficial topsoil (A Horizon) layer thickness generally varies between 50 mm and 200 mm; however, may be somewhat variable in thickness due to historical cultivation practices of the land surface and/or depositional processes (i.e., wind). Consideration can be given however, to incorporating the underlying B Horizon layer (organic content <5%) into the fill mass during general site grading. Full-time monitoring by experienced personnel is recommended in order to avoid over-stripping and to ensure appropriate material mixing and placement.

5.1.2 Lot Grading

It is assumed that surficial drainage will be directed towards a catchment pond or dry pond to be located on the north end of the site (Figure 3). The following recommendations are provided for lot grading.

Following organic topsoil stripping, all lots should be graded for drainage at a minimum gradient of 2.0%. The existing site soils, comprising low to medium plastic clay and clay till which are considered suitable for use as landscape fill materials and for use as general engineered fill materials for lot grading, provided they are acceptably moisture conditioned. High plastic clay should be expected at some locations and be separately stockpiled and not be used for generally engineered fill due to its high swelling potential. The moisture content of the site soils generally appear to be variable with respect to the anticipated optimum moisture content (OMC). Moisture conditioning will likely be required at the site for proper compaction. Although soil moisture variability should be expected, the earthwork contractor should assess the requirements and should consider such factors as weather and construction procedures.

General engineered cohesive fill materials for lot grading should be moisture conditioned to within a range of 0% to +2% of the OMC prior to compaction and compacted to a minimum of 98% of Standard Proctor Density (SPD). Granular materials, if used, placed as “general engineered fill” should be compacted within a range of ±1% of OMC.

5.1.3 Backfill Materials

The low to medium plastic soils on site, including native clay and clay till, are considered acceptable as general engineered fill materials for site grading purposes. Any sand or silt, if locally encountered, are only considered suitable for landscaping purposes or backfill below frost protection depths due to high frost susceptibility. High plastic clay, if encountered, should not be used as general engineered fill materials. The near-surface clay soils appear to be variable in moisture content across the site; and therefore, moisture conditioning will be required for proper backfill placement. The earthwork contractor should make his/her own estimate of the requirements for moisture conditioning to the recommended standards and should consider such factors as weather and construction procedures.

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

5.1.4 Construction Excavations

Excavations should be carried out in accordance with Alberta Occupational Health and Safety Regulations. For excavations required for underground utilities, for example the water lines, the excavation depth is understood to be less than 3.0 m from final grade. The following recommendations notwithstanding, the responsibility of all excavation cutslopes resides with the Contractor, who should take into consideration site-specific conditions concerning soil stratigraphy and groundwater. All excavations should be reviewed by the Contractor prior to personnel working within the base of the excavation.

Based on the findings of the drilling program, very stiff clay soils, in damp to moist conditions, are generally anticipated to be encountered within 3.0 m below grade during excavation. Short-term excavations (open for less than one month) within the very stiff clay 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 1.3 vertical (1.0H:1.3V). In areas where compact sandy soils or firm to stiff clay soils or seepage are encountered, a cutslope of 1.0H:1.0V or flatter should be considered.

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

General recommendations regarding construction excavations are contained in Appendix C.

5.1.5 Trench Backfill and Compaction

The level of compaction of the backfill must be suitable to limit post-construction trench settlement. A minimum compaction level of 95% of SPD is recommended for backfill within the pipe zone of the trench (to 300 mm above the top of pipe). For the remainder of the trench backfill, a minimum compaction standard of 98% of SPD should be utilized in all areas. The compacted thickness of each lift of backfill shall not exceed 250 mm. Moisture conditioning to OMC and 2% over OMC of the soils should be specified for general trench backfill. During placement of the backfill materials it is recommended that ‘notching’ of the excavation sidewalls (1.0H:1.0V) occur with every 1 m of height to develop a bond between the native soils and backfill materials, resulting in less potential for long-term settlement or consolidation.

It should be noted that the ultimate performance of the trench backfill is directly related to the uniformity of the backfill compaction. In order to achieve the uniformity, the lift thickness and compaction criteria should be strictly enforced. General recommendations regarding backfill materials and compaction are contained in Appendix C.

For frost protection, pipes buried with less than 2.0 m of soil cover (above top of pipe) should be protected with insulation to avoid frost damage to, or breakage of, the pipes. Rigid insulation placed under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

General recommendations regarding construction excavation and backfill materials and compaction are contained in Appendix C.

5.2 Pavement Structures

5.2.1 Subgrade Preparation

Within all roadway areas, following stripping of topsoil, the exposed subgrade should be proof-rolled to assess the subgrade characteristics. Following the proof-roll, a minimum subgrade preparation depth of 300 mm is recommended in all areas in order to improve subgrade uniformity. Where softer soils are encountered, subgrade preparation of 600 mm or more may be necessary. Subgrade preparation includes scarification, moisture conditioning to between OMC and +1% of OMC, and uniform compaction to a minimum of 98% of SPD.

Backfill to raise the subgrade level should be general engineered fill materials, as defined in Appendix C, moisture conditioned and compacted as noted previously. The subgrade should be prepared and graded to allow drainage into drainage ditches or catchbasins, if available. Proof-rolling of the prepared surface is recommended to identify localized soft areas and for an indication of overall subgrade support characteristics.

It is imperative that positive surface drainage be provided to prevent ponding of water within the roadway structure and subsequent softening and loss of strength of the subgrade materials. Surrounding landscaping should be such that runoff water is prevented from ponding beside paved areas in order to avoid softening and premature failure of the pavement surface.

5.2.2 Gravel Pavement Structures

The following minimum gravel pavement structure, using the subgrade preparation procedures in Section 5.2.1, is recommended. Both gravel materials should be compacted to 100% of SPD.

- 100 mm of crushed gravel or base gravel (25 mm minus), over
- 200 mm of pit run gravel or sub-base gravel over prepared clay subgrade.

It is imperative that positive surface drainage of gravel pavement be established to prevent ponding of water. Recommended minimum grades of 2% should be used in gravel surfaced areas. Surrounding landscaping should be such that runoff water is prevented from ponding beside gravelled areas.

5.2.3 Asphalt Pavement Structures

With no detailed traffic load available at the time of this reporting, Tetra Tech recommends the use of the “Local/Residential Roads” pavement structure in accordance with the Lethbridge County Engineering Guidelines & Minimum Servicing Standards (2019) for light duty parking areas and access roadways with light traffic or less than 0.3 million of 20-year of design equivalent single axle loadings (ESALs). The light duty structure is suitable for occasional single-axle delivery trucks and perhaps weekly garbage trucks. If more frequent truck traffic or design ESALs of greater than 0.3 million but less than 1.0 million is expected, the moderate duty structure should be used. The recommended pavement structures are presented in Table B.

Table B: Recommended Pavement Structures

Material Type	Light Duty (Local)	Moderate Duty (Arterial/Collectors)
Asphalt Pavement (mm)	120	150
Granular Base Course (mm)	300	300
Subgrade Preparation (mm)	300	300

For heavy duty loading aprons and refuse collection pads, the use of a Portland Cement concrete pavement is recommended, with a minimum thickness of 180 mm overlying 200 mm of crushed granular base course.

The recommended pavement layer thicknesses generally refer to average values and recognize typical construction variability. As-constructed layer thicknesses should satisfy the thickness tolerances identified in the Lethbridge County Engineering Guidelines & Minimum Servicing Standards (2019) (or equivalent) for granular materials and asphalt concrete.

5.3 Foundations

5.3.1 General

Based on the soil conditions encountered at the borehole locations, shallow foundations are considered suitable for the proposed residential development. Deep pile foundations are considered technically feasible; however, may not be preferred due to the relatively high cost and are not discussed and included in this report.

All shallow foundation design recommendations presented in this report are based on the assumption that an adequate level of monitoring by Tetra Tech 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 the following:

- For shallow foundations; inspection of bearing surfaces prior to placement of concrete or mudslab, and design review during construction.
- For earthworks; full-time monitoring and compaction testing.

Suitably qualified persons, independent of the Contractor, should carry out all such monitoring. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

5.3.2 Limit States Design

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

Factored Capacity = Ultimate Capacity x Soil Resistance Factors

In general, the soil resistance factors in Table C should be incorporated into the foundation design. These factors are considered to be in accordance with the Canadian Foundation Engineering Manual (CFEM) (2006) as well as the 2019 National Building Code of Canada - Alberta Edition.

Table C: Soil Resistance Factors – Shallow Foundations

Item	Soil Resistance Factor
Bearing Resistance	0.5
Passive Resistance	0.5
Horizontal Passive Resistance	0.5

Under LSD methodology, foundations should be designed on the basis of factored Ultimate Limit States (ULS) parameters. In order to determine the applicable working capacity, Serviceability Limit States (SLS) must also be considered.

5.3.3 Shallow Foundations

Shallow footings should be constructed a minimum of 1.4 m below the final design ground surface (frost protection requirement for footings under heated structures). For unheated structures, the footings should be constructed a minimum of 2.1 m below grade.

All footings should be founded on the stiff to very stiff native clay soils. Such soils meet the minimum bearing requirement for residence structures in accordance with the National Building Code – 2019 Alberta Edition. For specific foundation design, the ultimate static bearing pressure may be taken as 300 kPa, subject to other recommendations in this report. Factoring should be considered as noted in the previous section. Footing dimensions should be in accordance with the minimum requirements of the National Building Code – 2019 Alberta Edition.

Bearing certification by a geotechnical engineer is recommended to ensure that the shallow foundations are placed on competent native soils during construction. If weak soils are encountered at footing level, recommendations may be provided to remove the weak materials and bring the subcut back to design elevation with low strength lean mix concrete. Alternatively, it may be possible to lower the footing elevation to more competent native soils.

It is recommended that a grade-all bucket be used for final excavation to the foundation subgrade elevation to minimize disturbance of the founding soils. A 50 mm concrete mudslab should be placed immediately following excavation and inspection to protect the bearing surface from disturbance and inclement weather.

Further recommendations regarding shallow foundations are given in Appendix C.

5.3.4 Foundation Perimeter Drainage Requirements

It is recommended that a weeping tile and sump system be constructed around the outside perimeter of the buildings with basements to be constructed (at the base of the footings, if selected) to maintain a relatively consistent moisture profile of the subgrade soils. The weeping tile system should comprise a perforated weeping tile, in turn surrounded with a minimum of 150 mm thick blanket of washed rock (maximum size 20 mm), with the granular layer wrapped in non-woven geotextile. The weeping tile should have a minimum 0.5% slope leading to a sump.

5.3.5 Below-Grade Walls

All below-grade walls should be designed to resist lateral earth pressures 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/m³ for cohesive or granular backfill, respectively).

H = Depth below final grade (m).

Q = Surcharge pressure at ground level (kPa).

It is assumed that drainage will be provided for all below-grade walls through the installation of a weeping tile system, as described above, and hydrostatic pressures will not be a factor in design.

Backfill around concrete walls should not commence before the concrete has reached a minimum two thirds of its design strength and first floor framing is in place or 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% of SPD 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.

5.3.6 Floor Slab System

5.3.6.1 Floor Slabs-on-Grade

Construction of floor slabs-on-grade for this project is considered feasible, provided the following precautions and construction recommendations are followed.

Following removal of topsoil and excavation to design elevations, the exposed native subgrade should be scarified to a minimum depth of 300 mm, and moisture conditioned to a range of optimum to 2% over OMC. In areas where general engineered fill placed during site grading is encountered, a minimum depth of 150 mm subgrade preparation is recommended; however, if weathering is evident, 300 mm subgrade preparation is required. The minimum compaction should be 98% of SPD. The prepared subgrade should be inspected 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 placement 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 movement is unacceptable, the owner should consider a structurally supported floor.

Recommended procedures for compaction and backfill materials, and further recommendations for floor slabs-on-grade construction are included in Appendix C.

5.3.7 Building Site Grading

Drainage of surface water away from buildings should be maintained during construction. The finished grade of the proposed building site should be designed so that surface water is drained away from buildings by the shortest route. All drains should discharge well clear of the buildings. If there is a roof drain for a building, caution should be taken where downspouts discharge due to the high probability of ice forming in the winter. Downspouts may be discharged onto landscaped areas, provided the water is carried, by means of a concrete splash pad or extendable section so the point of discharge of the water is at least 2 m from the building. Landscaped surfaces adjacent to the walls of the buildings should be graded to slope away from the buildings at a gradient of at least 5% within 2 m of the buildings' perimeter. General landscaped areas should have grades of no less than 2% to minimize ponding.

5.3.8 Seismic Design

The site classification recommended for seismic site response is Classification D, as noted in Table 4.1.8.4.a of the 2019 National Building Code of Canada – Alberta Edition.

5.3.9 Cement Type

Based on soluble sulphate concentration test results from selected samples (23BH003 and 23BH004) taken during the field program and Tetra Tech's experience on local soils, the properties of concrete for foundations in contact with soil shall meet the requirements of the Canadian Standards Association (CSA) A23.1-14, Class S-2 exposure including water/cementing materials (w/cm) ratio of 0.45, air entrainment of 4% to 7% (for 14 mm to 20 mm nominal maximum aggregate size), and a minimum specified 56-day compressive strength of 32 MPa.

For this exposure classification, alternatives include the usage of Type HS (sulphate-resistant) Portland Cement or blends of cement and supplementary cementing materials conforming to Type HSb cements.

5.3.10 Frost Protection

For protection against frost action, all perimeter footings must be placed a minimum of 1.4 m below final grade for heated structures, or 2.1 m for unheated structures.

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.

5.4 Stormwater Dry Pond Development

5.4.1 General

The geotechnical aspects of design and construction of the stormwater management facility, should be in accordance with the pertinent sections of the "*Stormwater Management Guidelines for the Province of Alberta*", dated March 2013 and prepared by the Municipal Program Development Branch of Alberta Environmental Protection. Detailed recommendations for the design and construction of this facility are provided in this section. In addition, consideration should be given to local municipal jurisdictional requirements for these types of facilities.

A stormwater dry pond is understood to be proposed for this development and is to be constructed within the upper reach of the coulee (Figure 2). Specific details of the dry pond, with respect to footprint and depth are still under consideration and have not yet been finalized. It is recommended that Tetra Tech be provided the opportunity to

review the final configuration, as well as the design and construction aspects of the facility prior to construction, to ensure that the following recommendations are adhered to.

5.4.2 Design Considerations

Due to the proximity of the coulee slopes, where the slope stability is sensitive to the moisture increase of the slope soils, the dry pond should be designed with minimal water infiltration during storm events. Clay liner should be installed at the pond bottom and extend up along the interior sideslopes to the maximum operation water level, this will reduce the amount of potential seepage into the slope soils. A weep tile could be installed under the bottom of the pond to collect leakage water and improve the rate of the pond bottom drying out for easy maintenance. The water detention should be limited to 24 hours after the storm events in accordance with dry pond design requirement.

The use of the native clay till materials with medium to high plasticity encountered on this site (or clay till blended with the upper clay) for construction of a remoulded clay liner for the pond is considered feasible, provided certain precautions are undertaken, as recommended in the following sections. Clay liner should be provided with a minimum thickness of 600 mm at the pond bottom and interior sideslopes.

It is recommended that below the normal water level, the interior sideslopes should be no steeper than 4H:1V to 5H:1V, with a minimum slope in the bottom of the pond of 1% (2% is preferred). The maximum exterior sideslopes should be no greater than 3H:1V.

5.4.3 Pond Construction

5.4.3.1 General Base Preparation

Full-time monitoring is recommended by suitably qualified persons, independent of the Contractor. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

Following stripping of any organic material from the base and sideslopes of the pond, the containment basin areas should be over-excavated beneath the proposed invert elevation in order to allow sufficient thickness of compacted clay base liner. The clay soils within the base of the excavation should then be scarified to a minimum depth of 300 mm, moisture conditioned to between OMC and +2% of OMC, and recompacted to a minimum of 98% of SPD. The intent is to improve the base conditions and to provide a low permeable pond base, effectively increasing the clay liner thickness by 300 mm.

The basin sidewalls in the cut areas (up to the maximum operation water level) should also be over-excavated a sufficient amount to allow the construction of a compacted clay liner with the exposed subgrade scarified, moisture conditioned, and compacted as noted above.

Monitoring of excavated soils within the pond footprint is recommended so that unsuitable materials, such as low plastic silts or cohesionless sands if encountered, are wasted or incorporated only in general landscape areas (above the maximum operation water level), where low permeability is not a requirement.

The composition and consistencies of the soils encountered on site are such that conventional hydraulic excavators should be able to remove these materials. Cobbles and boulders may be present within the clay till matrix, albeit infrequently. General recommendations regarding backfill materials and compaction, as well as construction excavations are given in Appendix C

5.4.3.2 Remoulded Clay Liner

The following recommendations for the design and construction of remoulded clay liners are based on compliance with Alberta Environment's publication, "*Stormwater Management Guidelines for the Province of Alberta*", dated March 2013.

The plan dimensions of the excavation should exceed the final "toe-to-toe" interior basin dimensions to provide an overlap between the pond floor liner and berm or sideslope liner. The subgrade should be relatively level and proof-rolled to provide a good base for compacting the first liner lift to the specified density. Soft pockets that would prevent sufficient compaction of the liner must be over-excavated and replaced with compacted cohesive clay fill materials.

Careful site observation and testing will be required to avoid incorporating low or non-plastic materials into the liner. It is recommended that materials with a Liquid Limit of less than 30 not be incorporated into the liner; however, low plastic clays, silt, or sands not meeting liner requirements, may be used in the top area of the embankment above the maximum operation water level or outside the liner zone for berms.

Soil moisture contents for the clay till are generally variable with respect to the OMC for the composite clay till material. Moisture conditioning will be required during liner construction for the pond. Appropriate methods of moisture conditioning should be reviewed with qualified construction personnel prior to final design of the liner system.

Subsequent to the preparation of the pond floor (to 0.3 m depth), the excavated clay soils (liner borrow material) should be moisture conditioned to between OMC and +2% over the OMC. Each lift should then be compacted to a minimum of 98% of SPD in lifts of maximum 150 mm compacted thickness to a total placed liner thickness of 0.6 m for the base, as recommended above.

A maximum "clod" size of 100 mm during moisture conditioning (prior to compaction) will produce a relatively uniform moisture content throughout the soil matrix and a relatively homogenous compacted soil structure. The size of the "clods" can be controlled with agricultural equipment such as a disk. As far as practical, the liner should be built up in a uniform fashion over the containment basin area, in order to avoid sections of “butted fill” where seepage paths may develop. Compaction should be carried out utilizing "kneading" type compaction equipment such as vibratory padfoot or sheepsfoot type compactors. Completed liner areas should have the surface smoothed by a vibratory smooth drum roller.

All general engineered fill placement in excavation cuts (or abutted to natural slopes following topsoil removal) must be ‘notched’ into the native slope materials a minimum of 0.5 m to ensure a bond with the native materials to reduce seepage.

6.0 SLOPE STABILITY ASSESSMENT AND DEVELOPMENT GUIDELINES

6.1 Site Description

As described in Section 4.1 the proposed residential development footprint, adjacent to slopes of a tributary coulee of the Oldman River, is generally orientated east-west (in the area of the proposed development).

The proposed subdivision is on the flat prairie land with elevations varying from approximately Elevation 897.5 m to Elevation 899.7 m. The coulee bottom adjacent to the development area varies from approximate Elevation 885 m from the west edge to 882 on the east edge of the development area with elevation differences ranging between 12.5 m and 15.5 m. Figures 3, 4, and 5 depict the general topography of the coulee, based on the survey information provided by Stantec.

6.2 Site Reconnaissance

Tetra Tech personnel conducted a detailed site reconnaissance for the site. The reconnaissance included reviewing the existing condition of the slopes and a visual assessment of the slopes and areas at both the crest and toe of the slopes. The following pertinent points were noted:

- Groundwater seepage was not visible along the slopes; however, areas of lush vegetation were present along the slopes which may be an indication of high moisture condition of the slope soils (Photos 3 and 4). Two culverts were visible within the tributary coulee; one was present upstream of the tributary coulee (Photo 5), while another culvert was visible north of the site at the toe of the site slope surrounded by rip-rap (Photo 6).

Due to water meandering through the tributary coulee from the culverts, a drainage channel had formed along the toe of the slopes (Photo 7).

- Historical slope instability was evident along the upper portion of the slope face directly north of the site in the form of slumping (Photos 4 and 8).
- The entire slope north of the site was well vegetated by grass and shrubs, with trees located nearer to the toe of the slope (Photos 3, 4, 6, and 7).

6.3 Slope Stability Analysis

6.3.1 General

Tetra Tech conducted a slope stability analysis using modelling software, Slope/W by GeoStudio (2012). Slope geometry was based on elevation contours which were provided by Stantec. Based on the elevation contour data, three (3) representative slope cross-sections (A-A', B-B', and C-C') were generated and reviewed (Figure 3).

The minimum safe development setback distance was determined based on a minimum Factor of Safety (FOS) against slope instability of 1.5. This FOS is considered to be the current engineering standard for this type of development.

6.3.2 Soil Strength Parameters

Assumed soil strength parameters used in the analysis were based on the test results and Tetra Tech's local experience on similar soils in this area. Groundwater parameters were selected by Tetra Tech to represent post-development conditions assuming an increase in soil moisture caused by the development (lawn irrigation, limited leakage from dry pond installed with clay liner, etc.) and reduced evapotranspiration due to development cover (streets, sidewalks, residential dwellings, etc.).

The soil strength and groundwater parameters selected for the analyses, modelling the worst-case conditions (post-development), were as follows:

Material: Clay (CH)

- Unit Weight: 18.5 kN/m³
- Cohesive Intercept c': 0 kPa
- Friction Angle: 24°/12° (peak/residual)
- Pore Water Pressure Parameter r_u: 0.2

Material: Clay and Clay Till (CL-Cl)

- Unit Weight: 19 kN/m³
- Cohesive Intercept c': 0 kPa
- Friction Angle: 28°
- Pore Water Pressure Parameter r_u: 0.2

6.3.3 Long-Term Stability

The present stability of the slopes adjacent to the proposed development area has been reviewed based on the site reconnaissance, analyses using Limit Equilibrium Modelling (Slope/W by GeoStudio), and past experience with other slope stability assessments of the Oldman River Valley and coulee slopes in this area. Visual observations of the slopes in the project area indicate that the slopes are generally in stable conditions.

A parametric study was conducted on the slope sections to model the observed slope conditions by varying pore water pressure coefficients and the soil parameters. The parametric study included the used of residual friction angles in the upper high plastic clay and the high plastic clay within the upper zone of the clay till.

Based on the stability analyses and findings during the site reconnaissance, three potential failure mechanisms are identified for long-term considerations under assumed post-construction conditions, as follows:

- Surficial slope failure due to the loss of suction of slope soils during precipitate events.
- Shallow rotational failure or transitional failure along the upper high plastic clay layer.
- Medium depth combined rotational failure or transitional failure along the high plastic clay layer within the clay till deposit.

6.3.4 Impact of Development

Site development generally results in an increase in soil moisture due to irrigation, reduced evapotranspiration due to increased soil cover and reduced vegetation, septic field systems, and other buried utilities, etc. The anticipated increase in soil moisture has been incorporated into the stability model.

Development of the site will bring about changes in the factors which contribute to the present stability of the slopes. Evaporation of soil moisture will be reduced by the presence of ground cover (from structures, roadways, parking areas, etc.). Irrigation and possible leakage of water from underground utilities and the dry pond will increase the amount of water infiltrating the site subsoils. This combination of reduced evaporation of subsoil moisture and increased infiltration of water to the subsoils is considered to be the most significant influence of development on the factors that contribute to the future stability of the slopes. Increasing soil moisture content produces a reduction in the apparent cohesion and effective stress of the slope soils, resulting in a decrease of soils resistant strength against slope failures. For post-development analysis, the pore water pressure ru were selected to model anticipated increase in soil moisture. The results of the analysis, using the revised parameters and attaining FOS of 1.5, established the development setback requirements as presented in Section 6.4 and Figure 3.

6.4 Development Setback Requirements

Based on the results of the slope stability analyses, as well as local experience and the information discussed herein, Tetra Tech has determined the minimum development setback distance which is a minimum 16 m from the Top of Bank[1] and presented on Figure 3. The development setback distances have been determined by establishing a point within the subject site which results in a minimum FOS of 1.5 against slope instability impacting the development.

[1] Top-of-Bank: means the line where the general trend of the slope changes from greater than 15% to less than 15% and remains at less than 15%, as determined by field survey.

6.5 Development Guidelines

Precautionary measures, which should be included in the geotechnical aspects of the design of the proposed development, are outlined as follows:

- Any fill excavated from basements should be disposed of well away from the slope, and well behind the development setback line.
- Positive grading should be provided to ensure drainage off of the upper part of the property (i.e., at Top-of-Bank) is directed as sheet flow over the crest of the slopes (i.e., avoiding concentrating the flow which causes erosion).
- All utilities and plumbing should be carefully installed and regularly inspected to ensure they are in good working order.
- Normal, prudent design and construction procedures should be followed during development of the residences, including consideration of stormwater management. Stormwater retention facilities should be kept well away from the development setback line with clay liner to be installed, unless the recommendations contained in this report are strictly followed.
- The zone between the development setback line and Top-of-Bank should be treated as a restricted development zone. This involves the following:
  - Maintain vegetation cover.
  - No irrigation or discharge of water for any reason.
  - Earthworks is not allowed without review by a geotechnical engineer.
  - No dumping of grass cuttings, branches, or other materials of any kind.

Notwithstanding the recommendations discussed above, some surficial sloughing and slope movement may occur. The purpose of the development setback is not to prevent slope failure, but rather, to protect the development from being affected by the failure when it occurs.

7.0 DESIGN AND CONSTRUCTION GUIDELINES

Recommended general design and construction guidelines are provided in Appendix C, under the following headings:

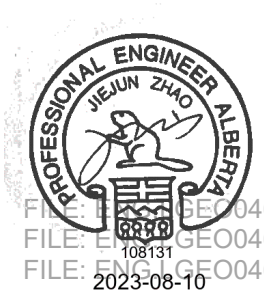
- Shallow Foundations
- Construction Excavations
- Backfill Materials and Compaction
- Floor Slabs-on-Grade

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 C, the main text should govern.

8.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.



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PERMIT TO PRACTICE
TETRA TECH CANADA INC.

RM SIGNATURE: _____

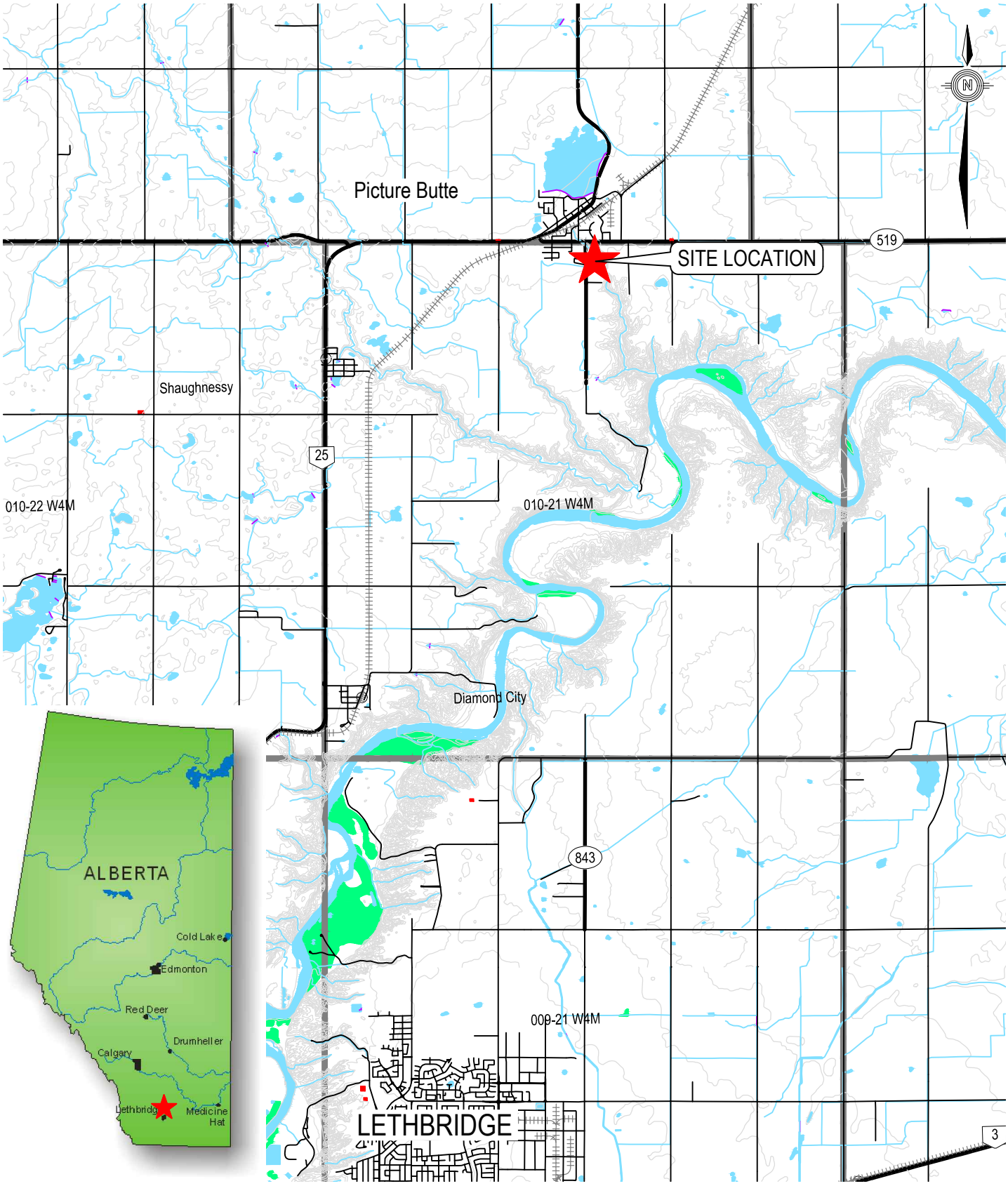
RM APEGA ID #: _____

DATE: _____

PERMIT NUMBER: P013774
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

FIGURES

Figure 1	Site Plan
Figure 2	Borehole Location Plan
Figure 3	Site Plan Showing Site Survey
Figure 4	Section A and B
Figure 5	Section C
Figure 5	Development Setback Limits



NOTES

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0 5,000m

Scale: 1:100,000 @ 8.5"x11"

CLIENT

Stantec Consulting Ltd.

TETRA TECH

PICTURE BUTTE
OAK POINTE DEVELOPMENT

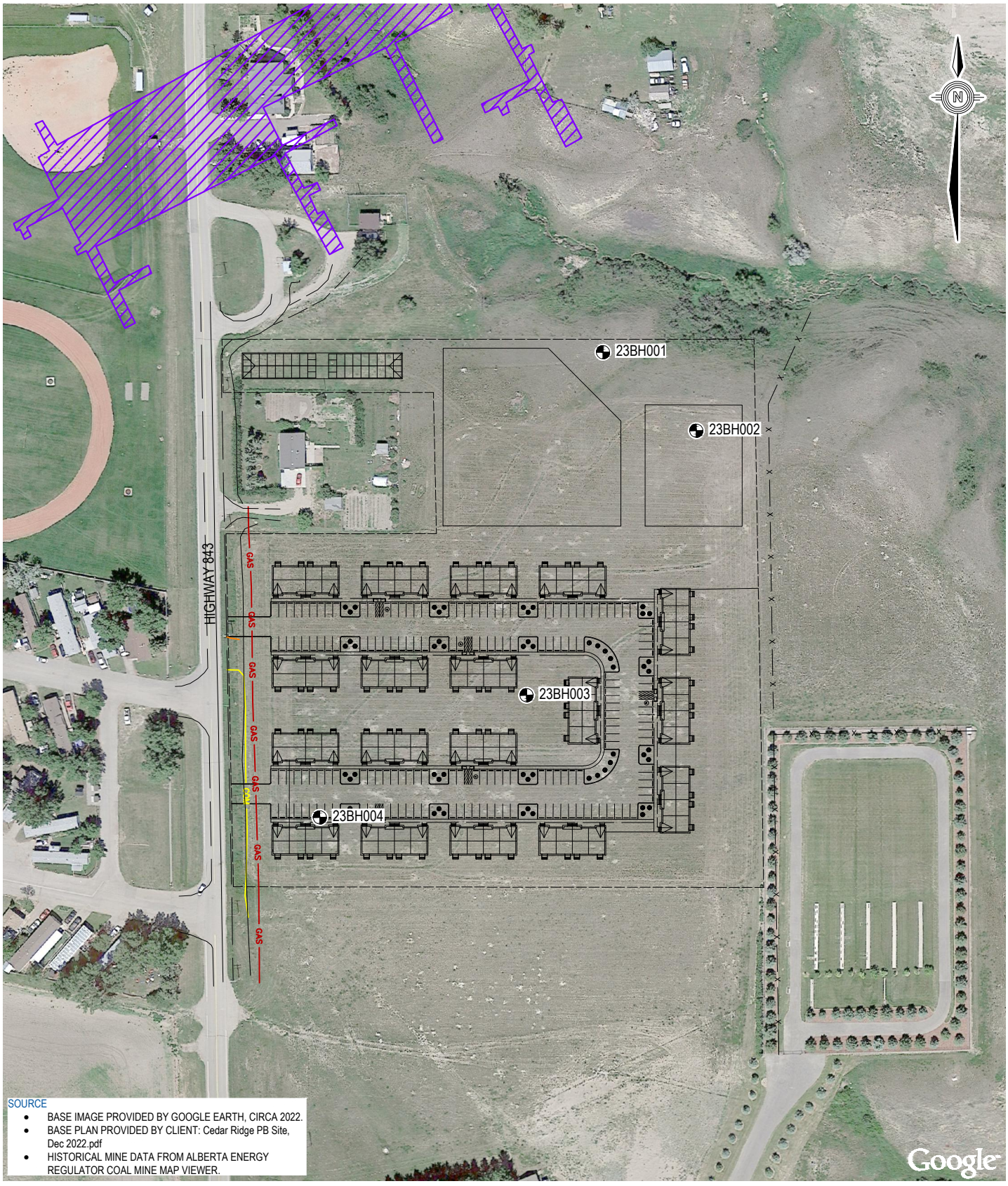
SITE LOCATION PLAN

PROJECT NO.	DWN	CKD	REV
ENG.LGE004650-01	LCH	JM	0

OFFICE	DATE
Tt Leth	June 2023

Figure 1

C:\Lethbridge\Drafting\ENG.LGE\OL\GE004650\CAD\LGE004650-01 Figure 1.dwg [FIGURE 1] June 30, 2023 - 2:13:11 pm (BY: HUGHES, LEANNE)



SOURCE

- BASE IMAGE PROVIDED BY GOOGLE EARTH, CIRCA 2022.
- BASE PLAN PROVIDED BY CLIENT: Cedar Ridge PB Site, Dec 2022.pdf
- HISTORICAL MINE DATA FROM ALBERTA ENERGY REGULATOR COAL MINE MAP VIEWER.

LEGEND

BOREHOLE LOCATION

HISTORICAL MINE LOCATION

0 100m

Scale: 1:2,000 @ 8.5"x11"

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PICTURE BUTTE
OAK POINTE DEVELOPMENT

BOREHOLE LOCATION PLAN

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENG.LGEO04650-01	LCH	JM	0

OFFICE	DATE
Tt Leth	July 2023

Figure 2

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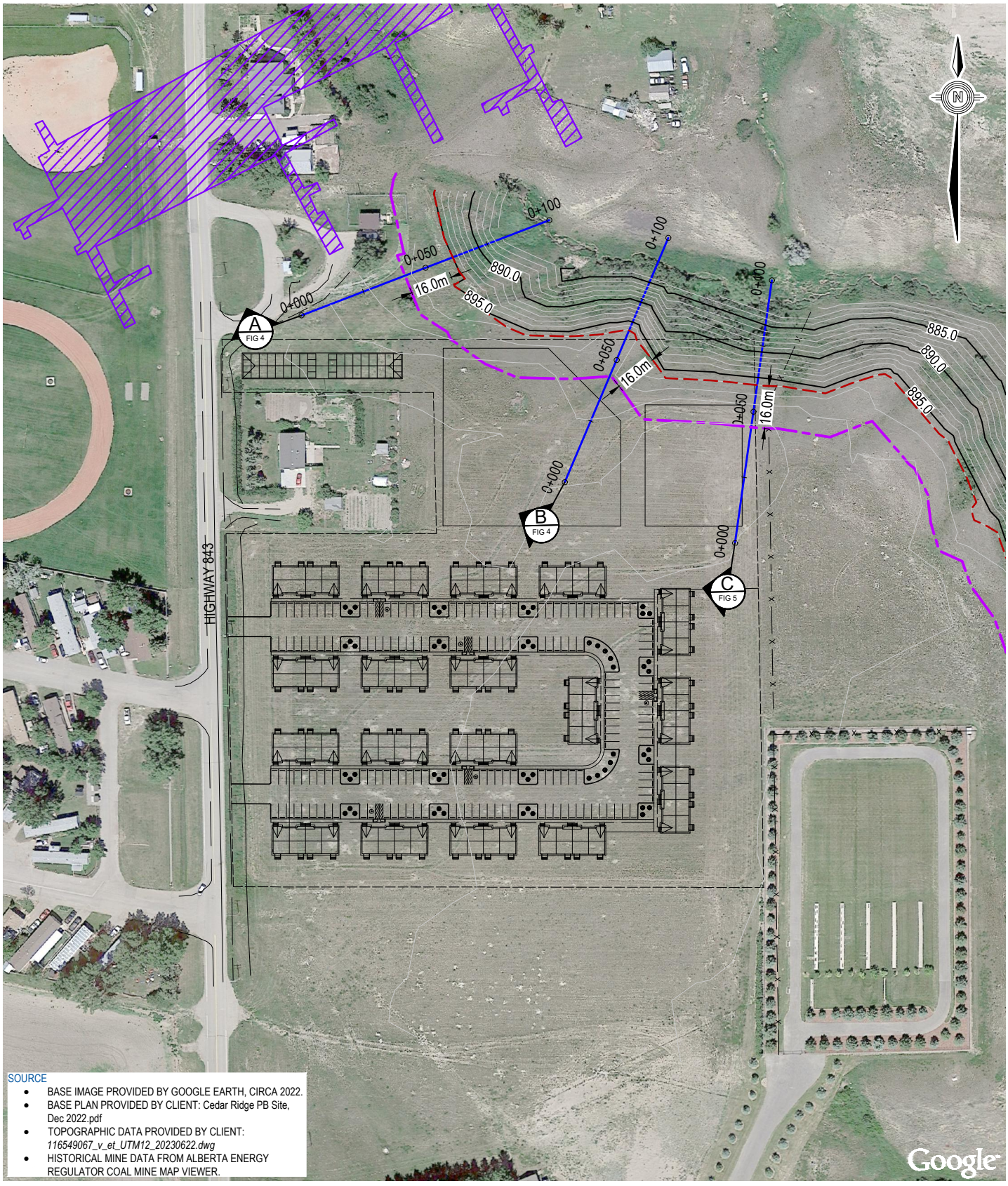

SOURCE

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- TOPOGRAPHIC DATA PROVIDED BY CLIENT: *116549067_v_et_UTM12_20230622.dwg*
- HISTORICAL MINE DATA FROM ALBERTA ENERGY REGULATOR COAL MINE MAP VIEWER.

LEGEND

- 1.0 m CONTOUR
- CROSS SECTION LOCATION
- DEVELOPMENT SETBACK LINE
- TOP OF BANK
- HISTORICAL MINE LOCATION

0 100m

Scale: 1:2,000 @ 8.5"x11"

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PICTURE BUTTE
OAK POINTE DEVELOPMENT

SITE PLAN SHOWING SITE SURVEY

TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENG.LGEO04650-01	LCH	JM	0

OFFICE	DATE
Tt Leth	June 2023

Figure 3

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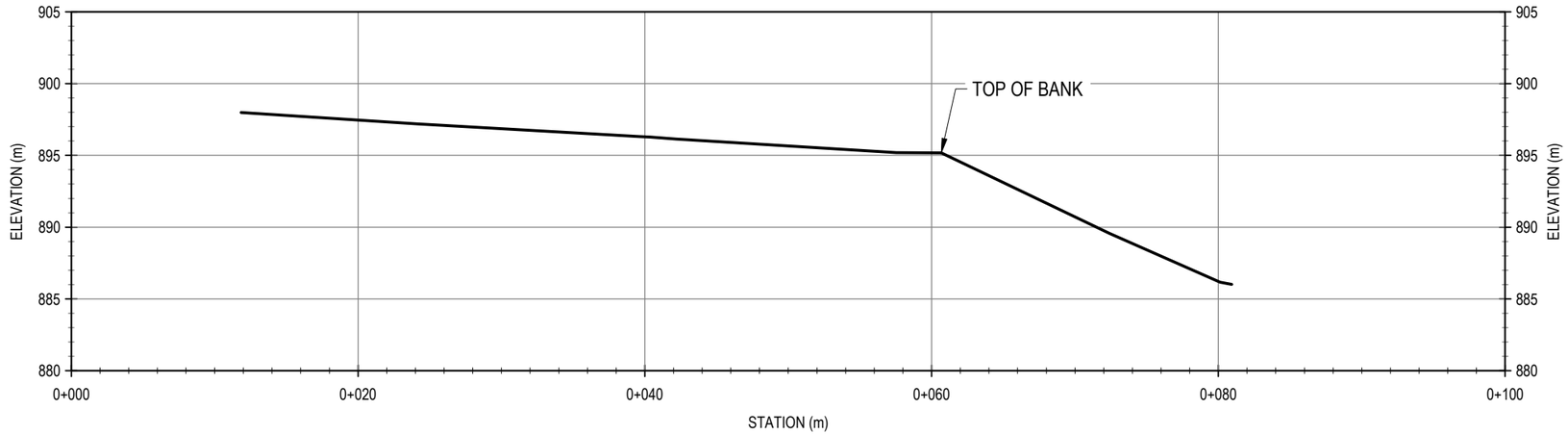
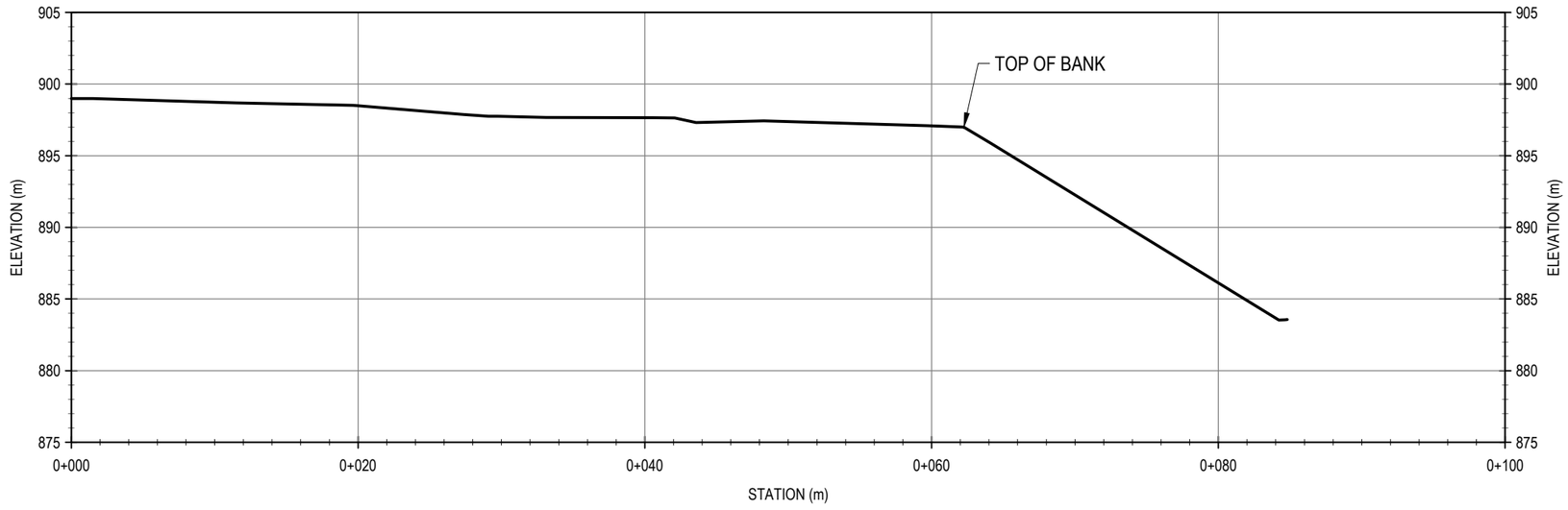


Section A



Section B

LEGEND

EXISTING GRADE PROFILE

0 50m

Scale: 1:1,000 @ 11"x17"

SOURCE
- TOPOGRAPHIC DATA PROVIDED BY CLIENT: *116549067_v_et_UTM12_20230622.dwg*

NOTE
- DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

CLIENT

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PICTURE BUTTE
OAK POINTE DEVELOPMENT

CROSS SECTIONS A AND B

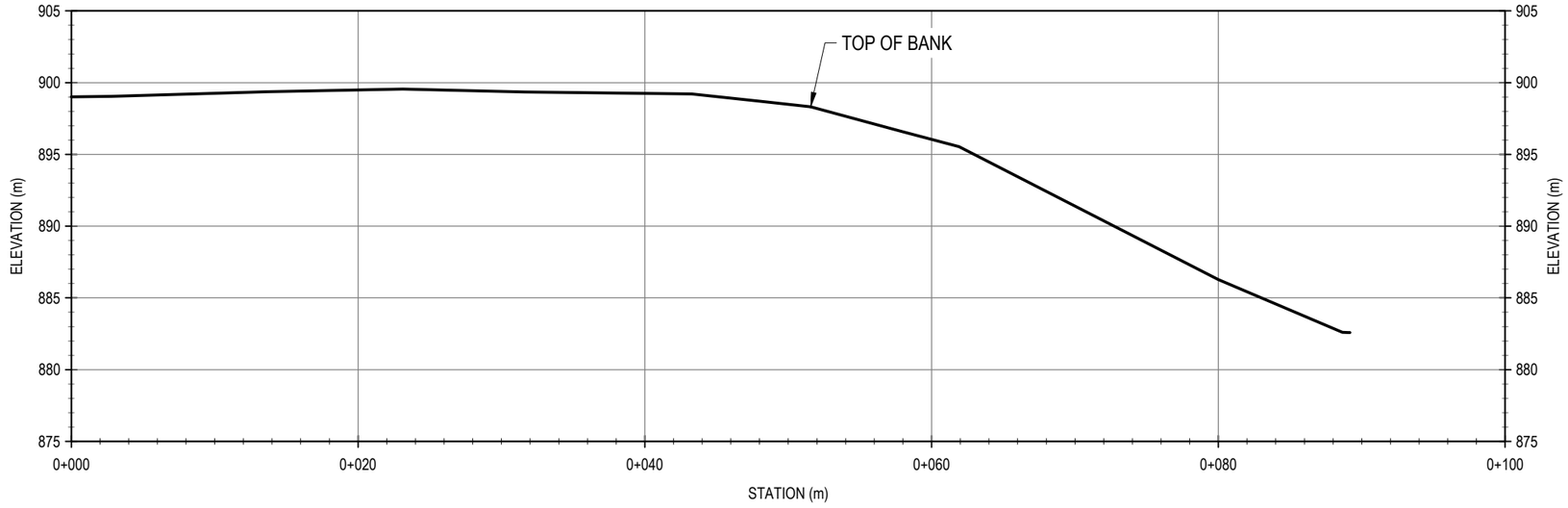
TETRA TECH

PROJECT NO.	DWN	CKD	REV
ENG.LGEO04650-01	LCH	JM	0

OFFICE: Tt Leth

DATE: July 2023

Figure 4



Section C

LEGEND

EXISTING GRADE PROFILE

0 50m

Scale: 1:1,000 @ 11"x17"

SOURCE
- TOPOGRAPHIC DATA PROVIDED BY CLIENT: *116549067_v_et_UTM12_20230622.dwg*

NOTE
- DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.

CLIENT

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TETRA TECH

PICTURE BUTTE
OAK POINTE DEVELOPMENT

CROSS SECTION C

PROJECT NO.	DWN	CKD	REV
ENG.LGEO04650-01	LCH	JM	0

OFFICE: Tt Leth

DATE: July 2023

Figure 5

C:\Lethbridge\Drafting\ENG.LGEO\LGEO04650\CAD\LGEO04650-01 Figure 2,3,4,5,6.dwg [FIGURE 5] , July 24, 2023 - 11:39:23 am (BY: HUGHES, LEANNE)

PHOTOGRAPHS

Photo 1	Northwest End of the Site – Facing East.
Photo 2	Northeast End of the Site – Facing Northwest.
Photo 3	Across Tributary Coulee – Facing South at Site Slope.
Photo 4	Across Tributary Coulee – Facing Southwest at Site Slope.
Photo 5	Culvert Upstream of the Tributary Coulee.
Photo 6	Culvert Along Site Slope.
Photo 7	Channel Visible at the Toe of the Site Slope – Facing South Across the Tributary Coulee.
Photo 8	Historical Instability on Slope North of Site – Facing East.

Photo 1: Northwest End of the Site – Facing East.

Photo 2: Northeast End of the Site – Facing Northwest.

Photo 3: Across Tributary Coulee – Facing South Toward the Site Slope.

Photo 4: Across Tributary Coulee – Facing Southwest Toward the Site Slope.

Photo 5: Culvert Upstream of the Tributary Coulee.

Photo 6: Culvert Along Site Slope.

Photo 7: Channel Visible at the Toe of the Site Slope – Facing South Across the Tributary Coulee.

Photo 8: Historical Instability on Slope North of Site – Facing East.

APPENDIX A
LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

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.

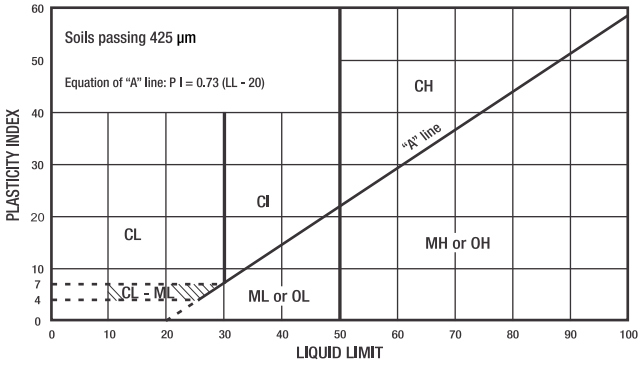
GENERAL DESCRIPTIVE TERMS

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. GW, GP, SW, SP GM, GC, SM, SC Borderline Classification requiring use of dual symbols. $C_U = D_{60} / D_{10}$ 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	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

Tt_Modified Unified Soil Classification.cdr

TETRA TECH

BOREHOLE KEYSHEET

Water Level Measurement

 Measured in standpipe, piezometer or well

 Inferred

Sample Types

 A-Casing

 Core

 Disturbed, Bag, Grab

 HQ Core

 Jar

 Jar and Bag

 NQ Core

 No Recovery

 Split Spoon/SPT

 Tube

Backfill Materials

 Asphalt

 Bentonite

 Cement/ Grout

 Drill Cuttings

 Grout

 Gravel

 Sand

 Slough

 Topsoil Backfill

Lithology - Graphical Legend[1]

 Asphalt

 Bedrock

 Cobbles/Boulders

 Clay

 Coal

 Concrete

 Fill

 Gravel

 Limestone

 Mudstone

 Organics

 Peat

 Sand

 Sandstone

 Shale

 Silt

 Siltstone

 Till

 Topsoil

1. The graphical legend is an approximation and for visual representation only. Soil strata may comprise a combination of the basic symbols shown above. Particle sizes are not drawn to scale

TETRA TECH

Borehole No: **23BH001**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 897.54 m
LETHBRIDGE, AB I N: 5525797 E: 372387	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	Elevation (m)
0		TOPSOIL -clay, silty, sandy, damp, dark brown, trace rootlets and organics.								897
		CLAY - silty, sandy, damp, very stiff, low plastic, light brown, oxides.			B1		11.1			
		... some sand, damp to moist, brown.								
1		... occasional sand pockets to 75 mm.			B2		11.6			
					D1	15				896
2		... some sand to sandy, moist, low plastic to medium plastic.			B3		12.6			
		CLAY (TILL) - silty, some sand to sandy, trace gravel, damp, very stiff, low plastic to medium plastic, light brown with dark brown mottling, coal and oxide specks, white precipitates.			B4					895
		... damp to moist.								
3		...thick sand pockets to 100 mm.			D2	14	12.4			
										894
		... moist, sandy, low plastic, silt and sand pockets.			B5		13.6			
4		... sand and silt lenses throughout.								
					B6					893
					D3	17	12.9			
5	Solid stem auger	... light brown with dark brown mottling.			B7					
		... some sand to sandy, low plastic to medium plastic.			B8					892
6					D4	20	11.5			
					B9					891
7					B10					
					D5	14	14.1			890
8		... some sand to sandy, low to medium plastic.			B11					
		... coal fragments, brown to dark brown.			B12					889
		... 75 mm coal seam.								
9					D6	14	14.5			
										888
10					B13					

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: JM	Completion Date: June 20, 2023
Reviewed By: JZ	Page 1 of 3

Stantec Consulting Ltd.

Borehole No: **23BH001**

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 897.54 m
LETHBRIDGE, AB I N: 5525797 E: 372387	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	23BH001	Elevation (m)
10											
		... brown with grey-brown inclusions, occasional high plastic clay inclusions.			B14						887
11					D7	16	14.7				
					B15						
		... brown with dark brown mottling, thick sand lenses.			B16						886
12											
					D8	17	13.9				885
		... stiff.			B17						
13											
		...some sand, medium plastic, grey-brown.			B18						884
		... grey-green.									
14					D9	10	15.1				
					B19						
					B20						883
15											
					D10	14	14.8				882
					B21						
16											
		... 5 mm sandstone fragments.			B22						881
					D11	14	14.9				
17					B23						
					B24						880
18											
					D12	14	15.5				879
					B25						
19		... stiff to very stiff.									
					B26						878
20											

2023-07-11 ▼ (Solid stem auger)

2023-07-11 ▼ (Elevation)

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: JM	Completion Date: June 20, 2023
Reviewed By: JZ	Page 2 of 3

TETRA TECH

Borehole No: **23BH001**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 897.54 m
LETHBRIDGE, AB I N: 5525797 E: 372387	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	23BH001	Elevation (m)
20	Solid stem auger				D13	13	15.6				877
					B27						
					B28						
21											
					D14	14	15.6				876
					B29						
22		... very stiff.									
					B30						875
23					D15	19	15.3				
		... sandstone and coal fragments.			B31						
											874
					B32						
24											
					D16	15	15.4				873
		End of Borehole @ 24.8 m									
25		No Seepage No Sloughing 1" Slotted PVC Pipe Installed to 24.8 m Water level measured DRY on June 20, 2023 Water level measured at 13.32 m below the ground surface on July 11, 2023									872
26											
											871
27											
											870
28											
											869
29											
											868
30											

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: JM	Completion Date: June 20, 2023
Reviewed By: JZ	Page 3 of 3

Borehole No: **23BH002**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 899.25 m
LETHBRIDGE, AB I N: 5525777 E: 372421	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Sample Number	SPT (N)	Moisture Content (%)	Elevation (m)
0	Solid stem auger	TOPSOIL -clay, silty, sandy, damp, dark brown, trace rootlets and organics.				899
		SILT - trace sand, trace clay, damp, compact, non-plastic, light brown - almost white.	B1		5.8	
1		CLAY (TILL)- silty, sandy, damp, very stiff, low plastic, light brown, white precipitates, silt pockets throughout.	B2			898
		... moist, brown, intebredded high plastic layers 1 cm thick, white precipitates throughout.	D1	12	23.5	
2			B3			897
		... coarse sand pockets, coal and oxide specks.	B4			
3			D2	12	19.1	896
			B5		21.4	
4		CLAY - silty, trace sand, moist, stiff, high plastic, light brown with dark brown mottling.	B6		28.9	895
		CLAY (TILL)- silty, sandy, damp to moist, stiff, low plastic, light brown with dark brown mottling, sand pockets throughout, coal and oxide specks, white precipitates.	D3	17	13.6	
5		... trace gravel, some sand to sandy, low plastic to medium plastic, very stiff.	B7			894
			B8			
6			D4	14	13.3	893
		... coal staining, some sand, medium plastic.	B9			
7		... stiff, some sand to sandy, low plastic to medium plastic.	B10			892
		... very stiff.	D5	18	12.6	
8		... some sand, medium plastic.	B11			891
		... course sand pockets throughout.	B12			
9			D6	13	15.5	890
10		... oxide staining, very stiff.	B13			

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: DL	Completion Date: June 20, 2023
Reviewed By: JZ	Page 1 of 3

Borehole No: **23BH002**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 899.25 m
LETHBRIDGE, AB I N: 5525777 E: 372421	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	23BH002	Elevation (m)
10											889
					B14						
11		... coal fragments.			D7	10	15.7	●	■ ▲		888
					B15				▲		
					B16				▲		
12											887
					D8	14	15.3	●	■ ▲		
					B17				▲		
13											886
					B18				▲		
14					D9	18	15.2	●	■ ▲		
					B19				▲		885
					B20				▲		
15											
					D10	18	14.4	●	■ ▲		884
		... grey.			B21				▲		
16											
					B22				▲		883
					D11	18	14.7	●	■ ▲		
17					B23				▲		
					B24				▲		882
18											
		... sand pockets throughout.			D12	14	14.9	●	■ ▲		
					B25				▲		881
19											
					B26				▲		880
20											

2023-07-11

Solid stem auger

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: DL	Completion Date: June 20, 2023
Reviewed By: JZ	Page 2 of 3

TETRA TECH

Borehole No: **23BH002**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 899.25 m
LETHBRIDGE, AB I N: 5525777 E: 372421	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	SPT (N) (20 40 60 80) / Pocket Pen. (kPa) (100 200 300 400)	23BH002	Elevation (m)
20	Solid stem auger				D13	17	16				879
					B27						
					B28						
21											878
					D14	14	15				
22					B29						877
					B30						
23					D15	16	15.4				876
					B31						
24					B32						875
					D16	14	15.4				
25		End of Borehole @ 24.8 m No Seepage No Sloughing 1" Slotted PVC Pipe Installed to 24.8 m Water level measured DRY on June 20, 2023 Water level meassured at 11.98 m below ground surface on July 11, 2023									874
26											873
27											872
28											871
29											870
30											

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 24.8 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: DL	Completion Date: June 20, 2023
Reviewed By: JZ	Page 3 of 3

Borehole No: **23BH003**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 899.73 m
LETHBRIDGE, AB I N: 5525669 E: 372356	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Sample Number	SPT (N)	Moisture Content (%)	Elevation (m)
0	Solid stem auger	TOPSOIL -clay, silty, sandy, damp, dark brown, trace rootlets and organics.				899
		CLAY - silty, some sand, damp, very stiff, medium plastic, light brown, white precipitates, organics.	B1		17.1	
1		CLAY (TILL)- silty, some sand, damp, very stiff, medium plastic, light brown with dark brown mottling, white precipitates, coal and oxide specks.	B2		14.3	
		... moist, intebedded dark brown high plastic lenses 0.4 cm thick.	D1	15	20.6	898
2			B3			
		... coal fragments.	B4		19.3	
						897
3		... damp to moist, gypsum crystals, intebedded silt lenses.	D2	19	15.2	
			B5			896
4						
			B6			
			D3	15	15.4	895
5		... brown with light brown mottling.	B7			
		... small light brown silt laminations.	B8			894
6						
			D4	13	18	
		End of Borehole @ 6.55 m				893
7		No Seepage No Sloughing 1" Slotted PVC Pipe Installed to 6.55 m Water level measured DRY on June 20, 2023 Water level measured DRY on July 11, 2023				
						892
8						
						891
9						
						890
10						

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 6.55 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: DL	Completion Date: June 20, 2023
Reviewed By: JZ	Page 1 of 1

Borehole No: **23BH004**

Stantec Consulting Ltd.

Project: Picture Butte - Oak Pointe Development	Project No: 704-ENG.LGEO04650-01
Location: Unit 230, 704 - 4 Avenue South	Ground Elev: 899.22 m
LETHBRIDGE, AB I N: 5525625 E: 372274	PROJECT ENGINEER: JACKSON MEADOWS

Depth (m)	Method	Soil Description	Graphical Representation	Sample Type	Sample Number	SPT (N)	Moisture Content (%)	Elevation (m)
0	Solid stem auger	TOPSOIL -clay, silty, sandy, damp, dark brown, trace rootlets and organics.						899
		CLAY - silty, trace sand, damp, medium plastic, light brown.			B1		8.9	
1		CLAY (TILL)- silty, trace sand, moist, very stiff to hard, medium plastic, brown, coal and oxide specks.			B2		24.2	898
		... dark brown mottling, high plastic pockets.			D1	25		
		... white precipitates.			B3		20	
2		... high plastic pockets throughout.			B4		21.4	897
3		... very stiff.			D2	16	19.3	896
		... oxide staining.			B5			
4		... damp to moist, stif to very stiff			B6			895
		... coal fragments.			D3	10	16.4	
5		... fine to course sand pockets.			B7			894
					B8			
6		... damp, very stiff			D4	22	13.4	893
		End of Borehole @ 6.55 m						
7		No Seepage No Sloughing 1" Slotted PVC Pipe Installed to 6.55 m Water level measured DRY on June 20, 2023 Water level measured DRY on July 11, 2023						892
8								891
9								890
10								

Plastic Limit / Moisture Content / Liquid Limit: 20 40 60 80

SPT (N): 20 40 60 80

Pocket Pen. (kPa): 100 200 300 400

TETRA TECH

Contractor: CHILAKO DRILLING LTD.	Completion Depth: 6.55 m
Equipment Type: 150mm Solid Stem	Start Date: June 20, 2023
Logged By: DL	Completion Date: June 20, 2023
Reviewed By: JZ	Page 1 of 1

APPENDIX C
DESIGN AND 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 in accordance with the applicable design code of the local jurisdiction.

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.

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 against inclement weather and provide a working surface for construction.

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 below:

- “Structural engineered fill” should comprise clean, well-graded granular soils.
- “Lean-mix concrete” should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa.

CONSTRUCTION EXCAVATIONS

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

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

Shallow excavations up to about 3 m 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 3 m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to Tetra Tech 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. Tetra Tech 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.

BACKFILL MATERIALS AND COMPACTION (GENERAL)

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% 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.

Excavation and construction operations expose materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration of performance. Unless otherwise specifically indicated in this report, the walls and floors of excavations, and stockpiles, must be protected from the elements, particularly moisture, desiccation, frost, and construction activities. Should desiccation occur, 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% 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% 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% 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% of SPD at slightly below (0 to 2%) the optimum moisture content.

4.0 “GENERAL ENGINEERED FILL”

Cohesive or granular soils are considered acceptable for use as “general engineered fill,” providing the soils are inorganic and free of deleterious materials.

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 have a fines content of less than 10%.

The materials above are also suitable for use as “general engineered fill.”

6.0 "STRUCTURAL ENGINEERED FILL"

Crushed gravel used as "structural engineered fill" should be hard, clean, well graded, crushed aggregate, free of organics, coal, clay lumps, coatings of clay, silt, and other deleterious materials. The aggregates should conform to the requirement when tested in accordance with ASTM C136 and C117. See exact project or jurisdiction for specifications. This material would typically have a fines content of less than 10%.

In addition to the above, further specification criteria identified below should be met:

"Structural Engineered Fill" – Additional Material Properties

Material Type	Percentage of Material Retained on 5 mm Sieve having Two or More Fractured Faces	Plasticity Index (<400 μm)	L.A. Abrasion Loss (percent Mass)
Various sized Crushed Gravels	See exact project or jurisdiction for specifications	See exact project or jurisdiction for specifications	See exact project or jurisdiction for specifications

Materials that meet the grading limits and material property criteria are also suitable for use as "select engineered fill."

7.0 DRAINAGE MATERIALS

"Coarse gravel" for drainage or weeping tile bedding should be free draining. Free-draining gravel or crushed rock generally containing no more than 5% fine-grained soil (particles passing No. 200 sieve) based on the fraction passing the 3/4-inch sieve or material with sand equivalent of at least 30.

"Coarse sand" for drainage should conform to the following grading limits:

"Coarse Sand" Drainage Material – Percent Passing by Weight

Sieve Size	Coarse Sand*
10 mm	100
5 mm	95 – 100
2.5 mm	80 – 100
1.25 mm	50 – 90
630 μm	25 – 65
315 μm	10 – 35
160 μm	2 – 10
80 μm	0 – 3

* From CSA A23.1-09, Table 10, "Grading Limits for Fine Aggregate", Class FA1

Note that the "coarse sand" above is also suitable for use as pipe bedding material. See exact project or jurisdiction for specifications.

8.0 BEDDING MATERIALS

The "Coarse Sand "gradation presented above in Section 7.0 is suitable for use as pipe bedding and as backfill within the pipe embedment zone, however see exact project or jurisdiction for specifications.

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 or abandoned pile foundation 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 engineered fill placement. If proof-rolling reveals any soft or loose spots, these should be excavated and the desired grade restored by engineered fill placement. The subgrade should be compacted to a depth of not less than 0.3 m to a density of not less than 98 percent Standard Proctor Maximum Dry Density (ASTM Test Method D698).

If, for economic reasons, it is considered desirable to leave low quality material in-place, such as existing fills, beneath a slab-on-grade, special ground treatment procedures may be considered, Tetra Tech could provide additional advice on this aspect if required.

A levelling course of well graded granular fill (with maximum size of 20 mm), at least 150 mm in compacted thickness, is recommended directly beneath all slabs-on-grade. The type of granular fill should be selected based on the design floor loadings. Alternatively a minimum thickness of 150 mm of 80 mm pit-run gravel overlain by a minimum thickness of 50 mm of 20 mm crushed gravel may be used. Coarse gravel particles 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 (ASTM Test Method D698).

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

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 before, during, and after the construction period.

Alberta

HRA Number: 4835-23-0050-002
October 18, 2023

Historical Resources Act Approval

Proponent: Oak Pointe Inc.
Box 174, Diamond City, AB T0K 0T0
Contact: Josh Marti

Agent: Stantec Consulting Ltd.
Contact: Meaghan Porter

Project Name: **Picture Butte Residential Area Structure Plan in 13-34-10-21 W4M (revised)**

Project Components:
- Area Structure Plan / Outline Plan
- Residential Development
- Access Road
- Electrical / Utility
- Water Supply Line
- Sewage Line

Application Purpose:
- Requesting HRA Approval / Requirements
- Amendment or Update to Project Submitted Previously

Historical Resources Act approval is granted for the activities described in this application and its attached plan(s)/sketch(es) subject to Section 31, "a person who discovers an historic resource in the course of making an excavation for a purpose other than for the purpose of seeking historic resources shall forthwith notify the Minister of the discovery." The chance discovery of historical resources is to be reported to the contacts identified within Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources.

Rebecca Traquair
Regulatory Approvals Coordinator
Alberta Arts, Culture, and Status of Women

Proposed Development Location:

MER	RGE	TWP	SEC	LSD List
4	21	10	34	13

Documents Attached:

Document Name	Document Type
Updated ASP drawing	Illustrative Material

PHASE I ENVIRONMENTAL SITE ASSESSMENT

LOTS 1 AND 2, BLOCK 3, PLAN 2311035
PICTURE BUTTE, ALBERTA

ENVIRONMENTAL SERVICES LTD.

Serving Albertans for 23 years
2000 - 2023

PROJECT NO. WA-23-101402

REPORT TO

OAK POINTE INC. GIDEON ACQUISITIONS LTD.
CLAYTON KOSTER JOINT VENTURE
ALSO KNOWN AS BUTTE LANDING

PHASE I
ENVIRONMENTAL SITE ASSESSMENT
LOTS 1 AND 2, BLOCK 3, PLAN 2311035
PICTURE BUTTE, ALBERTA

ENVIRONMENTAL SERVICES LTD.

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

Tel: (403) 381-8141
Fax: (403) 328-8142
www.waenvironmental.ca

October 17, 2023

EXECUTIVE SUMMARY

Between October 6 and October 17, 2023, WA Environmental Services Ltd. (WAES) conducted a Phase I Environmental Site Assessment of property located approximately 300 m south of Rogers Avenue South on the east side of Secondary Road 843 in the Town of Picture Butte, Alberta. The legal description for the site is Lot 1 and 2, Block 3, Plan 2311035. It is understood that the assessment is required due to a potential business transaction involving the property, with the intention to develop the site into multi-family four-plex residential units.

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

The site remained undeveloped until the mid-1960s when a single family dwelling/acreage was constructed. This remains to the present day and does not form part of this assessment as the owner is elderly and has an arrangement with the purchasers to stay in place until she decides to move into a more convenient location.

A County of Lethbridge potable water truck station occupies the property to the north. The Netherlands Reformed Congregation (church) is located to the south. Adjacent land use to the east is agricultural. The Picture Butte Memorial Cemetery is located to the southeast of the site and the Maple Estate Mobile Home Park and the running track for the Picture Butte High School are located to the west across Secondary Road 843.

No hazardous building materials were observed at the time of the site reconnaissance. However, should there be an intention to demolish the residence located in the northwest corner of the site, a hazardous materials assessment should be carried out, so as not to expose any workers to harmful substances such as asbestos, lead based paint etc.

Information gathered and observations made during the Phase I Environmental Site Assessment have not revealed any evidence of environmental contamination associated with the site.

Based on our findings, no further environmental investigation of the site is recommended at this time.

Table 1 - Summary of Findings and Recommendations			
Potential Source of Contamination	**Level of Environmental Contamination**	**Findings**	**Recommended Action**
Adjacent Properties	None	Adjacent land use is a mix of agricultural, residential and institutional.	None.
Historical Land Use	None	The site has been used for agricultural purposes until the mid-1960s when a single family dwelling/acreage was constructed in the northwest corner of the site.	None.
Underground Fuels and Chemicals	None	None observed or reported.	None.
Aboveground Fuels and Chemicals	None	None observed or reported.	None.
Waste Management	None	Presently no waste is generated at the site.	None.
Spill and Stain Areas	None	None observed or reported.	None.
Wastewater Discharges	None	Presently, no wastewater is generated at the site.	None.
Air Discharges	None	No concerns.	None.
Polychlorinated Biphenyls (PCBs)	None	None observed or reported.	None.
Asbestos	None	None observed or reported.	None.
UFFI	None	None observed or reported	None.
Ozone Depleting Substances (ODSs)	None	None observed or reported	None.
Lead	None	None observed or reported.	None.
Electromagnetic Frequencies	None	None observed or reported.	None.
Radon	None	See radon recommendations in report	None.
Hydraulic Hoists/Elevators	None	None observed or reported.	None.

Table 1 - Summary of Findings and Recommendations			
Potential Source of Contamination	**Level of Environmental Contamination**	**Findings**	**Recommended Action**
Mercury	None	None observed or reported.	None.
Mould	None	None observed or reported.	None.
Water Supply	None	The Town of Picture Butte has installed a potable water main to the property.	None.
Fill Areas	None	None observed or reported.	None.

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

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1.0 INTRODUCTION

WA Environmental Services Ltd. (WAES) was retained by Oak Pointe Inc., Gideon Acquisitions Ltd. and Clayton Koster a Joint Venture, also known as Butte Landing, to conduct a Phase I Environmental Site Assessment of a property located approximately 300 m south of Rogers Avenue South on the east side of Secondary Road 843, in the Town of Picture Butte, Alberta. The legal description for the site is Lot 1 and 2, Block 3, Plan 2311035. It is understood that the assessment is required due to a potential business transaction involving the property, with the intention to develop the site into multi-family four-plexes.

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

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

2.0 PHASE I SCOPE AND METHODOLOGY

2.1 Scope of Work

The Phase I ESA carried out by WAES on this property is based on the requirements of the Canadian Standards Association (CSA) Phase I Environmental Site Assessment Information Product, Z768-01, April 2013 (CSA protocol, reaffirmed in 2023) and consists of the following:

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

A Phase I ESA does not include sampling or testing of air, soil, groundwater, surface water or building materials. These activities would be carried out in a Phase II ESA, if required. No enhancements of this assessment were conducted. The professional qualifications of the project team and Insurance Certificates are provided in Appendix B. The contract between Oak Pointe Inc. Gideon Acquisitions Ltd. and Clayton Koster a Joint Venture, also known as Butte Landing and WAES to conduct the Phase I Environmental Site

Assessment is confidential and has not been included in this report.

2.2 Methodology

2.2.1 Records Review

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

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

2.2.2 Interviews

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

2.2.3 Site Visit

The subject property and readily visible and publicly accessible portions of adjacent sites were examined for the presence of actual or potential environmental contamination. All common areas of the property were accessible to WAES during the site visit on October 12, 2023. All areas of the site were available for assessment, with the exception of the residence located at the northwest corner of the site.

3.0 REGULATORY FRAMEWORK

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

4.0 SITE DESCRIPTION

4.1 Property Description

The site is located at the south end of the town of Picture Butte, Alberta, approximately 300 m south of Rogers Avenue South. The site is zoned as Urban Reserve (U-R) with a plan area of approximately 0.41 ha. The legal description for the site is Lot 1 and 2, Block 3, Plan 2311035, Picture Butte, Alberta. (Drawing 2, Appendix A).

Photograph 1: Looking northeast at the subject site from Secondary Road 843
Note: Residence located in the northwest corner of the site (arrowed).

4.2 Soil, Topography and Drainage

The site is generally flat. Surface water from the site appears to drain towards the coulee draw, east of the site. The site soils are typically silt and clay, overlying clay till up to 20 m thick.

Based on local topography, shallow groundwater flow is suspected to be eastward towards the coulee draw. The direction of regional (i.e., deep) groundwater flow is predicted to be southeast towards the Oldman River (Tokarsky, 1974[1]).

[1]Tokarsky, O. 1974. *Hydrogeology of the Lethbridge-Fernie Area.* Alberta Research Council

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

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

4.3 On-Site Buildings and Structures

There is one single family dwelling located at the northwest corner of the site, that is not included as part of this assessment. A summary of the property information is presented in Table 2.

Table 2 - Summary of Lot Information

Property	
Current Zoning	Urban Reserve (U-R)
Area	0.41 ha
Services: Sewer, Water, Electricity	The Town of Picture Butte has provided potable water to the property line. There is a catch basin located in close proximity to the north property line, however it is not connected to a storm sewer system at this time.

Building	
Number of Storeys	NA
Exterior Finish	NA
Interior Finish	NA
Roof	NA
Foundation	NA
Basement	NA
Insulation	NA
Lighting	NA
Heating, Ventilating, Air Conditioning	NA
Sumps, Floor Drains	NA
Underground and Aboveground Storage Tanks	NA

Photograph 2 – Looking east along north property line. Note catch basin Previously installed in preparation for storm sewer connection (arrowed)

5.0 ADJACENT PROPERTIES

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

Table 3 - Adjacent Properties - Land Use

Boundary Side of Site	Current Activity	Potential Sources of Contamination
North	A County of Lethbridge potable water truck station occupies the property	None Identified
South	Institutional: The Netherlands Reformed Congregation (church)	None Identified
East	Agricultural and the Picture Butte Memorial Cemetery (southeast)	None identified

Table 3 - Adjacent Properties - Land Use		
West	Residential: The Maple Estate Mobile Home Park and the running track for the Picture Butte High School are located to the west across Secondary Road 843.	None identified

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

Photograph 3 – Looking southwest at Maple Estate mobile home park across Secondary Road 843.

6.0 REVIEW OF HISTORICAL LAND USE AND REGULATORY HISTORY

6.1 Historical Land Use

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

Table 4 - Historical Information for the Site		
Period/Date	**Land Use**	**Sources of Information**
Prior to mid-1960s	Undeveloped/agricultural land.	Air photographs and interviews
Mid 1960s to the present day	The single family dwelling was constructed in the mid-1960s at the northwest corner of the site and remains to the present day	Air photographs and interviews

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

Table 5 - Historical Information for Adjacent Properties		
Boundary Side of Site	**Comments**	**Sources of Information**
North	The site to the north remained vacant agricultural land until the mid-1960s when the County of Lethbridge potable water truck station was constructed and remains to the present-day.	Air photographs and interviews
South	The property to the south of the subject site, remained as vacant agricultural land until the early 2000s when the Netherlands Reformed Congregation commenced development and remains to the present-day.	Air photographs and interviews
East	The site to the east remains as undeveloped agricultural land and coulee draw.	Air photographs and interviews
West	The site to the west was undeveloped agricultural land until 1978 when development of the present day trailer park began and remains to the present-day.	Air photographs and interviews

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

6.2 Regulatory History

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

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

- **Alberta Environment and Protected Areas, Environmental Site Assessment Repository**: Information received from the ESAR indicates that they have no records pertaining to the site.

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

- **Safety Codes Council of Alberta**: Written information received from the SCC states that they have no record of active or abandoned storage tanks registered at the site.

- **Town of Picture Butte Fire Department**: Verbal information received indicated that there are no records of violations (of the 2019 Alberta Fire Code) for the site.

- **Alberta Land Titles:** Written information from Alberta Land Titles indicated that previous ownership of the land has not revealed evidence of potential environmental contamination of the site.

7.0 SITE VISIT FINDINGS AND DISCUSSION

The site visit was carried out by Mr. Tim Waters, C.Tech on October 12, 2023.

7.1 Fuel/Chemical Handling and Storage

No aboveground fuel storage tanks or chemical handling, storage or disposal activities were observed at the site. No evidence of fill or vent pipes indicating the possible presence of underground storage tanks was observed on site.

7.2 Waste Materials

Presently, no waste is generated at the site.

7.3 Spill and Stain Areas

None observed at the time of the site reconnaissance.

7.4 Wastewater Discharges

No regulated wastewater or sewage is presently generated at the site. No oil/water separators were observed at the subject site.

7.5 Air Discharges

No sources of air emissions are presently generated at the site.

7.6 Polychlorinated Biphenyls (PCBs)

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

7.7 Asbestos

The common use of potential friable (breakable by hand) asbestos-containing materials (ACMs) (pipe/boiler insulation and fireproofing) in construction generally ceased voluntarily in the mid 1970s. None observed at the time of the site reconnaissance.

7.8 Urea Formaldehyde Foam Insulation (UFFI)

The sale and installation of UFFI as thermal insulation began in approximately 1970, and continued until December 1980 when it was banned under the federal *Hazardous Products Act*. UFFI was installed in both new and existing buildings during this period. Evidence of UFFI was not observed during the site reconnaissance, however, intrusive investigation of wall cavities and sampling is not within the scope of a Phase I ESA.

7.9 Lead

In 1976, the lead content in interior paint was limited to 0.5% by weight under the federal *Hazardous Products Act*. Lead is also associated with plumbing solder and old pipes as well as other lead based products such as wall shielding (x-ray rooms). If present, lead-based paint is typically concealed beneath multiple layers of paint applied over a period of years during renovation. Lead-based paint and plumbing equipment are not a direct health risk when concealed (under layer of non lead-based paint) and/or in good condition. Lead-based paint should be considered, however, when planning renovations or demolition, when particles could be released and/or ingested during the course of the work. No evidence of lead based

products was observed on-site during the site reconnaissance; however, intrusive sampling for lead and lead based paints in not within the scope of a Phase I ESA.

7.10 Ozone Depleting Substances (ODSs)

In 1994, the federal government filed the *Ozone-depleting Substances Regulations* to amend controls on production and consumption of (chlorofluorocarbons (CFCs). Halons, carbon, tetrachloride and methyl chloroform. ODSs may be associated with operations such as fire extinguishing systems, fumigant and pesticide application, foam manufacturing, prescription metered dose inhalers, refrigeration and air-condition units, solvent cleaning and degreasing facilities. No sources of ozone depleting substances (ODSs) were observed on-site.

7.11 Radon

Radon gas is a product of the decay series that begins with uranium. Radon is produced directly from radium, which can be commonly found in bedrock that contains black shale and/or granite. Radon gas can migrate through the ground and enter buildings through porous concrete or fractures. Radon tends to accumulate in poorly ventilated basements. Health Canada now recommends that all homeowners have their homes tested for radon. Methods that the builder can use to reduce entry routes in new home construction include:

- minimizing cracking of the basement floor slab by properly preparing the sub-slab area (i.e. replacing unstable soil, large stones, etc.) using higher strength concrete, and providing proper curing conditions,
- sealing the basement floor/foundation wall crack,
- sealing around all penetrations of the foundation walls and basement floors by objects such as utility lines (e.g. water, sewer, electrical, natural gas, fuel oil),
- installing a barrier of at least 0.15 mm (6 mil) polyethylene under the basement floor slab or on top of exposed soil in crawlspaces,
- installing special traps in floor drains that allow water to drain but prevent radon from entering the basement, and
- using a solid course of masonry units at the top and bottom of concrete block foundation walls.

Reducing the pressure difference between the home and soil may reduce the amount of radon drawn indoors. Options include:

- installing an insulated duct to provide outdoor air to a gas or oil furnace, boiler or water heater,
- for a forced-air service heating system, installing and insulated duct from the outdoors to the main return-air duct,
- equipping a wood or gas fireplace with glass doors that fit tightly and with a supply of outdoor air for combustion, and
- installing a balanced ventilation system such as a heat recovery ventilator (HRV).

7.12 Electromagnetic Frequencies (EMFs)

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

7.13 Noise and Vibration

There were no major sources of noise and vibration identified on or adjacent to the subject property during the site reconnaissance.

7.14 Hydraulic Hoists and Elevators

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

7.15 Mercury

None observed at the time of the site reconnaissance.

7.16 Mould

Mould can be found anywhere in a building, particularly if a flood or spill/leak has occurred and was not repaired immediately; and mould is usually associated with damp, enclosed areas. A mould assessment was not conducted for the subject site and mould was not observed at the time of the site reconnaissance.

7.17 Water Supply

Potable water for the subject site is supplied to the property line by the Town of Picture Butte.

7.18 Fill Areas

None observed at the time of the site reconnaissance.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The site remained undeveloped until the mid-1960s when a single family dwelling/acreage was constructed. This remains to the present day and does not form part of this assessment as the owner is elderly and has an arrangement with the purchasers to stay in place until she decides to move into a more convenient location.

A County of Lethbridge potable water truck station occupies the property to the north. The Netherlands Reformed Congregation (church) is located to the south. Adjacent land use to the east is agricultural. The Picture Butte Memorial Cemetery is located to the southeast of the site and the Maple Estate Mobile Home Park and the running track for the Picture Butte High School are located to the west across Secondary Road 843.

No hazardous building materials were observed at the time of the site reconnaissance. However, should there be an intention to demolish the residence located in the northwest corner of the site, a hazardous materials assessment should be carried out, so as not to expose any workers to harmful substances such as asbestos, lead based paint etc.

Information gathered and observations made during the Phase I Environmental Site Assessment have not revealed any evidence of environmental contamination associated with the site.

Based on our findings, no further environmental investigation of the site is recommended at this time.

9.0 CLOSURE

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

This report has been prepared for the sole benefit of Oak Pointe Inc. Gideon Acquisitions Ltd. and Clayton Koster a Joint Venture, also known as Butte Landing. This report may not be relied upon by any third party or entity without the express written consent of WA Environmental Services Ltd. and Oak Pointe Inc. Gideon Acquisitions Ltd. and Clayton Koster a Joint Venture, also known as Butte Landing.

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

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

The conclusions presented represent the best judgement of the assessor based on current environmental standards and on the site conditions observed on October 12th, 2023. Due to the nature of the investigation and the limited data available, the assessor cannot warrant against undiscovered environmental liabilities.

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

Respectfully submitted,

WA ENVIRONMENTAL SERVICES LTD.

Tim Waters, C.Tech
Project Manager

ASSOCIATED ENVIRONMENTAL SITE ASSESSORS OF CANADA INC. CERTIFIED ENVIRONMENTAL SITE ASSESSOR BEVERLY WATERS C.E.S.A.

2023/11/23

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

APPENDIX A

SITE PLANS

ENVIRONMENTAL SERVICES LTD.	Project: Phase I Environmental Site Assessment	Project No: WA-23-101402	Date: October 17,2023
	Location: Lots 1 & 2, Block 3, Plan 2311035 Picture Butte, Alberta	Drawn By: TGW Reviewed By: BFW	Client: Butte Landing
	Drawing 1: Site Location Plan		

WA ENVIRONMENTAL SERVICES LTD.	Project: Phase I Environmental Site Assessment	Project: WA-23-101402	Date: October 17, 2023
	Location: Lots 1 & 2, Block 3, Plan 2311035 Picture Butte, Alberta	Drawn By: TGW Reviewed By: BFW	Client: Butte Landing
	Drawing 2: Site Location Plan: Site Plan Showing Adjacent Land Use		

APPENDIX B

ASSESSOR QUALIFICATIONS

INSURANCE CERTIFICATES

Associated Environmental Site Assessors of Canada

this is to acknowledge that

Beverly Waters

has been qualified for the Certified Environmental Site Assessment Designation

C.E.S.A.

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

signed and sealed this day of October 7th, 2004

Brian Lazak, President

LLOYD'S

ARCHITECTS/ENGINEERS PROFESSIONAL LIABILITY INSURANCE

Effected with certain Lloyd's Underwriters ("the Insurer") throughLloyd's Approved Coverholder ("the Coverholder")

SOUTH WESTERN INSURANCE GROUP LIMITED

21 Four Seasons Place - Suite 105, Toronto, ON M9B 6J8

ARCHITECTS AND ENGINEERS PROFESSIONAL LIABILITY, ARCHITECTS, ENGINEERS AND CONTRACTORS POLLUTION LIABILITY, TECHNOLOGY BASED SERVICES, TECHNOLOGY PRODUCTS, COMPUTER NETWORK SECURITY, AND MULTIMEDIA AND ADVERTISING LIABILITY INSURANCE

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

RENEWAL This COVERAGE SUMMARY-DECLARATION, together with the Policy wordings and endorsements, if any issued to form a part thereof, completes the below numbered policy.

	BROKER Schwartz Reliance Insurance 300-10th Street South, LETHBRIDGE, AB, T1J 3Y5		**Policy No: LAP980175**
1.	**NAMED INSURED**	WA Environmental Services Ltd.	
	MAILING ADDRESS	221 Riverpark Blvd West, Lethbridge, AB, T1K 0P6	
	LOCATION ADDRESS	221 Riverpark Blvd West, Lethbridge, AB T1K 0P6	
	Description of Operations	Environmental / pollution 100%	
2.	**POLICY PERIOD**	From **June 8, 2023** to **June 8, 2024**	12:01 a.m. Standard Time at the Postal Address of the Named Insured as stated herein
3.	**LIMIT OF LIABILITY**		
	(a) $2,000,000	Each **Claim** Limit – Includes **Claims Expenses**	
	(b) $2,000,000	Annual Aggregate Limit – Includes **Claims Expenses**	
		The total Limit of Liability of the Insurer, including Damages and Claims Expenses, for all Claims first made against the Insured and reported in writing to the Insurer during the Policy Period shall not exceed in the Aggregate, the limit stated herein.	
4.	**DEDUCTIBLE**		
	(a) $7,500	Includes **Claims Expenses**.	
5.	**PREMIUM** **Minimum Earned Premium:**	**$16,810.00** **30 % ($5,043.00)**	
6.	**RETROACTIVE DATE**	June 08, 2000 - Primary $1,000,000 Limit June 08, 2011 - $1,000,000 excess of $1,000,000 Limit	
7.	**TECHNOLOGY BASED SERVICES, TECHNOLOGY PRODUCTS, COMPUTER NETWORK SECURITY, AND MULTIMEDIA AND ADVERTISING LIABILITY INSURANCE COVERAGE OPTION:** Purchased ☑ If this box is checked then Insuring Agreements C, D, E and F of this Policy shall apply. Not Purchased ☐ If this box is checked then Insuring Agreements C, D, E and F of this Policy **shall not apply**. If no box is checked, then Insuring Agreements C, D, E and F of this Policy shall not apply.		

This policy contains a clause which may limit the amount payable

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

8.	**OPTIONAL EXTENSION PERIOD:** 100% of premium set forth in Item 5 above.	
9.	**NOTICE OF CLAIM TO:**	**South Western Insurance Group Ltd.** **1.855.801.0299** **swgclaims@scm.cas**
10.	**NOTICE OF ELECTION:**	**South Western Insurance Group Ltd.** 21 Four Seasons Place - Suite 105, Toronto, ON M9B 6J8
11.	**SERVICE OF SUIT:**	See Identification of Insurer Section.
12.	**CHOICE OF LAW:**	**Canada**
13.	**FORMS AND ENDORSEMENTS ATTACHED HERETO:**	

LYD-IRS2	Mandatory/Compulsory Attachments Clause
STATSALL	Statutory Conditions and General Conditions
623AFB0089	AFB Short Rate Cancellation Table Endorsement
623AFB0097	Warranted No Higher Limits Endorsement
AMDEND	Amendatory Endorsement
L648B-20	Cyber Exclusion Endorsement
LBA-041B	Rain Screen Exclusion
LSW-559	Retroactive Limitation Clause
MIN-EARN1	Minimum Earned Premium Endorsement – 30%
NMA-1477	Radioactive Contamination Exclusion Clause - Liability - Direct
NMA-2918	War and Terrorism Exclusion
NMA-2962	Biological or Chemical Materials Exclusion
AFB-AE – A&E Media Tech	
LBA-091	Supplementary Payments Amendment

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

IDENTIFICATION OF INSURER / ACTION AGAINST INSURER

This insurance has been effected in accordance with the authorization granted to the Coverholder by the Underwriting Members of the Syndicates whosedefinitive numbers and proportions are shown in the Table attached to Agreement No. **B1306C502782200** (Hereinafter referred to as "the Underwriters"). The Underwriters shall be liable hereunder each for his own part and not one for another in proportion to the several sums that each of them has subscribed to the said Agreement. In any action to enforce the obligations of the Underwriters they can be designated or named as "Lloyd's Underwriters" and such designation shall be binding on the Underwriters liable hereunder as if they had each been individually named as defendant. Service of such proceedings may validly be made upon the Attorney In Fact In Canada for Lloyd's Underwriters, whose address for such service is Royal Bank Plaza South Tower, 200 Bay Street, Suite 2930, P.O. Box 51 Toronto, Ontario M5J 2J2.

NOTICE

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

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

Per

John A. Barclay, President & CEO

The Insured is requested to read this policy, and if incorrect, return it immediately for alteration. In the event of an occurrence likely to result in a claim under this Insurance, immediate notice should be given to the office designated above.

This policy contains a clause which may limit the amount payable

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

Intact Insurance Company

General Liability

Coverage	Form	Deductible $	Limit of Insurance $
Commercial General Liability Max	LR20-3		
Coverage A - Bodily Injury and Property Damage Liability - Each Occurrence			2,000,000
Coverage A - Liability for Abuse - Aggregate			2,000,000
Coverage A - Products-Completed Operations - Aggregate			2,000,000
Coverage A - Property Damage Deductible - Each Occurrence		1,000	
Coverage B - Personal Injury and Advertising Injury Liability - Per Person or Organization			2,000,000
Coverage C - Medical Payments - Each Person			50,000
Coverage D - Tenants' Legal Liability - Any One Premises		1,000	500,000
S.E.F. No. 96 - Contractual Liability Endorsement	L220-2		
Coverage Territory Amendment - Canada only	L407-2		
Crane and Hoist Operators' Liability Endorsement	L408-2	1,000	100,000
Employee benefit program liability	L410-2		
Aggregate			1,000,000
Each Employee		1,000	1,000,000
Forest and Prairie Fire Fighting Expense Endorsement - Oil and Gas	L416OG-2		
Limit of liability - Aggregate			1,000,000
Limit of liability - Each accident or "occurrence"		2,500	1,000,000
S.E.F. 94 Legal Liability for Damage to Hired Automobiles	L429-1		
Subsection 1 - All Perils		1,000	75,000
S.E.F. No. 99 Excluding Long term Leased Vehicle Endorsement	L431-1		
S.P.F. No. 6 - Standard Non-Owned Automobile Liability Policy	L432-2		
Section A - Third party Liability			2,000,000

General Liability

Coverage	Form	Deductible $	Limit of Insurance $
Absolute Pollution Exclusion Endorsement	L436-2		
Concrete Rip & Tear Liability Endorsement	L440-2		
Limit of Liability - Annual aggregate			50,000
Limit of Liability - Each claim			50,000
Reimbursement			1,000
Employers Liability Exclusion	L442-2		
Sub-contractor's Warranty Endorsement	L450-2		
Minimum Limit of Liability - Aggregate Limit			1,000,000
Minimum Limit of Liability - Per Accident or Occurrence			2,000,000
Amended Professional Services Exclusion Endorsement	L483-2		
Oil and Gas Limitation Endorsement	L508-2		
Deductible: land		5,000	
Deductible: pipelines		50,000	
Deductible: underground		1,000	
Deductible: water		25,000	

Rating Information(s)

Premises, Property and Operations	Rating Base
Environmental Consultants	Flat premium
Environmental Consultants	Flat premium

Amount of revenue (receipts) disclosed on file for pricing and coverage purposes* $506,000
*Note – Only operation(s) where pricing is receipts based are included in the amount of revenues shown.

Name: Timothy G. Waters, C.Tech

Position: Senior Project Manager

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

Relevant Experience:

- Lead assessor on 150 Phase I Environmental Site Assessments of residential, commercial, industrial and institutional properties throughout Alberta and B.C.

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

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

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

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

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

APPENDIX C

RESOURCE INFORMATION

REGULATORY CONTACTS, PERSONS INTERVIEWED, AND HISTORICAL SOURCES

SOURCE	INFORMATION/CONTACT/PHONE NUMBER
Alberta Environment and Protected Areas	Environmental Permits/Approvals Mr. Dennis Eriksen, Regulatory Approvals Centre (403) 427-6311
Aerial Photographs	1938, 1950, 1974, 1981, 1991, 2003, 2010, 2018, 2022
Fire Insurance Maps	Not available for this site
Historical City Directories	Not available for this site
Previous Environmental Reports	None
Other Sources	Ms. Iris Djurfors, Environmental Law Centre, (403) 424-5099 Mr. Gerry Letendre, SCC, (780) 413-0099 Town of Picture Butte Planning Dept. (403) 732-4555 (Michelle) Town of Picture Butte, Volunteer Fire Dept, (403) 732-4100 Schwartz Reliance Registry (Land Titles) (403) 320-1010 Mr. Art Leusink, A.J. Excavating, Picture Butte (403) 308-8127 Ms. Erin Mick, CBC contributor: "*Growing Up in a Trailer Park*" Mr. Josh Marti, Avison Young Realtor: (403) 795-8484

APPENDIX D

REGULATIONS

Federal

Legislation

Canada Water Act

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

Canadian Environmental Protection Act

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

Fisheries Act

Transportation of Dangerous Goods Act/Regulations

Hazardous Products Act

Policies, Guidelines and Codes

Canadian Council of Ministers of the Environment (CCME)

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

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

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

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

Provincial

Alberta Fire Code (2019)

Environmental Protection and Enhancement Act (1993)

Ozone-Depleting Substances and Halocarbons Regulation (2000)

Occupational Health and Safety Act (1993)

Transportation of Dangerous Goods Control Act (1986)

Municipal

Town of Picture Butte Unsightly/Untidy Premises By-law

Town of Picture Butte Refuse By-law

Town of Picture Butte Sewer Service By-law

Town of Picture Butte Noise Control By-law

Traffic Impact Assessment

Picture Butte Multi-Family Residential

Prepared for:

Oak Pointe Inc.

Prepared by:

Stantec Consulting Ltd.
230 – 704 4th Avenue South
Lethbridge AB, T1J 0N8

Sign-off Sheet

This document entitled Traffic Impact Assessment was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Oak Pointe Inc. Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by: **Angela Forsyth, P.Eng.**

Reviewed by: **Lindsay Haskins, P.Eng.**

Corporate Authorization

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) is undertaking a Traffic Impact Assessment (TIA) for the proposed residential development by Oak Pointe Inc., in Picture Butte, Alberta. The subject area is located adjacent to Highway 843, approximately 350 metres south on the intersection of Highway 843 and Highway 519 (Rogers Avenue). **Figure 1** illustrates the location of the site within the town of Picture Butte.

Figure 1: Site Location

1.1 OBJECTIVES

The objectives of this TIA are as follows:

- Collect the historic traffic volumes from Alberta Transportation and Economic Corridors (ATEC) at the intersection of Hwy 843 and Hwy 519.

- Estimate the magnitude and characteristics of peak hour traffic generated by the proposed development.
- Evaluate the impacts of vehicular traffic generated by the proposed development on the existing intersections.
- Identify and recommend appropriate traffic operation and/or infrastructure improvements necessary to accommodate the anticipated traffic.

1.2 STUDY AREA

The study area includes the following existing intersections:

- Highway 843 and Highway 519
- Highway 843 and Maple Ridge Estates

Figure 2 outlines these intersections.

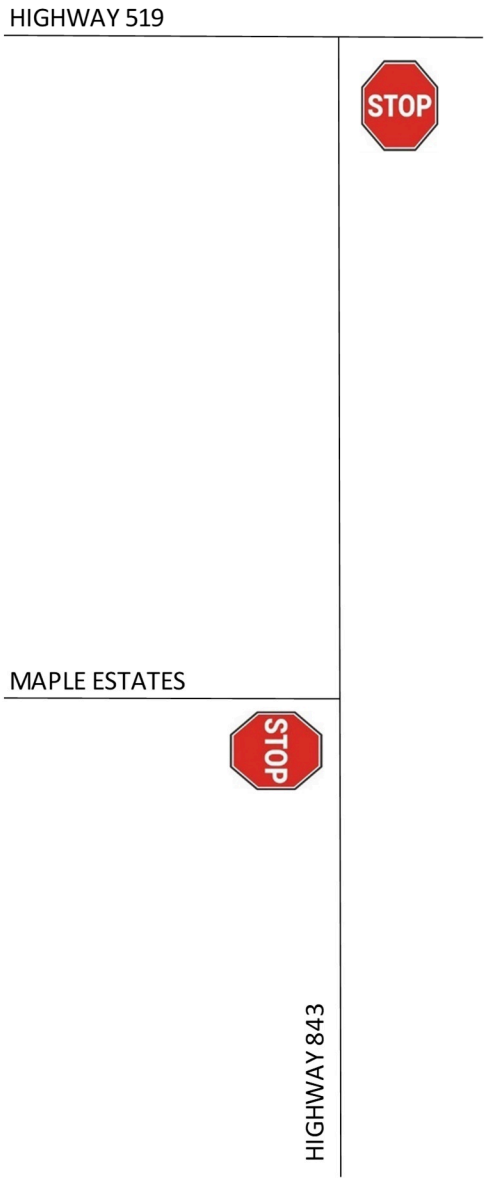


Figure 2: Existing Intersections

2.0 EXISTING INFRASTRUCTURE

2.1 ROAD NETWORK

The existing road network within the area is comprised of two-lane rural cross sections along Highway 519 and Highway 843. There are direct accesses to several residential properties, farm lands and subdivisions. Highway 843 in this area extends from Hwy 519 on the north limit, to a dead end approximately 3 kilometres to the south.

There are two intersections in the immediate area of the proposed development. A mobile home park (Maple Ridge Estates) on the west side of Hwy 843 accesses the highway from two dedicated access points, separated by approximately 80 metres.

2.2 LAND USE

There is an existing residence that will remain on the north end of the proposed development. There is also a water fill station to the north. Picture Butte High School sits to the northwest of this site, however there is no access to the school along Highway 843. To the south there are some residences, a church, a seniors centre, a feed lot and several farming operations.

3.0 EXISTING CONDITIONS

3.1 TRAFFIC VOLUMES

Background traffic volumes were obtained from ATEC's Traffic Volume Data Map, and estimated using the ITE Trip Generation Manual, 11th Edition for Maple Estates traffic. The two most recent traffic counts were completed in 2014, 2019. Pre-COVID-19 traffic growth suggests less than 1% traffic growth from the year 2014 to 2019. Post-COVID-19 traffic estimates suggest that traffic volumes have mostly recovered since 2019, but are not projecting any growth. Although this traffic data in the area suggests very little growth, the background volumes were grown to 2043 using a 2% growth rate. Existing 2022 and Horizon 2043 background traffic volumes can be found in **Figure 3** and **Figure 4**, respectively.

Existing Conditions

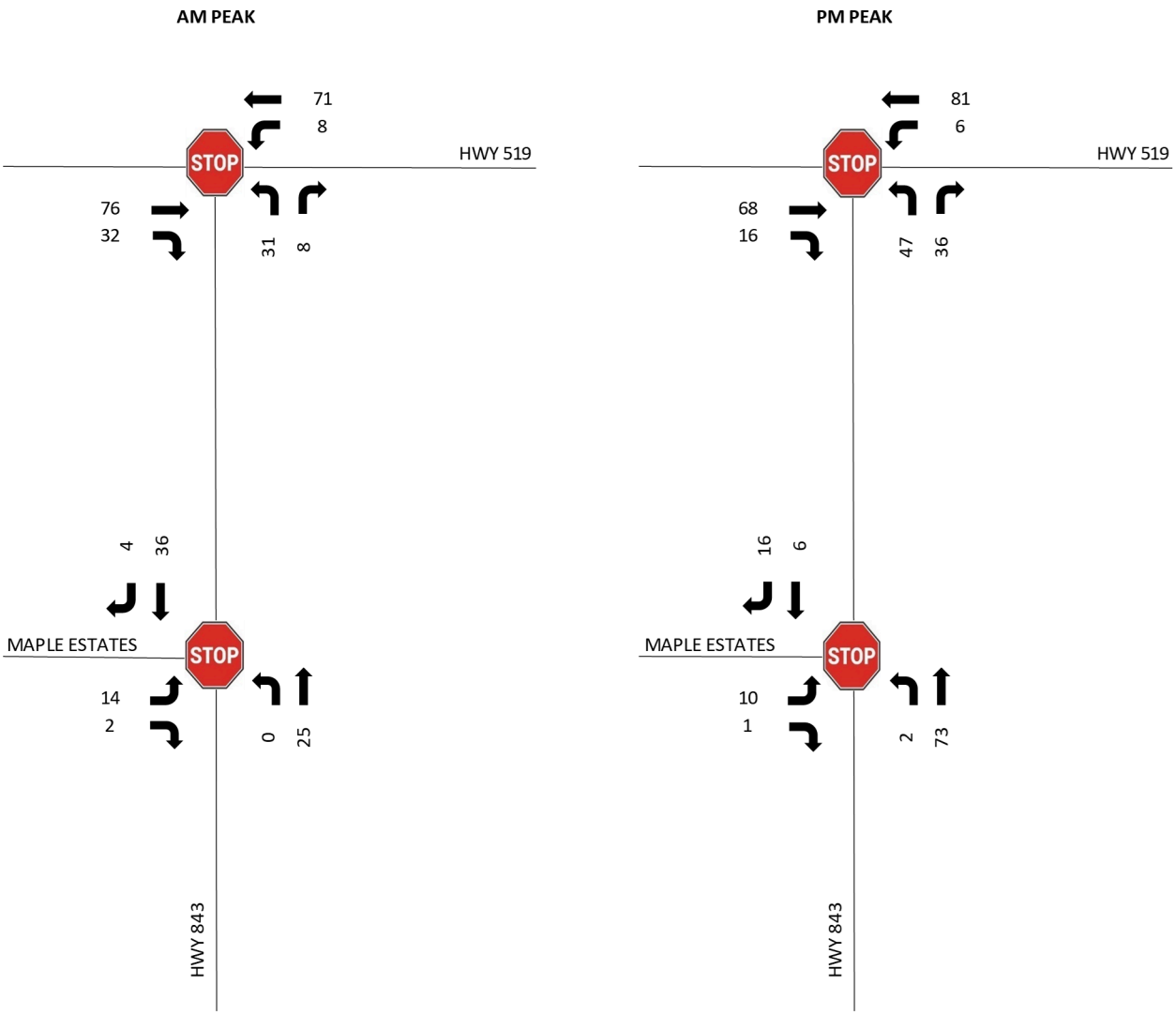


Figure 3: Existing (2022) Background Traffic Volumes

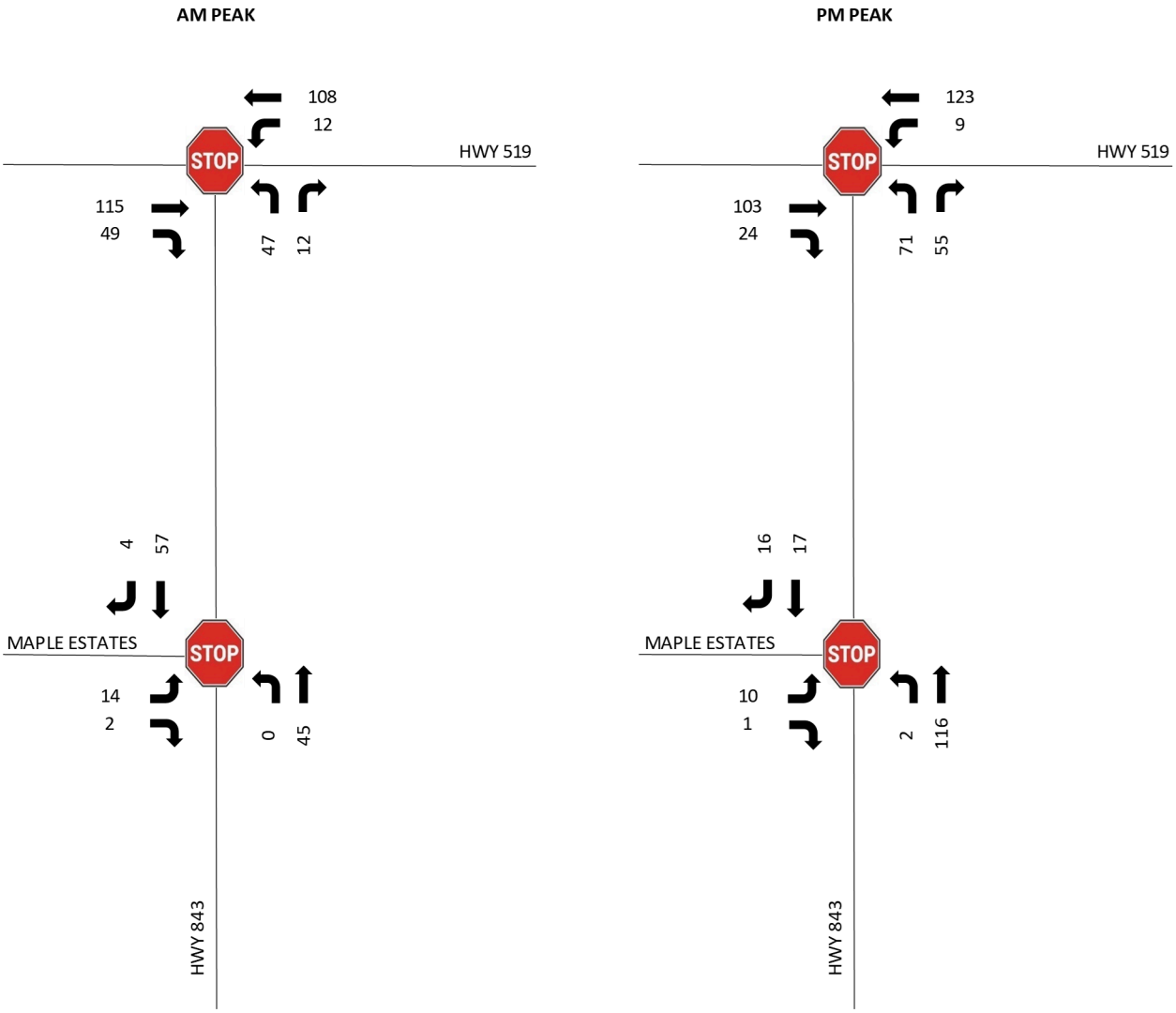


Figure 4: Horizon 2043 Background Traffic Volumes

3.2 OPERATING CONDITIONS

Intersection analysis was completed using the Synchro 11 software package, supporting the Highway Capacity Manual. The methodology considers the intersection geometry, traffic volumes, posted speed limit, and intersection control for unsignalized intersections. For signalized intersections, the intersection geometry, traffic volumes, posted speed limit, traffic signal phasing/timing plan and pedestrian volumes are all considered. The level-of-service criteria is tabulated below in **Table 1** for both unsignalized and signalized intersections.

Level of Service	Average Control Delay (seconds per vehicle)		Comment
	Signalized Intersection	Unsignalized Intersection	
A	10.0 or less	10.0 or less	Very good operation
B	10.1 to 20.0	10.1 to 15.0	Good operation
C	20.1 to 35.0	15.1 to 25.0	Acceptable operation
D	35.1 to 55.0	25.1 to 35.0	Congestion
E	55.1 to 80.0	35.1 to 50.0	Significant congestion
F	More than 80.0	More than 50.0	Unacceptable operation

Table 1: Level of Service Criteria

The volume-to-capacity (v/c) ratio was also considered in the analyses. The v/c ratio represents the percentage of capacity the traffic volumes are consuming. If the v/c ratio is above 1.0, then the movement or intersection has exceeded capacity.

3.3 INTERSECTION ANALYSIS

Both intersections appear to operate acceptably under existing conditions. The background synchro analysis is shown in **Table 2**.

Existing Conditions

Intersection	Intersection Control	Scenario	Measure	Eastbound			Westbound			Northbound			Southbound			Level of Service
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
Highway 843 & Hwy 519	Two-Way Stop Control	AM Peak	Volumes (vph)		115	49	12	108		47		12				A
			Level of Service		A			A			B					
			V/C Ratio by Movement		0.1			0.01			0.09					
			95th Percentile Queue (m)		0			0.2			2.2					
		PM Peak	Volumes (vph)		103	24	9	123		71		55				A
			Level of Service		A			A			B					
			V/C Ratio by Movement		0.08			0.01			0.17					
			95th Percentile Queue (m)		0			0.2			4.8					
Highway 843 & Maple Estates	Two-Way Stop Control	AM Peak	Volumes (vph)	14		2				0	45			57	4	A
			Level of Service		A						A			A		
			V/C Ratio by Movement		0.02						0			0.04		
			95th Percentile Queue (m)		0.4						0			0.04		
		PM Peak	Volumes (vph)	10		1				2	116			17	16	A
			Level of Service		A						A			A		
			V/C Ratio by Movement		0.01						0			0.02		
			95th Percentile Queue (m)		0.3						0			0		

Table 2: Level of Service Summary for Background Operating Conditions

4.0 PROPOSED DEVELOPMENT

A site plan has been developed for the parcel, consisting of twenty, four-unit townhouse buildings, for a total of 80 residential units. The site is accessed by a single access lining up with the Maple Estates access to the west. The access point will service an internal loop accessing each residential building. A gated, graveled additional link will be provided for emergency access at an existing residential access point. The proposed site plan is shown in **Figure 5**.

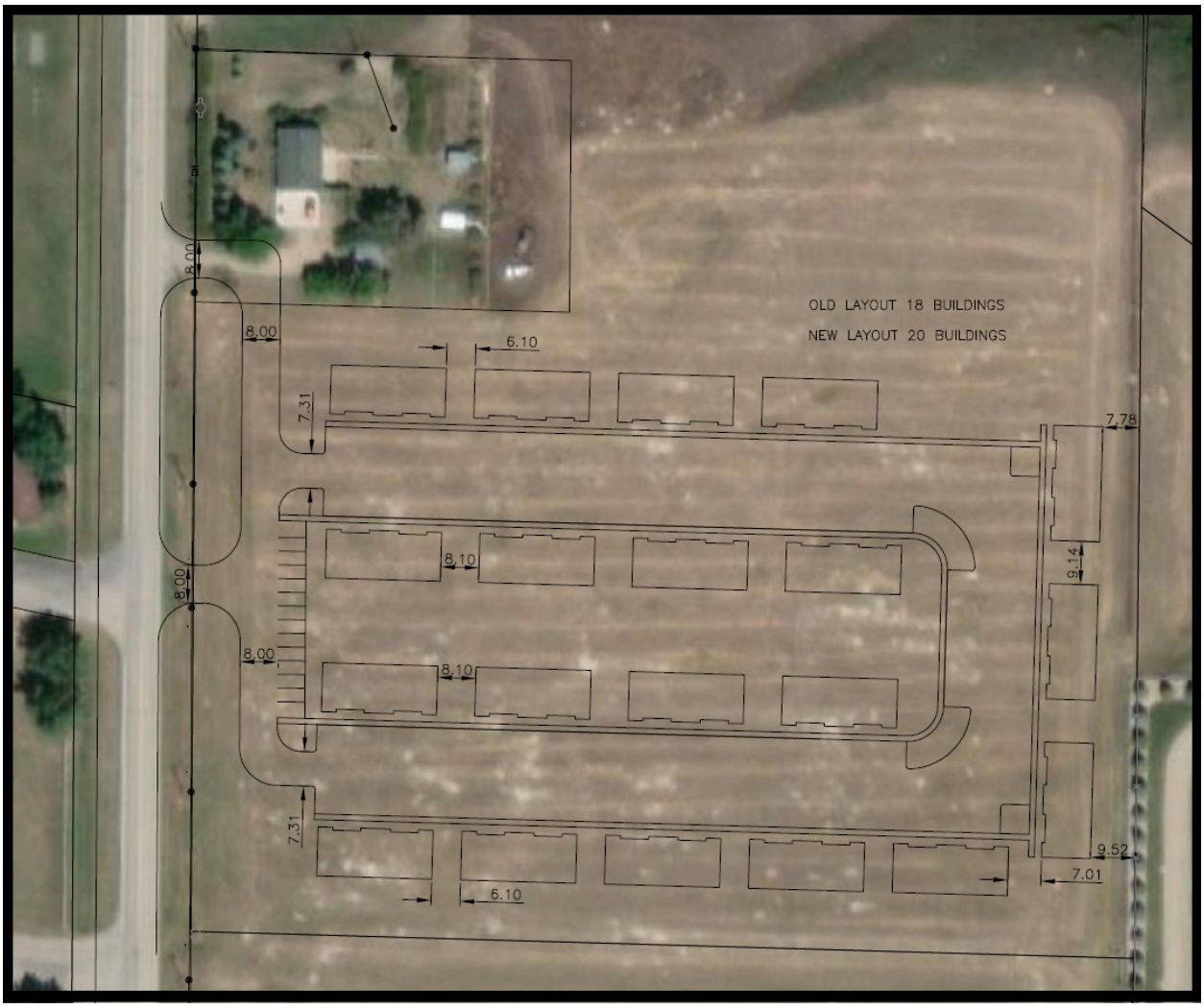


Figure 5: Site Plan

4.1 TRIP GENERATION

The trip generation for the site was estimated using the ITE Trip Generation Manual, 11th Edition. **Table 3** summarizes the estimated site traffic rates generated by the proposed site plan.

Land Use	Variable	AM Peak			PM Peak		
		Trip Rate	% In	% Out	Trip Rate	% In	% Out
215 – Single-Family Attached	Units	0.48	25%	75%	0.57	59%	41%

Table 3: Trip Generation Rate

4.2 TRIP DISTRIBUTION AND ASSIGNMENT

The directional distribution patterns for the new primary trips were based on the existing land uses and trip distribution patterns in the area. There is very little development to the south, so 90% of the new trips were assigned to northbound Hwy 843, with the remaining 10% assigned to southbound. At the intersection of Hwy 843 and Hwy 519, the existing trip distribution was taken into consideration, as well as the nature of the new residential trips. Although the existing trip distribution at this intersection is two-thirds to the west, that percentage was increased to 75% for this development. Much of the existing traffic to the south is for farming purposes, with more commercial destinations. This residential traffic will likely be travelling to the more densely populated areas of Picture Butte or continuing to the City of Lethbridge. The trip distribution is summarized in **Table 4**.

Peak hour	Intensity (units)	Total Trips	In				Out			
			Total	West	East	South	Total	West	East	South
AM	80	38	10	7	2	1	29	20	6	3
PM	80	46	27	18	6	3	19	13	4	2

Table 4: Peak Hour Trip Distribution

Based on the trip distribution patterns, the AM and PM peak hour traffic generated from the development were then assigned to the subject intersections. The assignment for the generated AM and PM peak hour traffic is illustrated in **Figure 6** and **Figure 7**, respectively.

Adding the development volumes to the background volumes give the full-build traffic volumes distributed over the roadway network. The full-build AM and PM peak hour volumes are shown in **Figure 8** and **Figure 9**, respectively.

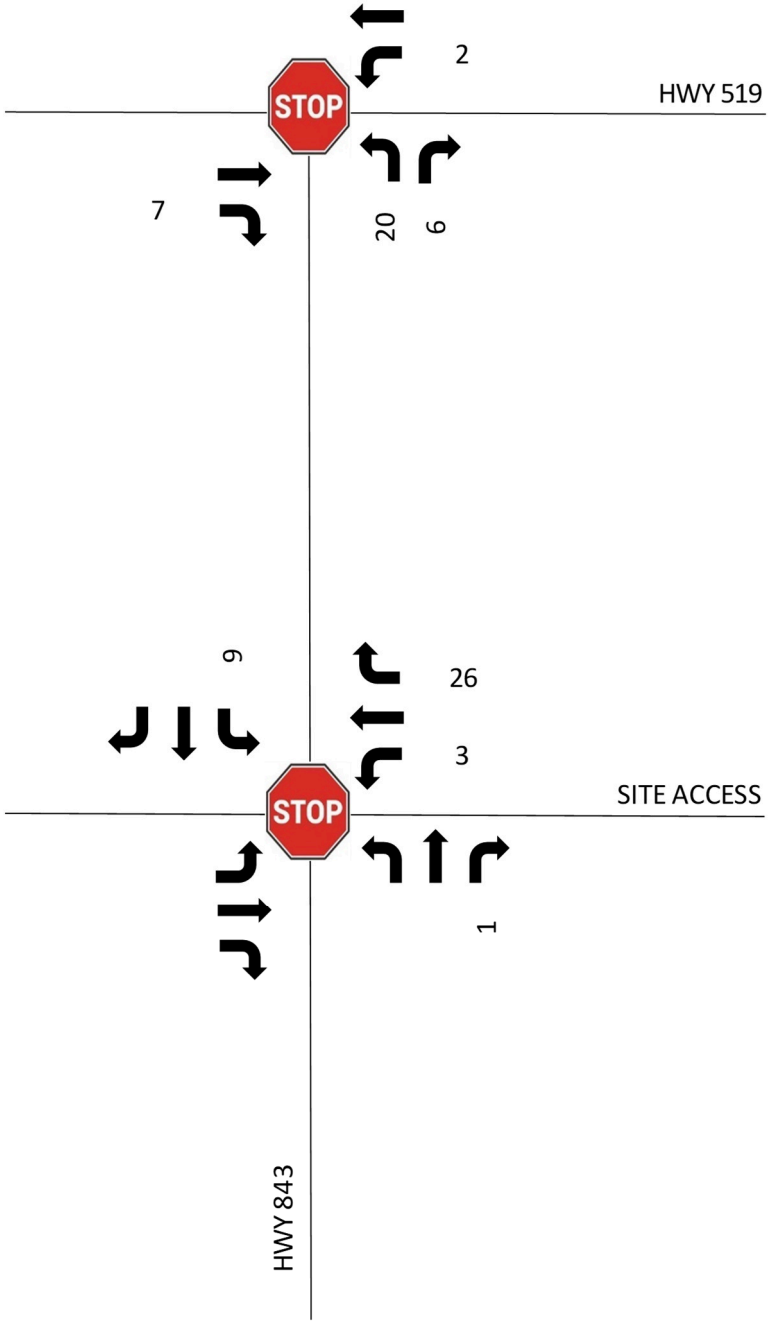


Figure 6: AM Peak Development Traffic

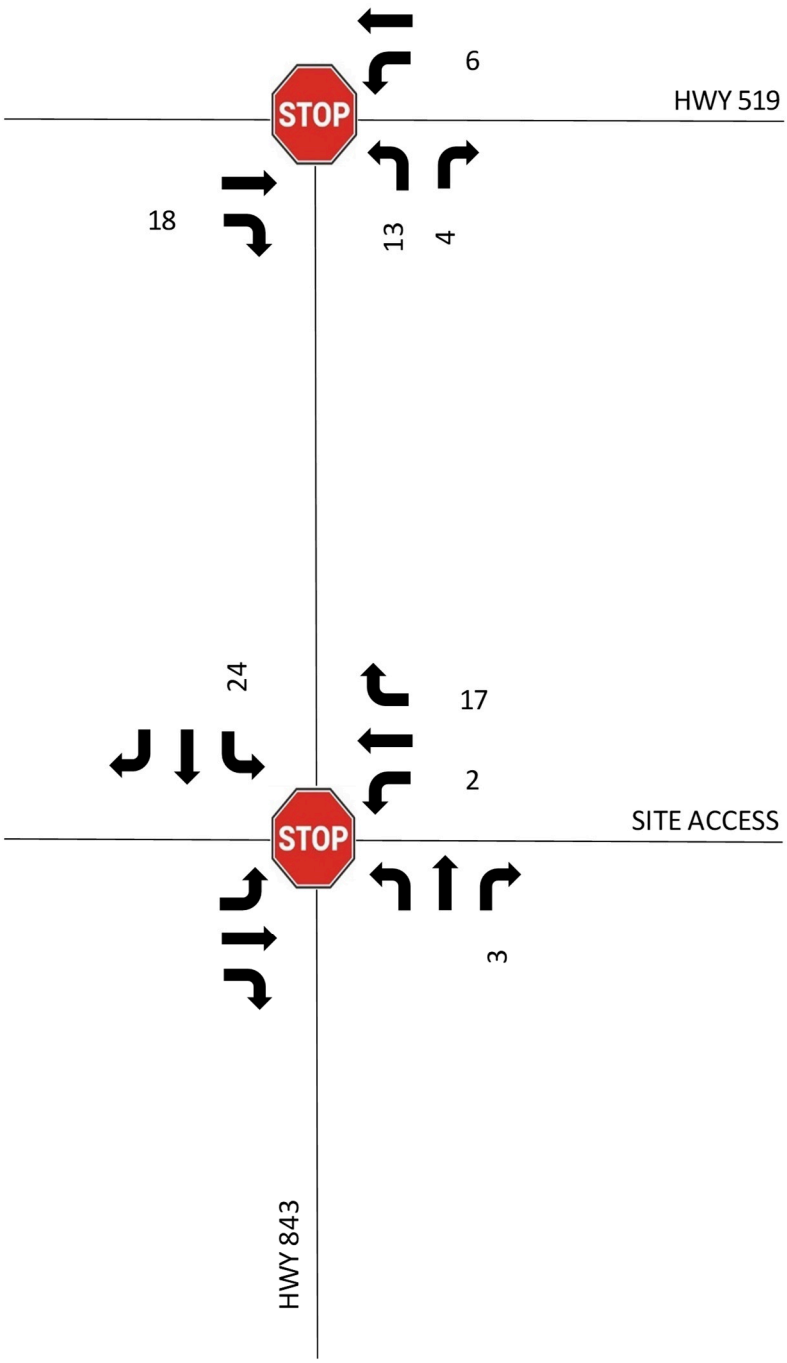


Figure 7: PM Peak Development Traffic

Proposed Development

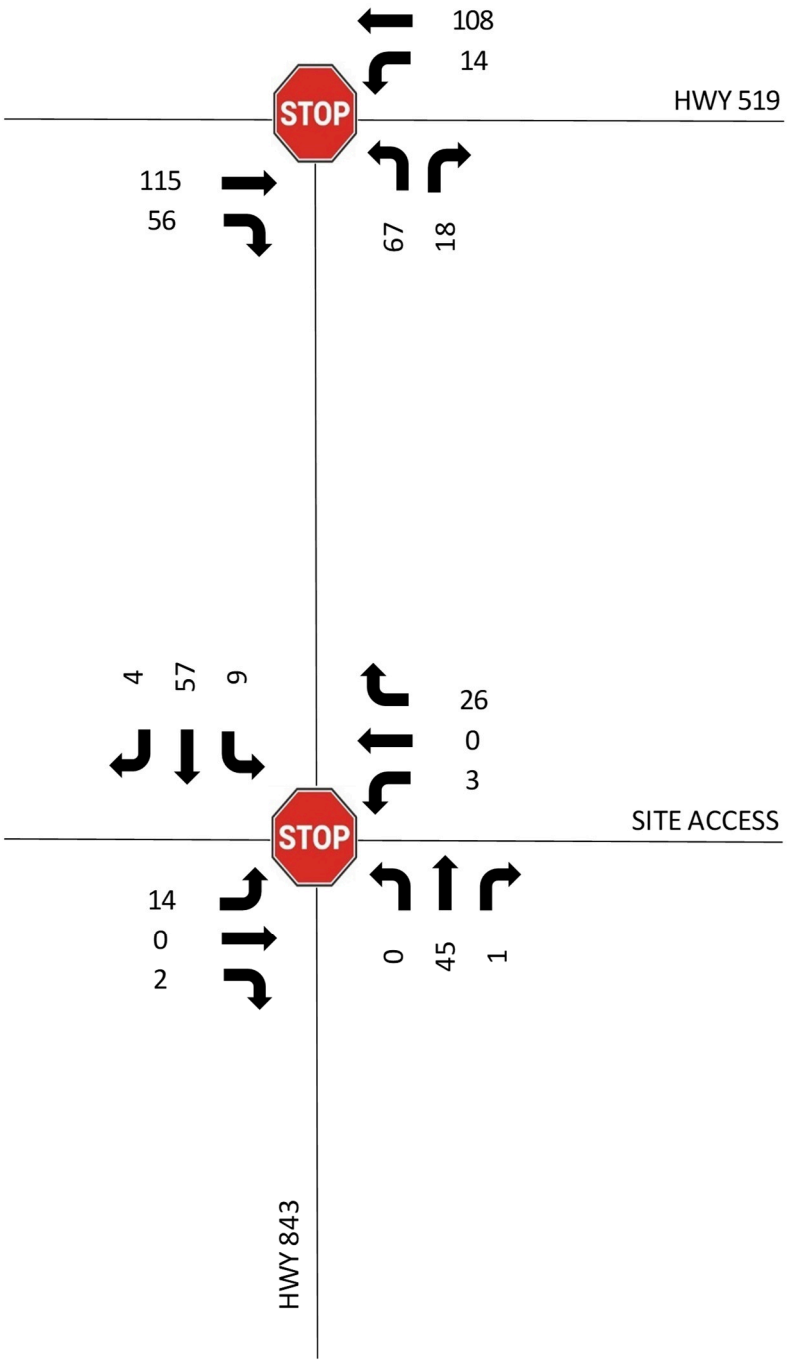


Figure 8: AM Peak Post-Development Traffic

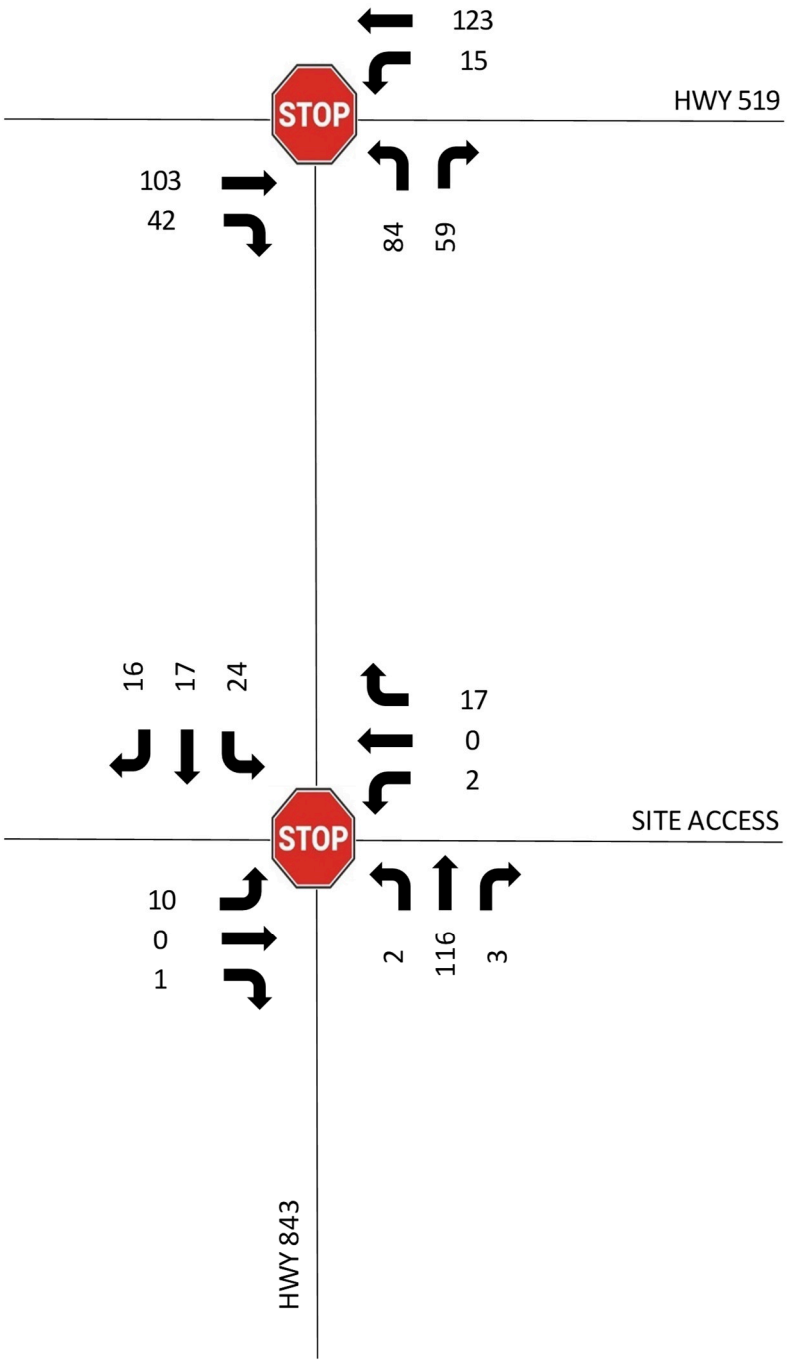


Figure 9: PM Peak Post-Development Traffic

5.0 TRANSPORTATION ASSESSMENT

5.1 INTERSECTION ANALYSIS

The intersection in the proposed site plan, as well as the intersection of Hwy 843 & Hwy 519, were analyzed for traffic operations. Traffic volumes were applied to the network and analyzed with existing geometrics and traffic control.

5.1.1 2043 Horizon Full-Build Operating Conditions

The post-development full-build operating conditions for the subject intersections in the study area were reviewed based on the existing lane configurations. The results of the analysis are summarized in **Table 5**.

The results summarized in Table 8 indicate that traffic operations will be acceptable with existing lane configurations and traffic control.

Intersection	Intersection Control	Scenario	Measure	Eastbound			Westbound			Northbound			Southbound			Level of Service
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
Highway 843 & Hwy 519	Two-Way Stop Control	AM Peak	Volumes (vph)		115	56	14	108		67		18				A
			Level of Service		A			A			B					
			V/C Ratio by Movement		0.11			0.01			0.13					
			95th Percentile Queue (m)		0			0.3			3.4					
		PM Peak	Volumes (vph)		103	42	15	123		84		59				A
			Level of Service		A			A			B					
			V/C Ratio by Movement		0.09			0.01			0.2					
			95th Percentile Queue (m)		0			0.3			5.8					
Highway 843 & Maple Estates	Two-Way Stop Control	AM Peak	Volumes (vph)	14	0	2	3	0	26	0	45	1	9	57	4	A
			Level of Service		A			A			A			A		
			V/C Ratio by Movement		0.02			0.03			0			0.01		
			95th Percentile Queue (m)		0.5			0.7			0			0.1		
		PM Peak	Volumes (vph)	10	0	1	2	0	17	2	116	3	24	17	16	A
			Level of Service		B			A			A			A		
			V/C Ratio by Movement		0.02			0.02			0			0.02		
			95th Percentile Queue (m)		0.4			0.5			0			0.4		

Table 5: Level of Service Summary for 2043 Horizon Full-Build Operating Conditions

6.0 ATEC INTERSECTION TREATMENT WARRANTS

Using 2022 ATEC turning movement diagrams, and a growth rate of 2%, horizon 2043 Annual Average Daily Traffic (AADT) was obtained. AADT was determined from the ITE Trip Generation Manual, 11th Edition. The resulting AADT values are provided in **Table 6**.

Roadway	AADT (2022 Background)	AADT (2043 Background)	AADT (2043 Post-Development)
Highway 519	2,140	3,244	3,631
Highway 843	780	1,182	1,698
Proposed Access	--	--	576

Table 6: Estimated AADT

As shown the table, the horizon 2043 post-development AADT for both highways is not significantly higher than the background horizon condition. Figure D-7.4 is not appropriate in this analysis, as the area is urban in nature, and the posted speed of all roadways in the study area is 50 km/h. With this low posted speed and urbanization, a Type I intersection would be appropriate at this access location. The AADT is relatively low, and coupled with the low volume of left turns, traffic is unlikely to be delayed by a left-turning vehicle. This is consistent with the adjacent access on the west side of Highway 843.

7.0 ILLUMINATION

Both highways are currently illuminated with continuous overhead lighting.

8.0 ACCESS MANAGEMENT

The residential site has been designed such that the primary access lines up with the existing access to Maple Estates. This will transform the existing 3-leg intersection into a 4-leg intersection at the current location and not create any additional access points to Highway 843.

9.0 RECOMMENDATIONS

It is recommended that an additional leg be constructed aligning with the existing north access point to Maple Estates. This should continue to be a Type I intersection, given the low AADT, speeds and urbanization. No additional improvements are recommended to the existing infrastructure through horizon year 2043.

APPENDIX A

Traffic Counts

Reference Number:
104090

Intersection of:
519 & 843 AT PICTURE BUTTE

North On:

Vehicle Type	Volume	%
A: Passenger Vehicle	0	####
B: Recreational Vehicle	0	####
C: Bus	0	####
D: Single Unit Truck	0	####
E: Tractor Trailer Unit	0	####
AADT	**0**	
ASDT	0	

2022 AADT / ASDT Estimates

Leg AADT Volumes

0
2,140 1,860
780

Total Entering Volume:
2,400

From North

	0		
	Right	Thru	Left
	0	**0**	**0**
A	0	0	0
B	0	0	0
C	0	0	0
D	0	0	0
E	0	0	0

To North

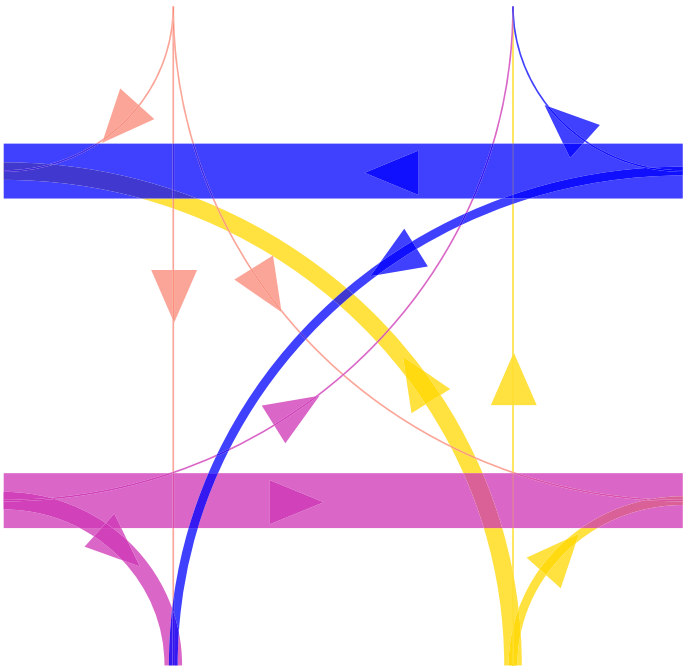
	0
A	0
B	0
C	0
D	0
E	0

To West

	1,070
A	937
B	11
C	7
D	46
E	69

From East

	940		
	Left	Thru	Right
	130	**810**	**0**
A	120	692	0
B	0	9	0
C	3	5	0
D	6	37	0
E	1	67	0



West On: 519

	Volume	%
A	1,862	87.0%
B	19	0.9%
C	15	0.7%
D	94	4.4%
E	150	7.0%
AADT	**2,140**	
ASDT	2,390	

East On: 519

Vehicle Type		
A	1,614	85.9%
B	17	0.9%
C	16	0.9%
D	87	4.6%
E	146	7.8%
AADT	**1,860**	
ASDT	2,090	

From West

	1,070		
	Left	Thru	Right
	0	**810**	**260**
A	0	686	239
B	0	7	1
C	0	4	4
D	0	37	11
E	0	76	5

To East

	930
A	802
B	8
C	8
D	44
E	78

To South

	390
A	359
B	1
C	7
D	17
E	6

From South

	390		
	Left	Thru	Right
	260	**0**	**130**
A	245	0	116
B	2	0	1
C	2	0	4
D	9	0	7
E	2	0	2

South On: 843

Vehicle Type	Volume	%
A: Passenger Vehicle	720	92.3%
B: Recreational Vehicle	4	0.5%
C: Bus	13	1.7%
D: Single Unit Truck	33	4.2%
E: Tractor Trailer Unit	10	1.3%
AADT	**780**	
ASDT	880	

ABBREVIATIONS:

AADT: Annual Average Daily Traffic. Average daily traffic expressed as vehicles per day for the period from January 1 to December 31 (inclusive), 365 days.

ASDT: Average Summer Daily Traffic. Average daily traffic expressed as vehicles per day for the period from May 1 to September 30 (inclusive), 153 days.

NOTE:
Coloured line thickness corresponds to turning movement volume.

Reference Number:
104090

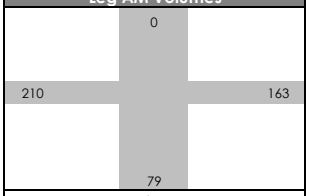
Intersection of:
519 & 843 AT PICTURE BUTTE

North On:

Vehicle Type	Volume	%
A: Passenger Vehicle	0	####
B: Recreational Vehicle	0	####
C: Bus	0	####
D: Single Unit Truck	0	####
E: Tractor Trailer Unit	0	####
AM	**0**	

2022 AM 100th Highest Hour Estimates

Leg AM Volumes



Total Entering Volume: **226**

From North

	Right	Thru	Left
	0	**0**	**0**
A	0	0	0
B	0	0	0
C	0	0	0
D	0	0	0
E	0	0	0

To North

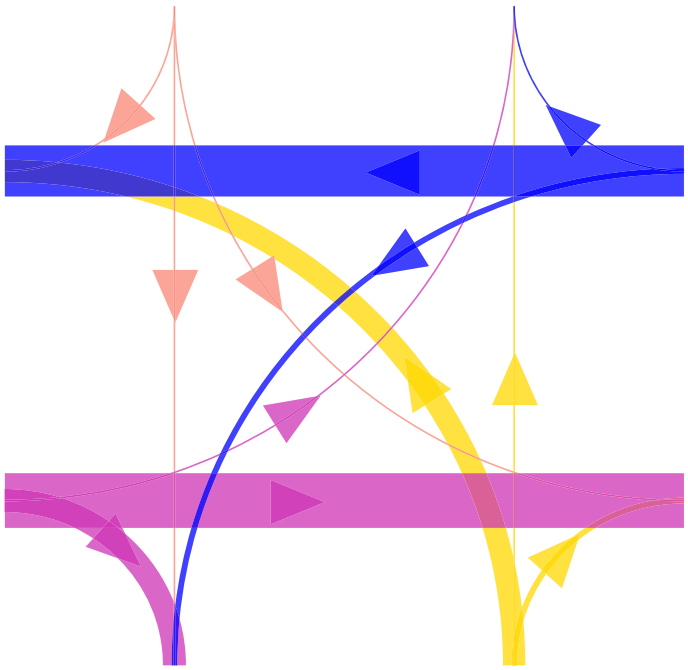
	0
A	0
B	0
C	0
D	0
E	0

To West

	102
A	78
B	2
C	2
D	10
E	10

From East

	Left	Thru	Right	
	8	**71**	**0**	
A	7	56	0	A
B	0	2	0	B
C	0	1	0	C
D	0	4	0	D
E	1	8	0	E



West On: 519

	Volume	%
A	171	81.4%
B	3	1.4%
C	2	1.0%
D	19	9.0%
E	15	7.1%
AM	**210**	

East On: 519

Vehicle Type	Volume	%
A	135	82.8%
B	3	1.8%
C	1	0.6%
D	10	6.1%
E	14	8.6%
AM	**163**	

From West

	Left	Thru	Right
	0	**76**	**32**
A	0	65	28
B	0	1	0
C	0	0	0
D	0	5	4
E	0	5	0

To East

	84
A	72
B	1
C	0
D	6
E	5

To South

	40
A	35
B	0
C	0
D	4
E	1

From South

	Left	Thru	Right
	31	**0**	**8**
A	22	0	7
B	0	0	0
C	1	0	0
D	6	0	1
E	2	0	0

South On: 843

Vehicle Type	Volume	%
A: Passenger Vehicle	64	81.0%
B: Recreational Vehicle	0	0.0%
C: Bus	1	1.3%
D: Single Unit Truck	11	13.9%
E: Tractor Trailer Unit	3	3.8%
AM	**79**	

NOTE:
Coloured line thickness corresponds to turning movement volume.

Reference Number:
104090

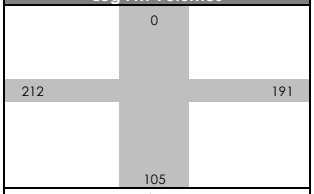
Intersection of:
519 & 843 AT PICTURE BUTTE

North On:

Vehicle Type	Volume	%
A: Passenger Vehicle	0	####
B: Recreational Vehicle	0	####
C: Bus	0	####
D: Single Unit Truck	0	####
E: Tractor Trailer Unit	0	####
PM	**0**	

2022 PM 100th Highest Hour Estimates

Leg PM Volumes



Total Entering Volume:
254

From North

	0		
	Right	Thru	Left
	0	**0**	**0**
A	0	0	0
B	0	0	0
C	0	0	0
D	0	0	0
E	0	0	0

To North

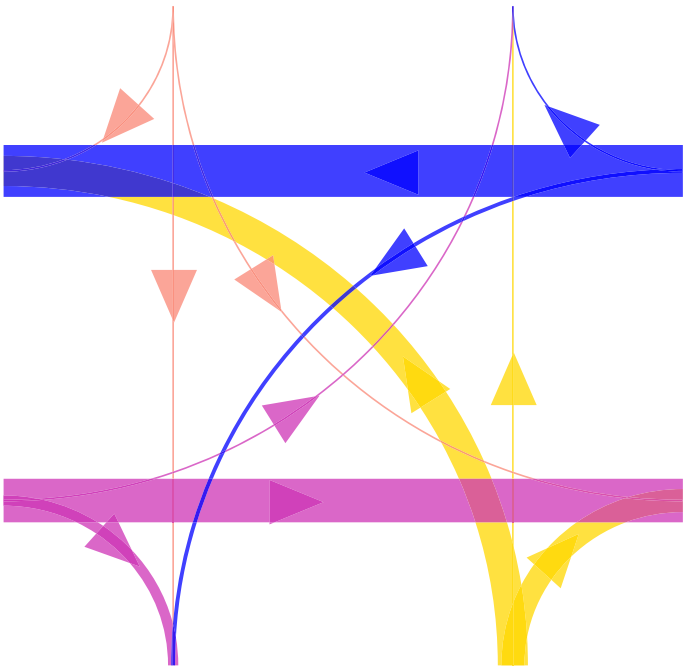
	0
A	0
B	0
C	0
D	0
E	0

To West

	128
A	113
B	2
C	0
D	2
E	11

From East

	87	
Left	Thru	Right
6	**81**	**0**
6	66	0
0	2	0
0	0	0
0	2	0
0	11	0



West On: 519

	Volume	%
A	188	88.7%
B	3	1.4%
C	2	0.9%
D	3	1.4%
E	16	7.5%
PM	**212**	

East On: 519

Vehicle Type		
A	166	86.9%
B	3	1.6%
C	2	1.0%
D	4	2.1%
E	16	8.4%
PM	**191**	

From West

	84		
	Left	Thru	Right
	0	**68**	**16**
A	0	60	15
B	0	1	0
C	0	1	1
D	0	1	0
E	0	5	0

To East

	104
A	94
B	1
C	2
D	2
E	5

To South

	22
A	21
B	0
C	1
D	0
E	0

From South

	83		
	Left	Thru	Right
	47	**0**	**36**
A	47	0	34
B	0	0	0
C	0	0	1
D	0	0	1
E	0	0	0

South On: 843

Vehicle Type	Volume	%
A: Passenger Vehicle	102	97.1%
B: Recreational Vehicle	0	0.0%
C: Bus	2	1.9%
D: Single Unit Truck	1	1.0%
E: Tractor Trailer Unit	0	0.0%
PM	**105**	

NOTE:
Coloured line thickness corresponds to turning movement volume.

APPENDIX B

Synchro Output

Intersection	
Int Delay, s/veh	2.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	115	49	12	108	47	12
Future Vol, veh/h	115	49	12	108	47	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	8	8	8	4	4
Mvmt Flow	125	53	13	117	51	13

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	178	0	295	152
Stage 1	-	-	-	-	152	-
Stage 2	-	-	-	-	143	-
Critical Hdwy	-	-	4.18	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.272	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1362	-	692	889
Stage 1	-	-	-	-	871	-
Stage 2	-	-	-	-	879	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1362	-	685	889
Mov Cap-2 Maneuver	-	-	-	-	685	-
Stage 1	-	-	-	-	871	-
Stage 2	-	-	-	-	870	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	10.5
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	719	-	-	1362	-
HCM Lane V/C Ratio	0.089	-	-	0.01	-
HCM Control Delay (s)	10.5	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	2	0	45	57	4
Future Vol, veh/h	14	2	0	45	57	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	4	4
Mvmt Flow	15	2	0	49	62	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	113	64	66	0	-	0
Stage 1	64	-	-	-	-	-
Stage 2	49	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	884	1000	1536	-	-	-
Stage 1	959	-	-	-	-	-
Stage 2	973	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	884	1000	1536	-	-	-
Mov Cap-2 Maneuver	884	-	-	-	-	-
Stage 1	959	-	-	-	-	-
Stage 2	973	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.1	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1536	-	897	-	-
HCM Lane V/C Ratio	-	-	0.019	-	-
HCM Control Delay (s)	0	-	9.1	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	103	24	9	123	71	55
Future Vol, veh/h	103	24	9	123	71	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	8	8	8	4	4
Mvmt Flow	112	26	10	134	77	60

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	138	0	279	125
Stage 1	-	-	-	-	125	-
Stage 2	-	-	-	-	154	-
Critical Hdwy	-	-	4.18	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.272	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1410	-	707	920
Stage 1	-	-	-	-	896	-
Stage 2	-	-	-	-	869	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1410	-	701	920
Mov Cap-2 Maneuver	-	-	-	-	701	-
Stage 1	-	-	-	-	896	-
Stage 2	-	-	-	-	862	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	10.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	782	-	-	1410	-
HCM Lane V/C Ratio	0.175	-	-	0.007	-
HCM Control Delay (s)	10.6	-	-	7.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	1	2	116	17	16
Future Vol, veh/h	10	1	2	116	17	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	4	4	4	4
Mvmt Flow	11	1	2	126	18	17

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	157	27	35	0	-	0
Stage 1	27	-	-	-	-	-
Stage 2	130	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.14	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.236	-	-	-
Pot Cap-1 Maneuver	834	1048	1563	-	-	-
Stage 1	996	-	-	-	-	-
Stage 2	896	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	833	1048	1563	-	-	-
Mov Cap-2 Maneuver	833	-	-	-	-	-
Stage 1	995	-	-	-	-	-
Stage 2	896	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1563	-	849	-	-
HCM Lane V/C Ratio	0.001	-	0.014	-	-
HCM Control Delay (s)	7.3	0	9.3	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	115	56	14	108	67	18
Future Vol, veh/h	115	56	14	108	67	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	8	8	8	4	4
Mvmt Flow	125	61	15	117	73	20

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	186	0	303	156
Stage 1	-	-	-	-	156	-
Stage 2	-	-	-	-	147	-
Critical Hdwy	-	-	4.18	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.272	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1353	-	685	884
Stage 1	-	-	-	-	867	-
Stage 2	-	-	-	-	876	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1353	-	677	884
Mov Cap-2 Maneuver	-	-	-	-	677	-
Stage 1	-	-	-	-	867	-
Stage 2	-	-	-	-	865	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	10.8
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	712	-	-	1353	-
HCM Lane V/C Ratio	0.13	-	-	0.011	-
HCM Control Delay (s)	10.8	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	14	0	2	3	0	26	0	45	1	9	57	4
Future Vol, veh/h	14	0	2	3	0	26	0	45	1	9	57	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	4	4
Mvmt Flow	15	0	2	3	0	28	0	49	1	10	62	4

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	148	134	64	135	136	50	66	0	0	50	0	0
Stage 1	84	84	-	50	50	-	-	-	-	-	-	-
Stage 2	64	50	-	85	86	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	820	757	1000	836	755	1018	1536	-	-	1557	-	-
Stage 1	924	825	-	963	853	-	-	-	-	-	-	-
Stage 2	947	853	-	923	824	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	793	752	1000	829	750	1018	1536	-	-	1557	-	-
Mov Cap-2 Maneuver	793	752	-	829	750	-	-	-	-	-	-	-
Stage 1	924	819	-	963	853	-	-	-	-	-	-	-
Stage 2	921	853	-	915	818	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.5	8.7	0	0.9
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1536	-	-	814	995	1557	-	-
HCM Lane V/C Ratio	-	-	-	0.021	0.032	0.006	-	-
HCM Control Delay (s)	0	-	-	9.5	8.7	7.3	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Intersection	
Int Delay, s/veh	4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	103	42	15	123	84	59
Future Vol, veh/h	103	42	15	123	84	59
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	8	8	8	8	4	4
Mvmt Flow	112	46	16	134	91	64

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	158	0	301	135
Stage 1	-	-	-	-	135	-
Stage 2	-	-	-	-	166	-
Critical Hdwy	-	-	4.18	-	6.44	6.24
Critical Hdwy Stg 1	-	-	-	-	5.44	-
Critical Hdwy Stg 2	-	-	-	-	5.44	-
Follow-up Hdwy	-	-	2.272	-	3.536	3.336
Pot Cap-1 Maneuver	-	-	1386	-	686	909
Stage 1	-	-	-	-	886	-
Stage 2	-	-	-	-	859	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1386	-	678	909
Mov Cap-2 Maneuver	-	-	-	-	678	-
Stage 1	-	-	-	-	886	-
Stage 2	-	-	-	-	849	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	11
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	757	-	-	1386	-
HCM Lane V/C Ratio	0.205	-	-	0.012	-
HCM Control Delay (s)	11	-	-	7.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	0	1	2	0	17	2	116	3	24	17	16
Future Vol, veh/h	10	0	1	2	0	17	2	116	3	24	17	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	4	4	2	2	4	4
Mvmt Flow	11	0	1	2	0	18	2	126	3	26	18	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	220	212	27	211	219	128	35	0	0	129	0	0
Stage 1	79	79	-	132	132	-	-	-	-	-	-	-
Stage 2	141	133	-	79	87	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.14	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.236	-	-	2.218	-	-
Pot Cap-1 Maneuver	736	685	1048	746	679	922	1563	-	-	1457	-	-
Stage 1	930	829	-	871	787	-	-	-	-	-	-	-
Stage 2	862	786	-	930	823	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	711	672	1048	734	666	922	1563	-	-	1457	-	-
Mov Cap-2 Maneuver	711	672	-	734	666	-	-	-	-	-	-	-
Stage 1	929	814	-	870	786	-	-	-	-	-	-	-
Stage 2	844	785	-	912	808	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	9.1	0.1	3.2
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1563	-	-	732	898	1457	-	-
HCM Lane V/C Ratio	0.001	-	-	0.016	0.023	0.018	-	-
HCM Control Delay (s)	7.3	0	-	10	9.1	7.5	0	-
HCM Lane LOS	A	A	-	B	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	-	-