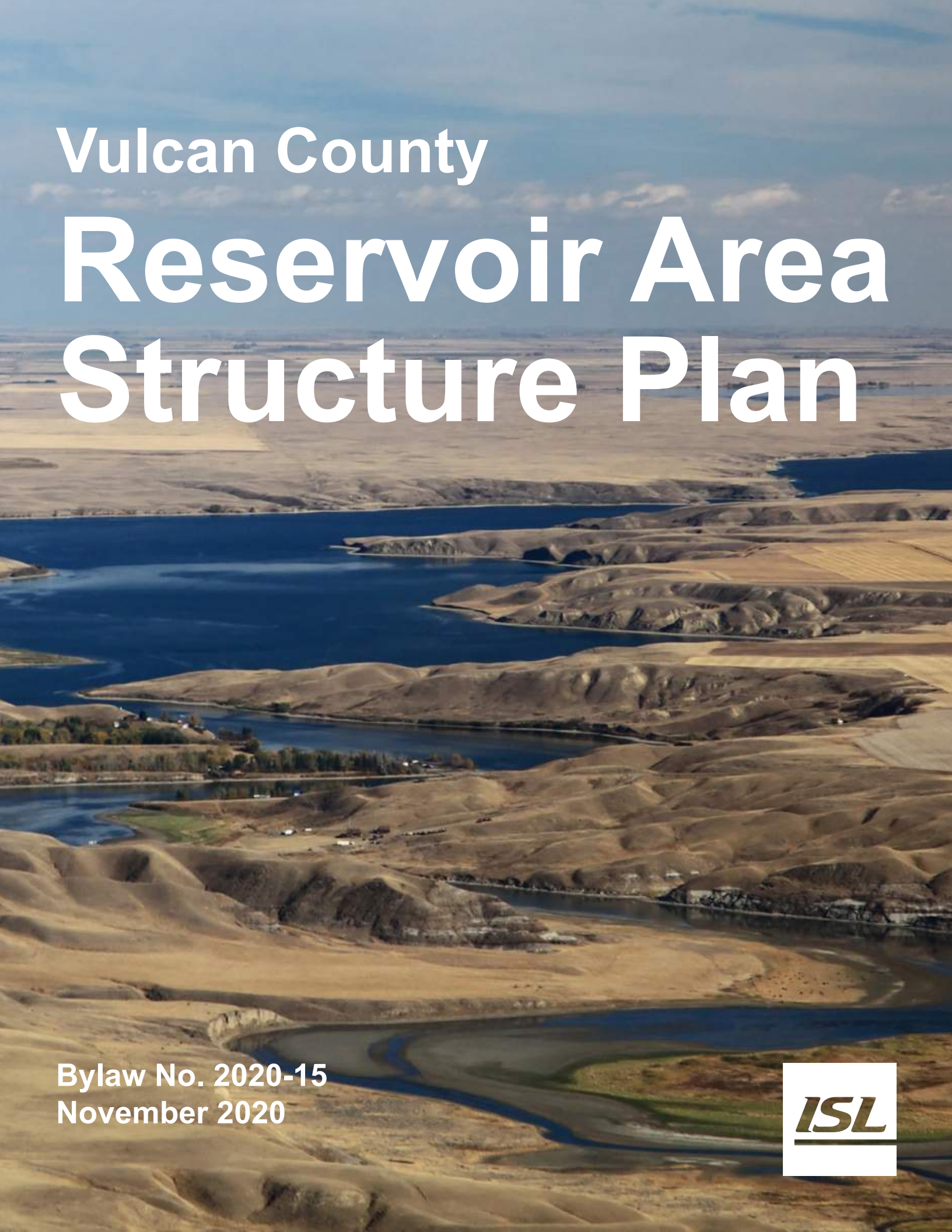

Vulcan County
Reservoir Area Structure Plan

Bylaw No. 2020-15
November 2020

VULCAN COUNTY

Vulcan - Alberta

BYLAW 2020-015

Being a Bylaw of Vulcan County in the Province of Alberta to adopt the McGregor, Travers, Little Bow Area Structure Plan.

WHEREAS Section 633 of the Municipal Government Act, being Chapter M-26 of the Revised Statutes of Alberta, 2000, and amendments thereto, whereby a municipality may pass a bylaw for municipal purposes of adopting an Area Structure Plan;

AND WHEREAS the Council of Vulcan County has identified the McGregor, Travers, Little Bow Reservoirs, as having potential for increased development;

AND WHEREAS development, redesignations, and subdivisions proposals, must recognize the potential conflict of reservoir use;

AND WHEREAS the Council of Vulcan County wishes to implement development, redesignation, and subdivision guidelines which take into account the special nature of the area;

NOW THEREFORE under the authority and subject to the provisions of the Municipal Government Act, Revised Statues of Alberta 2000, Chapter M-26, as amended, the Council duly assembled does hereby enact the following:

1. That Vulcan County Council does hereby adopt the McGregor, Travers, Little Bow Area Structure Plan as shown on Schedule A
2. Bylaw 97-018 is hereby rescinded.
3. This Bylaw shall take effect upon third and final reading hereof.

Received first reading this 17 day of July, 2020

Jason Schneider, Reeve

Nels Petersen, CAO

Received second reading this 5 day of November, 2020

Jason Schneider, Reeve

Nels Petersen, CAO

Received third reading and finally passed this 5 day of November, 2020

Jason Schneider, Reeve

Nels Petersen, CAO

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Cover photo courtesy of Elfie Hall used with permission from Vulcan County
All photos provided by Vulcan County for use in the ASP

SECTION ONE

Planning Context

1

This section outlines the policy framework that enables and directs the Reservoir ASP and compliance with the County's statutory Planning documents.

1-1 PURPOSE

This Reservoir Area Structure Plan ("Reservoir ASP") provides a comprehensive framework for future development within the plan area ensuring: the efficient use of land, adequate provision of infrastructure and public facilities, conservation of resources, economic development opportunities, protection of significant natural environments, and the development of healthy, safe and viable communities.

Policies have been developed to achieve the following objectives:

- Facilitation of orderly development,
- Protection of the irrigation and water supply functions of the reservoirs,
- Reduction of land use conflicts,
- Collaborative stakeholder input and intermunicipal cooperation,
- Compatibility with Provincial Policies and Regulations,
- Provision of a safe and efficient road network, and
- Protection of the natural environment and historical resources.

1-2 BACKGROUND

The original Area Structure Plan (ASP) for McGregor, Travers and Little Bow Reservoirs was adopted in 1985 by Vulcan County as Bylaw No. 85-006. In 1998 the ASP was updated to address the evolving nature of development surrounding the reservoirs and reflect changes to provincial legislation effecting planning and a growing emphasis on environmental protection in the region. The updated ASP was adopted as Bylaw No. 97-018.

In 2014 the Travers Ridge RV Park ASP was adopted as Bylaw No. 2014-002 to facilitate the development of a bare land condominium adjacent to the boundary of Little Bow Provincial Park. The Travers Ridge RV Park ASP is included as **Appendix D** within this document.

1-3 REGULATION AND POLICY DIRECTION

All policies within the Reservoir ASP must be consistent with higher order policies. If there are discrepancies between this ASP and higher order planning documents, higher order documents will take precedence. The Reservoir ASP has been developed in compliance with the following documents:

Municipal Government Act (MGA)

The MGA empowers municipalities to shape their communities. It regulates how municipalities are funded and how they should plan for growth. Per the MGA requirements for Area Structure Plans, the Reservoir ASP addresses the following:

- Sequencing of development proposed for the area,
- Proposed land uses,
- Proposed density of population, and
- General location of major transportation routes and public utilities.

South Saskatchewan Regional Plan (SSRP)

The (SSRP) sets the stage for robust growth, vibrant communities and a healthy environment within the region. The SSRP identifies strategic direction for the region over the next 10 years.

The Reservoir ASP provides a local framework to support the following objectives:

- Alignment with provincial policies,
- Commitment to stakeholder engagement,
- Balanced economic development opportunities and social and environmental considerations,
- Describes the strategies, actions, approaches and tools required to achieve desired outcomes
- Monitoring, evaluation and reporting to assess progress, and
- Guidance to provincial and local decision-makers regarding land use management.

Vulcan County Strategic Plan

The Strategic Plan sets forth a vision to provide opportunity and growth through cooperation, progressive leadership, and accessible Administration. The plan highlights the economics, recreation, and attractions that make Vulcan County a great place to call home and do business.

The following strategic priorities included in the Strategic Plan have informed the policies within the Reservoir ASP:

- Increased and Diversified Economic Development
- Collaborative Environment
- Support of the Agricultural Industry
- Safe Communities

Vulcan County Municipal Development Plan (MDP)

Mission: *Our intent is to manage our lands wisely and ensure that Vulcan County remains a great place to live, work and raise a family.*

The Reservoir ASP demonstrates its consistency with the Mission of the MDP by:

- Providing policies that will protect agricultural lands,
- Encouraging development in order to expand the County's assessment base,
- Providing consistent standards for zoning applications or Conceptual Schemes,
- Promoting intermunicipal cooperation, and
- Encouraging options for renewable energy generating facilities

The County may require a Conceptual Scheme to be prepared for areas of land, to provide a more detailed and comprehensive framework for future redesignation, subdivision and development, to encourage collaboration between landowners, and to achieve efficient and orderly development.

Intermunicipal Development Plans

A portion of the ASP Plan area in the north falls within the Vulcan County/Village of Milo Intermunicipal Development Plan (IDP) boundary and a portion of the Plan area in the southeast falls within the Vulcan County/Municipal District of Taber IDP boundary. Where any conflict arises between the policies of the Reservoir ASP and a specific IDP, the IDP will take precedent.

Land Use Bylaw

The Development Concept prepared for the Reservoir ASP can be accommodated within the Vulcan County Land Use Bylaw (LUB). Land use categories shown on the Development Concept do not signify land use districts specified in the LUB. Future development proposals within the areas currently designated Recreation Vicinity District (RV) or Urban Fringe (UF), will require an amendment to the LUB prior to development.

Environmental Regulation

All development within the Plan area will be consistent with higher order environment regulations including those of Alberta Environment and Parks (AEP) and the Bow River Irrigation District (BRID).

1-4 PLAN INTERPRETATION

Map Interpretation

Unless otherwise specified within this plan, the boundaries or locations of any symbols or areas shown on a map are approximate only, not absolute, and shall be interpreted as such. They are not intended to define exact locations except where they coincide with clearly recognizable physical features or fixed boundaries such as property lines or utility/road rights-of-way. No measurements or area calculations should be taken from the ASP maps.

Policy Interpretation

Where “shall”, “will”, “must” or “require” are used in a policy, the policy is considered mandatory in order to achieve a desired result.

Where “should” is used in a policy it is anticipated that the policies will be applied unless it can be clearly demonstrated to the satisfaction of the Development Authority, that the policy is not reasonable, practical and feasible in a given situation.

1-5 MONITORING AND REVIEW

The Reservoir ASP is a long-term policy document that promotes a vision for development within the plan area and provides guiding principles and policies that work towards achieving that vision over-time. The policies within the Reservoir ASP will be monitored and should be reviewed and updated every 15 - 20 years, or when deemed necessary. The ASP may also be amended in response to changes in the overall policy direction within Vulcan County or specific development applications.

1-6 AMENDING THE ASP

If major changes with regards to land use, road networks or any other significant aspect of the Plan are contemplated, an amendment to the Reservoir ASP, that includes a public hearing, shall be held in accordance with the MGA. Minor changes will not require an amendment if, in the opinion of the Development Authority, the intent of the ASP is still achieved. Where an amendment to this ASP is requested by an applicant, the applicant shall be required to submit the justification and information necessary to support the amendment.

1-7 LIMITATIONS

Policies within the Reservoir ASP are not to be interpreted as an approval for a use on a specific site. Detailed site conditions or constraints – including environmental considerations – must be assessed on a case-by-case basis as part of an application for a Land Use Amendment, Subdivision, or a Development Permit.

SECTION TWO 2

Plan Area

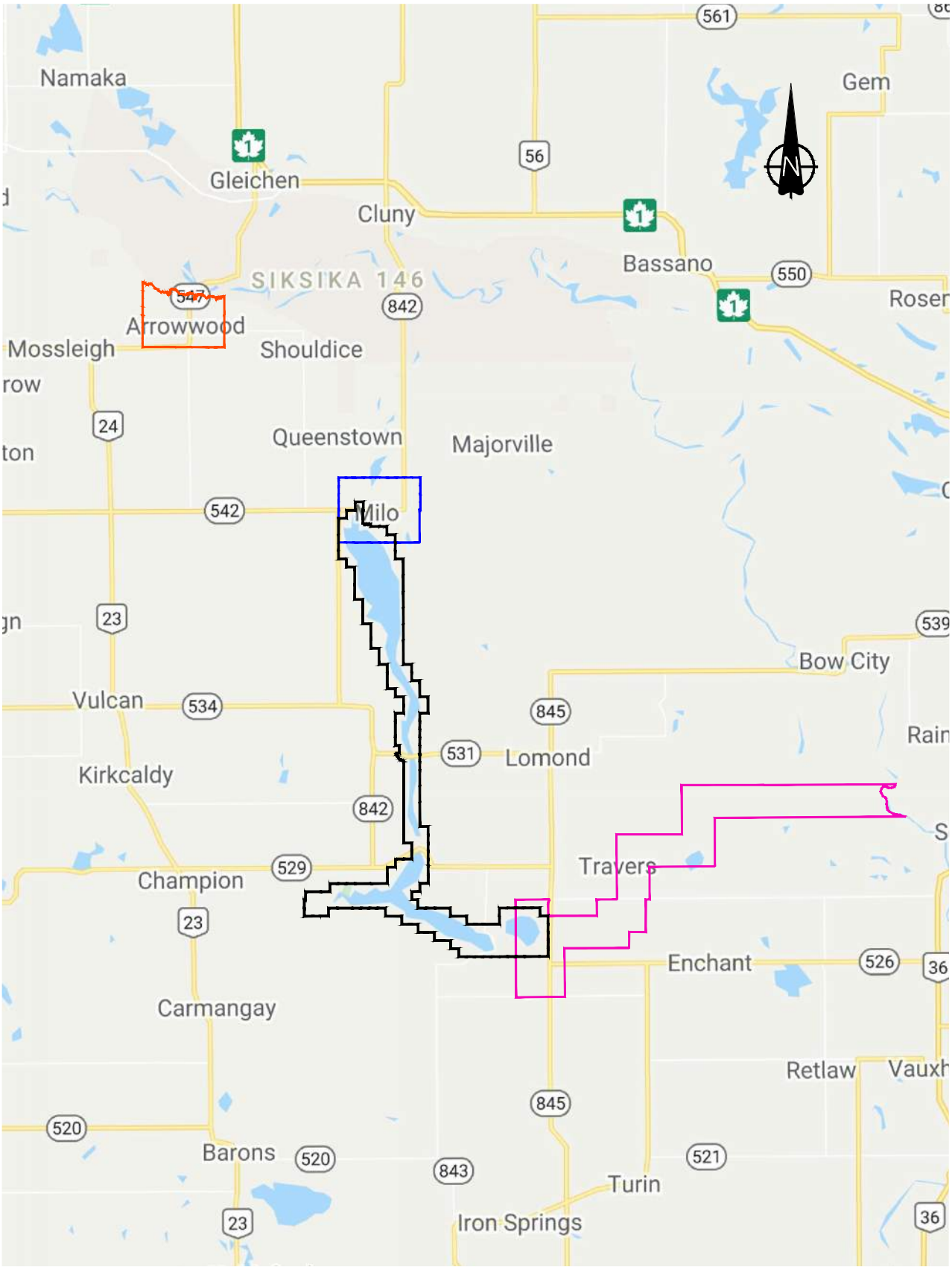
This section describes the location of the ASP and current landownership within the plan area.

2-1 LOCATION

The Reservoir ASP is approximately 19,305 hectares in size and surrounds the Travers Reservoir, McGregor Lake and Little Bow Reservoir. The Village of Lomond is approximately 14 km to the east of McGregor Lake and approximately 17 km north of Little Bow Reservoir. The Village of Milo is approximately 2 km to the northeast of McGregor Lake Reservoir. There are no significant population centres near Travers Reservoir. See **Figure 1 – Location Plan** and **Figure 2 – Plan Area**.

The McGregor, Travers and Little Bow Reservoirs form part of the Carseland-Bow River Headworks system owned by AEP but operated by the BRID under contract by AEP. The reservoirs are centrally located within Vulcan County, 105 km north of Lethbridge and 145 km south of Calgary. The three-reservoir system is man made and would not exist without water supplied through a diversion on the Bow River near Carseland and dams on the Little Bow River. Travers Reservoir and Little Bow Reservoir are fed via the Little Bow River as well as a canal from McGregor Lake which has its water diverted from the Bow River.

Main canals connect the three water supply reservoirs and the system concludes at the outlet of Little Bow Reservoir. Vulcan County and the Municipal District of Taber receive water from this major water supply system.



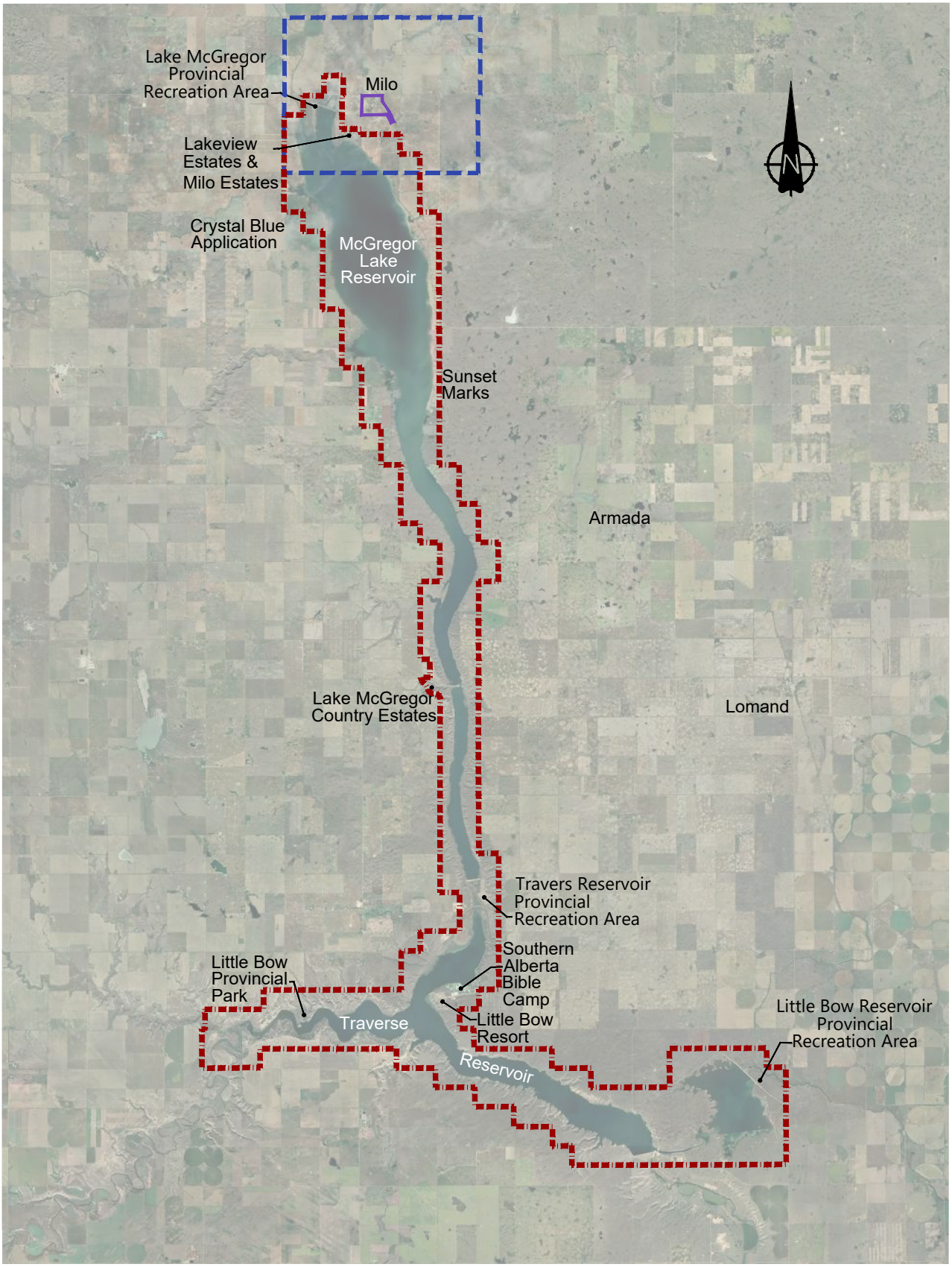
NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Arrowwood/Vulcan County IDP Boundary
- Vulcan County/MD of Taber IDP Boundary

FIGURE 1

PLAN LOCATION



NTS

LEGEND

- ASP Boundary
- Proposed IDP Boundary
- Milo Village Boundary

FIGURE 2

PLAN AREA

2-2 ENVIRONMENT AND TOPOGRAPHY

The Reservoir ASP is located in the Grassland Natural Region and in two Natural Subregions; the Dry Mixed-grass and the Mixed-grass. Natural vegetation in the region consists of short grasses, bunch grasses and long grasses. Woody plants such as trembling aspen, balsam poplar, eastern cottonwood, willow and other shrubs grow in valleys and coulees where more moisture is available. Vegetation surrounding the ASP area is mainly cultivated. Within the plan area, the land nearest the reservoir appears to be largely native grassland and coulees oriented toward the reservoir. Soils are primarily Orthic Dark Brown Chernozemic with a few pockets of well-drained Orthic Gleysols on steep, eroded slopes and Orthic Gleysols in damp depressed areas around the reservoir.

The plan area is characterized by eroded glacial meltwater channels within the Oldman River drainage basin. Topography varies, ranging from gently sloping shores in the north to deep coulees and steep slopes in the southwest. General conditions are outlined in **Appendix B – Desktop Environmental Review.**

2-3 LAND OWNERSHIP

A breakdown of land ownership within the plan area at the time of adoption is as follows (ownership is shown on **Figure 3 – Land Ownership**):

Table 1 – Ownership List

OWNER	APPROXIMATE AREA*
Crown Lands	6,500 ha
County Lands	105 ha
Private Ownership	4,410 ha
Reservoirs	8,290 ha
Total ASP Area	19,305 ha

*Areas are approximate only and subject to rounding.

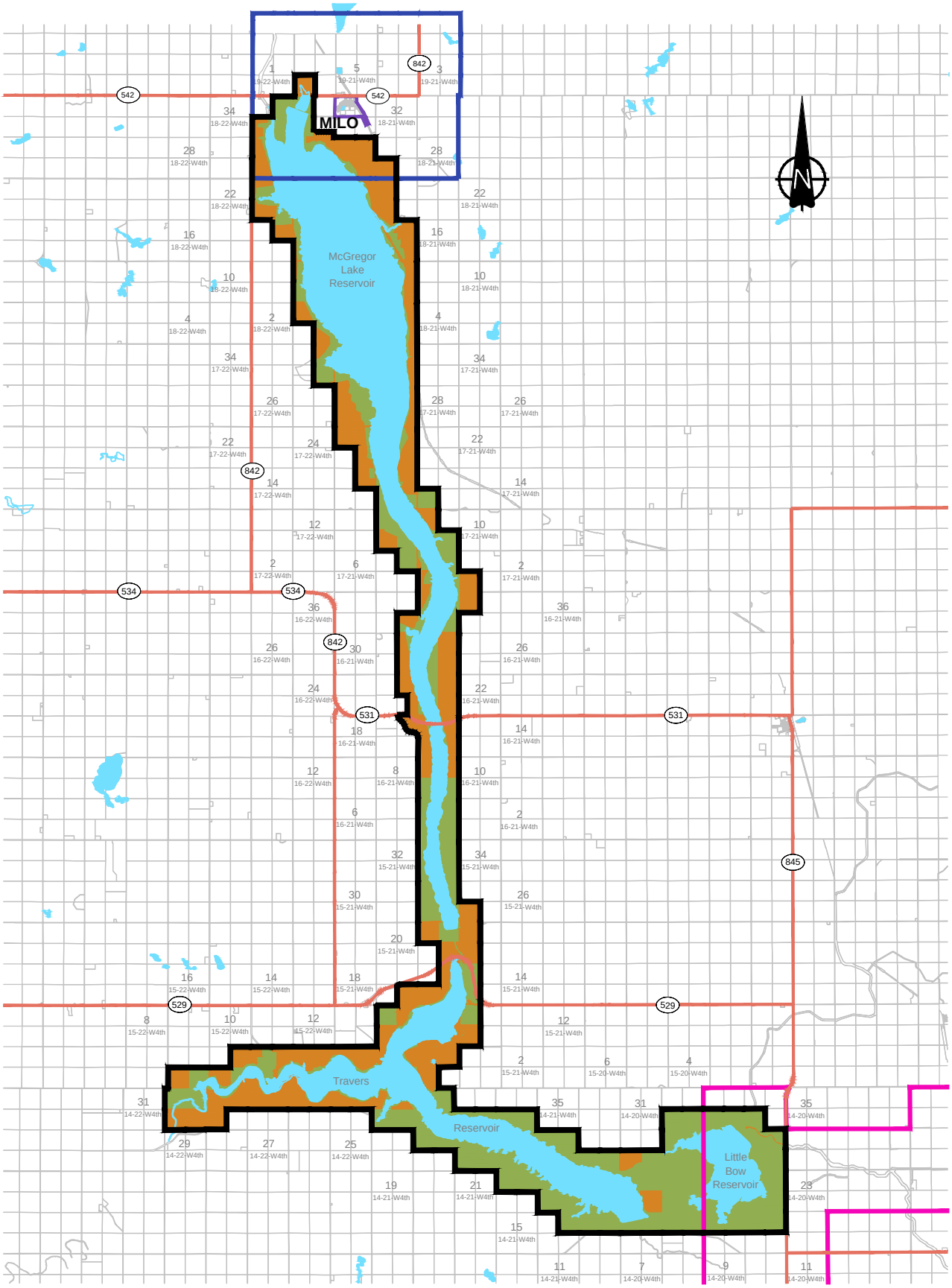
2-4 EXISTING USES

The plan area is predominantly designated as Reservoir Vicinity (RV) District to allow agricultural and non-agricultural uses to meet increasing pressures for development, without compromising the irrigation function of the reservoirs. The majority of the reservoir fringe areas consist of a mix of extensive agricultural uses and natural areas. Portions of the ASP area are also designated as Urban Fringe (UF) District and Rural Recreational (RR) District as shown on **Figure 4 – Current Land Use**.

Existing development in the plan area includes:

- **Lakeview Estates & Milo Estates:** Approximately 35 lots situated southwest of Milo on the west shore of McGregor Lake.
- **Lake McGregor Provincial Recreation Area:** Approximately 100 sites suitable for RVs and tents, supporting activities that include sailing, wind surfing, water skiing, canoeing and fishing.

- **Sunset Marks:** Approximately 20, predominately deep lots, all with water access on the east shore of McGregor Lake.
- **Lake McGregor Country Estates:** Mix of approximately 100 RV lots and approximately 75 larger lots with frame houses, plus an indoor/outdoor pool, recreation area and community hall.
- **Lake McGregor Landing:** The Landing is a 15 lot subdivision on the west side of Lake McGregor.
- **Southern Alberta Bible Camp:** Approximately seventy-five cabins, plus a lodge and auditorium.
- **Little Bow Resort:** Approximately 150 cottages and approximately 50 undeveloped lots for recreational users, full time residents and seasonal residents.
- **Little Bow Provincial Recreation Area:** 110-ha area Provincial Park located on the north shore of the west arm of Travers Reservoir. Established in 1954 and redeveloped in the 1970s and 1980s.
- **Little Bow Reservoir Campground:** A campground consisting of 25 campsites for RV's and tents.
- **Travers Reservoir Provincial Recreation Area:** A campground located in Travers Reservoir Provincial Recreation Area with 32 unserviced campsites.
- **Crystal Blue Harbour Subdivision Application:** An application to subdivide 89 hectares in the northwest area of the ASP Plan area is currently being considered by the County. This proposed subdivision would see 432 single family units established. Further details are provided in **Appendix E - Crystal Blue Harbour Subdivision Application**.

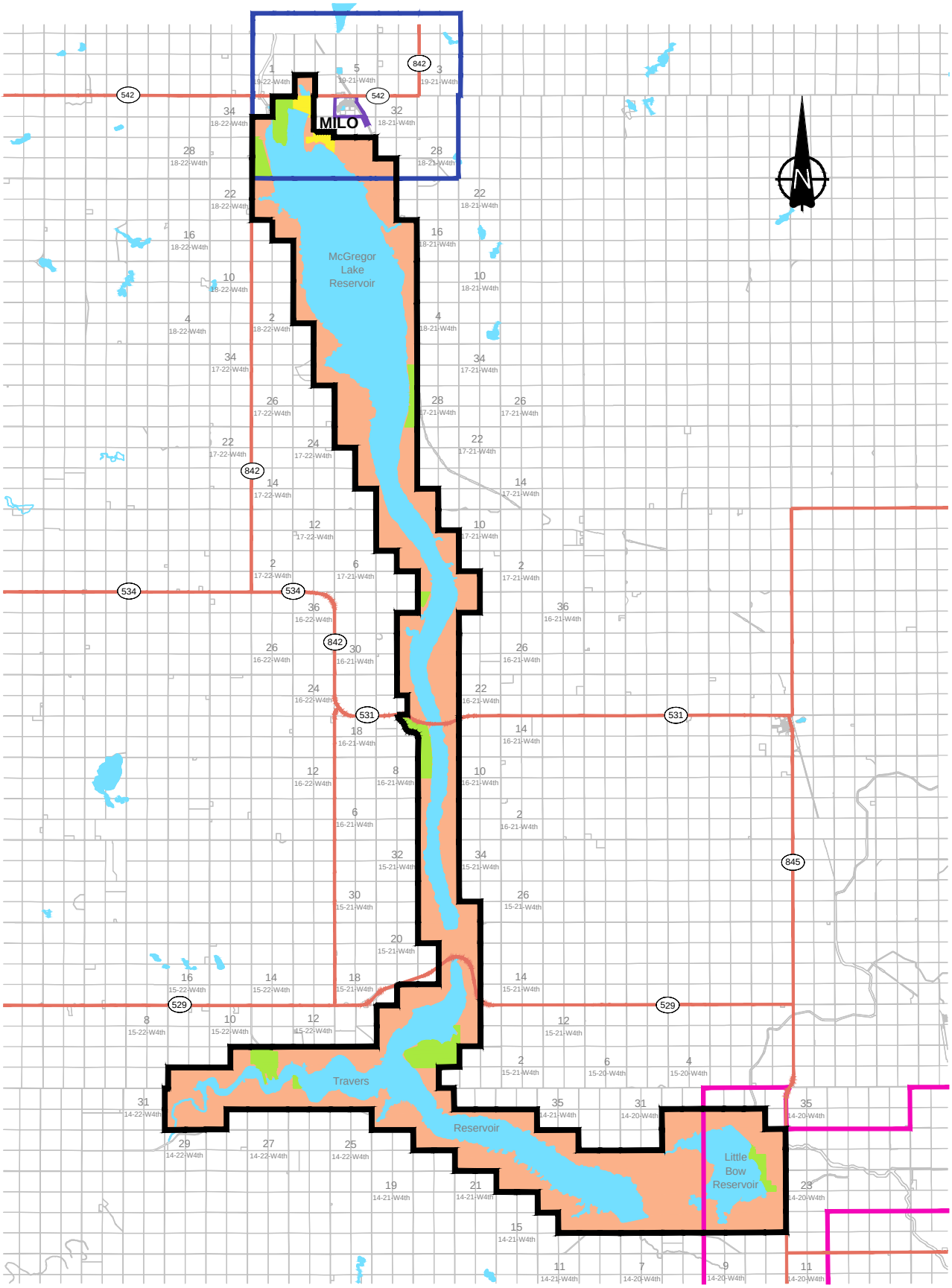


NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Milo Village Boundary
- Vulcan County/MD of Taber IDP Boundary
- Crown Owned Land
- Private Ownership
- Highway

FIGURE 3
LAND OWNERSHIP



NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Milo Village Boundary
- Vulcan County/MD of Taber IDP Boundary
- (RR) Rural Recreational
- (RV) Reservoir Vicinity
- (UF) Urban Fringe
- Waterbody
- Highway

FIGURE 4
CURRENT LAND USE

2-5 GROWTH PROJECTIONS

It is difficult to determine projections for full buildout potential of the plan area at this time because future development will depend on more detailed planning studies to identify those portions of the plan area that are realistically able to be developed.

Constraints to development include environmentally sensitive lands, serviceability of the lands, infrastructure requirements and the ability of the lands to accommodate additional subdivision. Most of these constraints can only be quantified at the time of the proposed development, based on the market and the low probability that all of the agricultural lands and non-developed areas will be converted to accommodate future residential development. Some areas will continue to accommodate agricultural and/or industrial uses.

In order to anticipate residential growth, numbers were generated by assuming only 60% of any parcel could be developable, with the balance accounting for environmental constraints, municipal reserve dedication, infrastructure requirements or development of non-residential uses. The resulting areas were divided by the overall density ranges allowable for specific policy areas to determine the maximum capacity for development. These calculations resulted in a theoretical capacity for a maximum 2,500 additional residential units over the ASP area.

These projections may be unrealistic maximums, at best, but they serve to give an indication of the implications of future development over the long term and well past the anticipated 25-year life of this plan. Further studies will be identified to confirm infrastructure requirements at the Conceptual Scheme stage for residential and non-residential uses.

2-6 RESERVOIR PROTECTION

Travers and McGregor Reservoirs are a source of drinking and irrigation water for developments around the reservoirs and for several towns in the Bow River Irrigation District. They are also major recreational resources for the region.

Key challenges in protecting the reservoirs include:

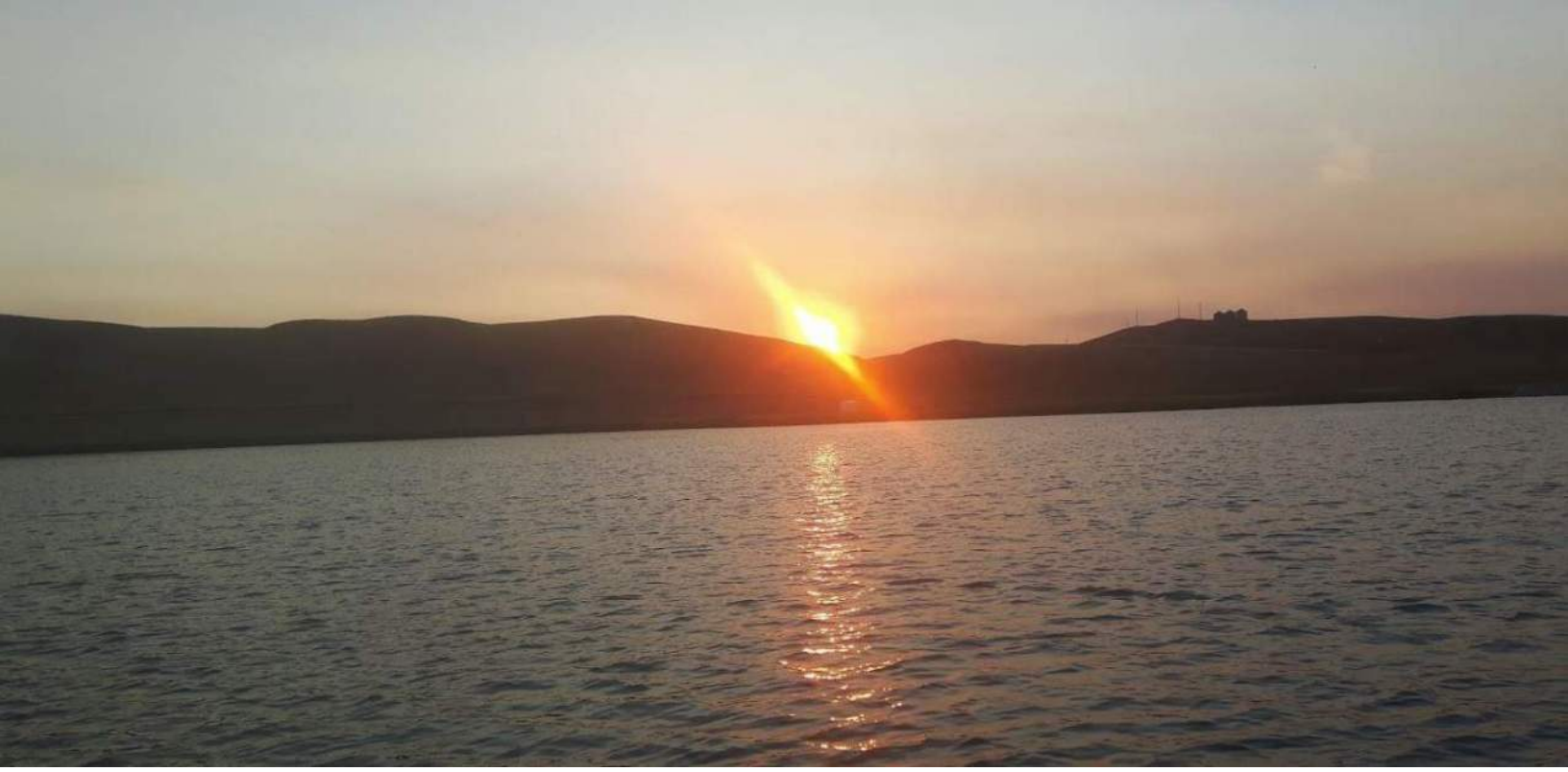
- Shoreline erosion which can affect the quality of water,
- Loss of vegetation along the shores,
- Wave action caused by high speed boats,
- Pollution of the water from motorboat use, and
- Seasonal residency.

Efforts to limit damage to environmentally sensitive areas along the reservoir shorelines and preserve water quality are encouraged. Minimum setbacks from the high-level waterline of the reservoir will be determined by a qualified professional based on site specific evaluation and erosion mitigation strategies presented in any current County of Vulcan erosion assessment studies.

2-7 PLAN AREA CONTEXT AND CONSTRAINTS

Analysis of the current context of the Vulcan County Reservoir Area Structure Plan was undertaken to identify constraints that may impact future development. Primary constraints within the Plan area are described below. Policy within the ASP has been crafted to proactively address these constraints.

- **Reservoir Protection:** The water-supply function of the reservoirs could be threatened by development which could cause potential contamination risk or, with respect to shoreline development, exacerbate erosion issues.
- **Natural Resource Development:** There is a significant number of oil and gas wells and high-pressure lines, particularly in the Lake McGregor area. Required setbacks may limit development in these areas.
- **Significant Crown Owned Lands:** A clear understanding of how Crown lands may be divested, acquired and ultimately developed will require communication and cooperation between the County, the Crown and developers.
- **Servicing Infrastructure:** The lack of water and sewer servicing in the communities limits the amount of growth and development that can occur in the area.
- **Adjacent Agricultural Uses:** Development has the potential to impact agricultural lands and the rural character they support.
- **Increased Usership of Reservoirs:** Increased usership has the potential to threaten the natural environment and negatively impact the existing rural character of the reservoir area, however access to the water needs to be maintained for all stakeholders including residential, agricultural, industrial and recreational users.



SECTION THREE

Development Concept

3

This section introduces the Development Concept and related policies to guide future development in the Plan Area.

3-1 PUBLIC CONSULTATION

The Reservoir ASP was developed in consultation with a Citizens Panel consisting of landowners, selected stakeholders and the general public as well as Council and Administration via a series of meetings, workshops and public engagement events. Feedback was used to inform the Development Concept and policies within this plan. Additional public consultation will be required at the Conceptual Scheme stage. Consultation milestones included:

- **Council Workshop (December 4, 2019)** with Council to discuss the vision for the ASP as well opportunities and challenges associated with the Plan Area.
- **Citizen Panel Workshop (December 4, 2019)** with local landowners representing agricultural, acreage, resort community, and developer perspectives to discuss the vision for the ASP, obtain local knowledge of the Plan Area and provide information to be shared with the wider community.
- **Community Open House (December 12, 2019)** for the community to learn about the purpose of the ASP and obtain feedback used to refine the Development Concept and draft ASP.
- **Draft ASP Select Circulation (April 2020)** to present an initial draft Reservoir ASP to landowners and stakeholders within the plan area for review and feedback.
- **Public Hearing (May 20, 2020)** to provide an opportunity for the public to provide comment and to aid Council in its decision to approve the plan as a local bylaw.

3-2 VISION

The Reservoir ASP accommodates future development within the plan area while respecting the values of the adjacent agricultural community, recognizing the critical water-supply role of the reservoirs and supporting recreational opportunities for residents and visitors.

3-3 GUIDING PRINCIPLES

Agricultural Protection

High quality agricultural lands should be protected while still allowing for subdivision and development to occur. Future development should respect agricultural areas within and adjacent to the plan area by avoiding land use conflicts.

Reservoir Protection

The primary consideration for the reservoirs is their water-supply function. Negative impacts of development should be minimized, particularly in areas directly adjacent to reservoirs. Environmental strategies shall be prepared prior to development to demonstrate how negative impacts will be mitigated. Public reservoir access should be provided in a manner that is sensitive to the natural environment.

Environmental Stewardship

Environmentally sensitive areas should be protected from negative development impacts. Innovative approaches such as green infrastructure, water conservation and low impact development are encouraged to achieve environmental sustainability. Natural resources should be respected to avoid destruction or overuse.

High Quality Design

Development should respect and improve on the aesthetics and character of the rural landscape. Design and aesthetic standards should be developed to provide a consistent level of quality throughout the area.

3-4 DEVELOPMENT CONCEPT

The area surrounding the reservoirs accommodates a variety of residential and non-residential uses. The area is particularly attractive to country residential and recreational development but is also well suited for agricultural and industrial based activities. See **Figure 5 – Development Concept.**

Access to the reservoirs is a primary consideration for all users within the Development Concept. Shoreline erosion and potential flooding shall be considered in establishing potential rights-of-way, development setbacks, municipal and environmental reserve.

Policy Areas were delineated based upon contextual factors which included their degree of access to existing transportation routes, current localized land use, existing subdivision and development patterns, proximity to neighbouring municipalities, topography and natural area characteristics. High level policies have been developed for each of policy areas that reflect their unique position within the greater ASP area.

The overall policy areas are shown on **Figure 6 – ASP Policy Areas** and in detail in:

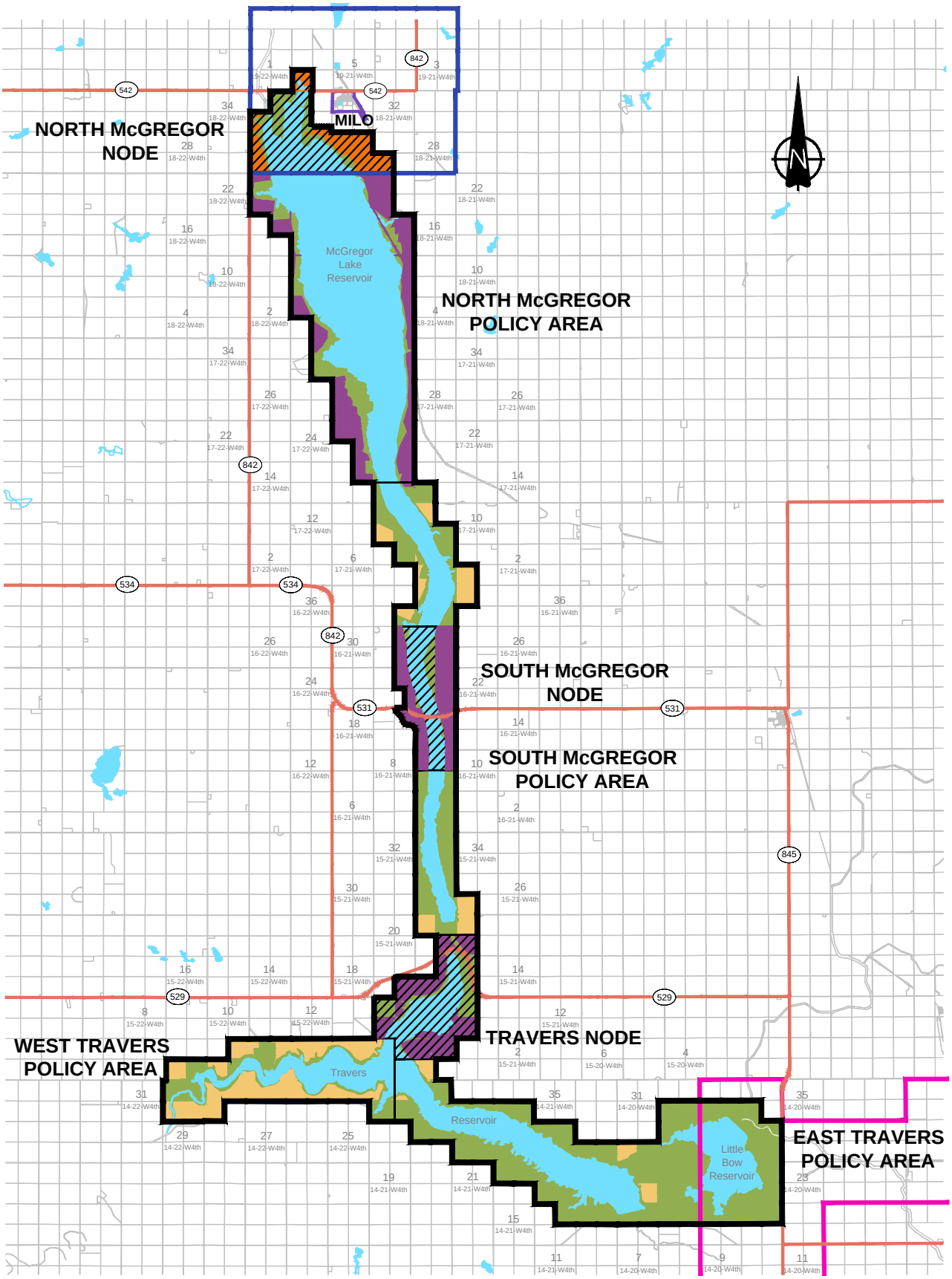
Figure 7 – North McGregor Development Concept

Figure 8 – South McGregor Development Concept

Figure 9 – Travers Development Concept

Identification of the distinct Policy Areas is useful in characterizing the geographic areas that lie within the Plan area and reference to them is made consistently throughout the Plan. Lands within the ASP are relatively homogeneous in nature. Developing distinct visions and policies for each of the Policy Areas within the ASP, while pragmatic, would suggest differences in the underlying values and interests of residents and stakeholders that seem not to really exist. As a result, the ASP generally addresses the entire Plan area, distinguishing where appropriate between the Policy Areas, including specific guidelines for Nodes within each of the areas, where existing conditions lend themselves to a higher intensity of future residential development.

The ASP requires the development of Conceptual Schemes for comprehensive development proposals. Site specific analysis of plan areas will be required as part of a Conceptual Scheme application as outlined in **Section 12 – Plan Implementation** and **Appendix A – Conceptual Scheme Requirements**. Smaller development proposals not requiring a Conceptual Scheme will need to demonstrate that the proposed lot size is adequate to accommodate the proposed servicing strategy.

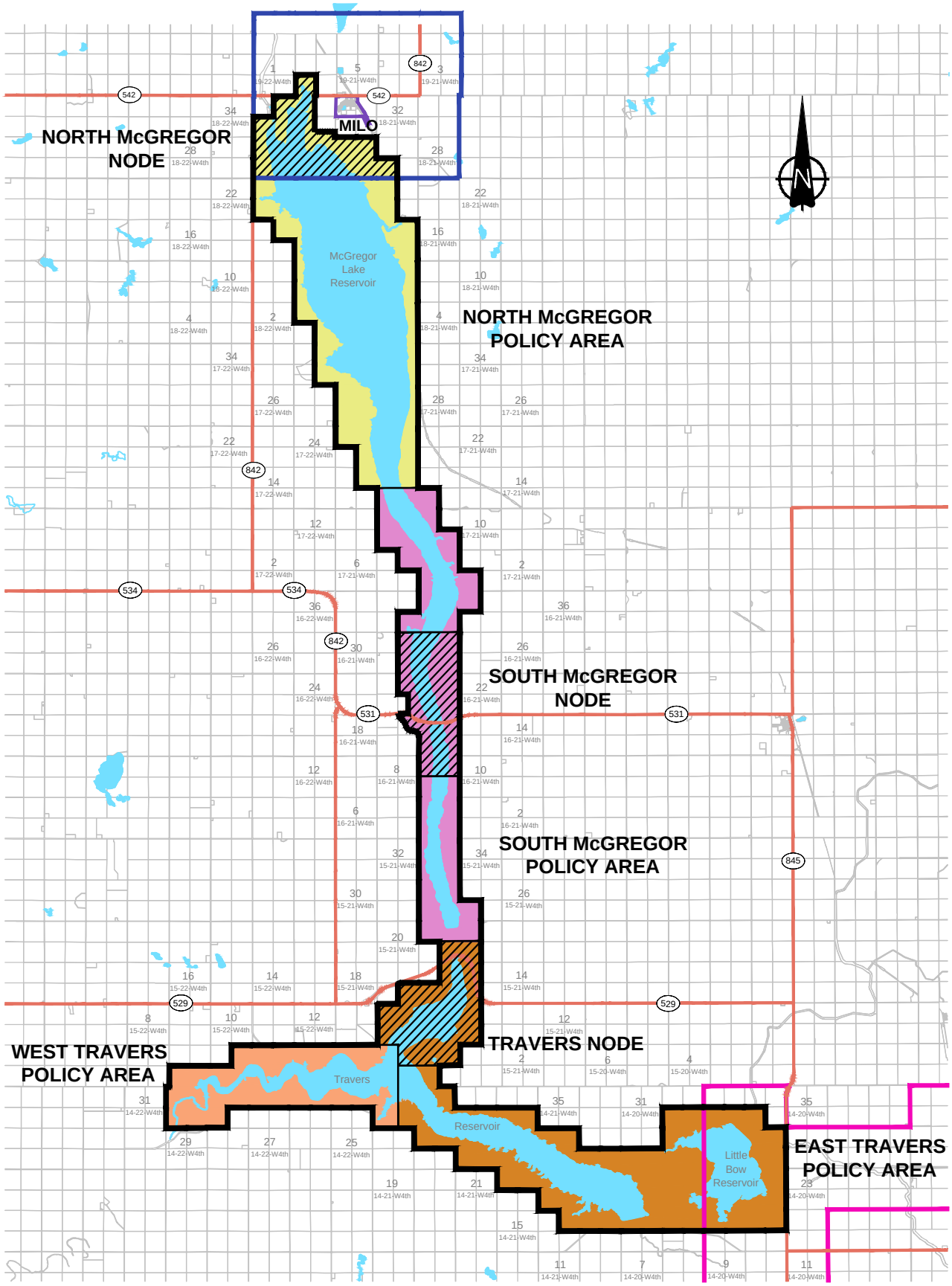


NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Milo Village Boundary
- Vulcan County/MD of Taber IDP Boundary
- Highway
- Future Development Type 1 Min lot size TBD
- Future Development Type 2 Min lot size 1 ac±
- Future Development Type 3 Min lot size 4 ac±
- Crown Owned Lands

FIGURE 5
DEVELOPMENT CONCEPT



NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Milo Village Boundary
- Vulcan County/MD of Taber IDP Boundary
- Highway
- North McGregor Policy Area
- North McGregor Node
- South McGregor Policy Area
- South McGregor Node
- East Travers Policy Area
- Travers Node
- West Travers Policy Area

FIGURE 6
ASP POLICY AREAS

SECTION FOUR

North McGregor Policy Area

4

This section outlines policies that apply only to the North McGregor policy area.

4-1 GENERAL POLICIES

The North McGregor Policy Area is characterized by convenient access and existing country residential development located on the eastern shore of McGregor Lake. This Policy Area is well suited for moderate intensity residential development with a focus on lakeside residences and supporting recreational infrastructure (e.g. marina's or boat launches). Ensuring continued access to the reservoirs for residents and visitors will be an important consideration for future development in this area.

There is also the potential for re-subdivision of existing country residential parcels to increase density in areas with existing servicing infrastructure. Importance will be placed on ensuring continued public access to the reservoir for residents and visitors. The majority of future residential growth for the ASP is anticipated to occur in this area. Policies have been developed to ensure that development is compatible with existing development and the rural character of the area. Residential development will generally be limited to minimum lot sizes of 0.4 hectares. Non-residential development will be evaluated on a case by case basis.

Recommended Uses

- Residential
- Recreational
- Agriculture

Policy 4.1.1	Future development should not negatively impact the quality of existing development.
Policy 4.1.2	Country Residential lots shall be at least 0.4 hectares in size.

Policy 4.1.3	Redevelopment of existing Country Residential lots shall be permitted if the newly created lots are a minimum 0.4 hectares in size.
Policy 4.1.4	Low-density residential development is encouraged in vacant and undeveloped residential lots.
Policy 4.1.5	Grouped Country Residential development or housing clusters with lots less than 0.4 hectares in size may be considered as part of a Conceptual Scheme.
Policy 4.1.6	Opportunities to integrate recreational infrastructure within or adjacent to grouped Country Residential development are encouraged.
Policy 4.1.7	Only one single family dwelling shall be permitted on a country residential lot unless the lot is subdivided to accommodate additional dwellings. The resulting lot sizes shall comply with the County's LUB.
Policy 4.1.8	Non-residential uses and lot sizes shall be determined on a case by case basis.
Policy 4.1.9	A servicing strategy including water, sanitary and stormwater management options shall be submitted as part of a Conceptual Scheme application.
Policy 4.1.10	Public Engagement shall be required for Conceptual Schemes.

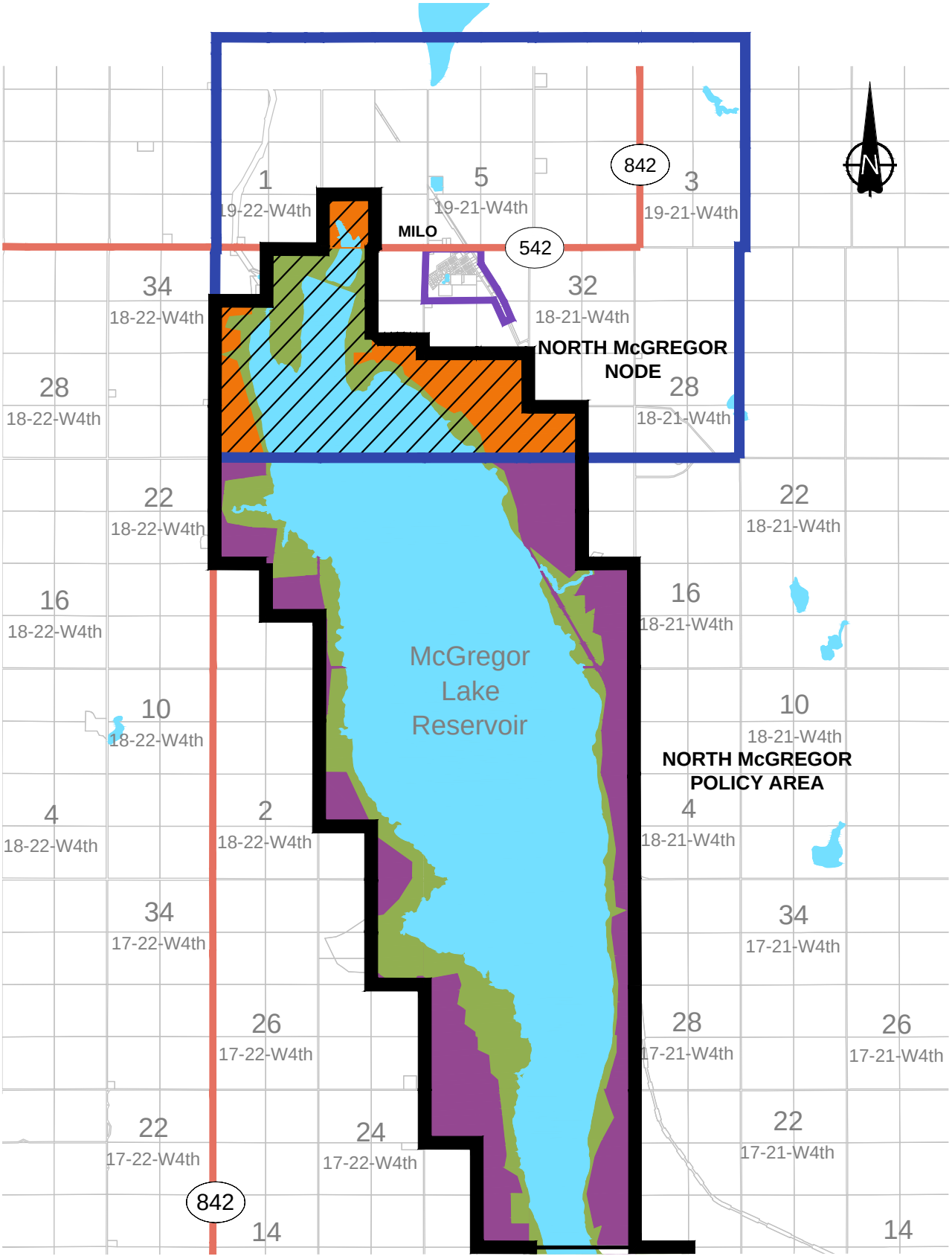
4-2 NORTH MCGREGOR NODE

The North McGregor Node is unique with its proximity to Milo and access from Highways 542 and 842. The Node area falls within the Vulcan County/Milo Intermunicipal Development Plan (IDP) boundaries. Policies for this area reflect the importance of collaboration between the County and Village regarding any development proposed within the Node. Given the existing development within the Node, its proximity to Milo and convenient access, the node is anticipated to accommodate a higher level of residential and recreational development intensity aimed at establishing a vibrant community.

Recommended Uses

- Residential
- Recreational
- Agriculture

Policy 4.2.1	Development shall comply with IDP policies.
Policy 4.2.2	Conceptual Schemes shall be required to demonstrate how development will respect existing development.
Policy 4.2.3	The Village of Milo shall be circulated on Conceptual Scheme applications.
Policy 4.2.4	The minimum lot size for Country Residential development shall be 0.8 ha.
Policy 4.2.5	Grouped Residential development or housing clusters with lots less than 0.8 hectares in size may be considered as part of a Conceptual Scheme.
Policy 4.2.6	Opportunities to integrate recreational infrastructure within or adjacent to Grouped Residential development are encouraged.



NTS

LEGEND

- ASP Boundary
- Vulcan County/Village of Milo IDP Boundary
- Milo Village Boundary
- Highway
- Future Development Type 1 Min lot size 2 ac
- Future Development Type 2 Min lot size 1 ac
- Future Development Type 3 Min lot size 4 ac
- Crown Owned Lands

FIGURE 7
NORTH McGREGOR DEVELOPMENT CONCEPT

SECTION FIVE

South McGregor Policy Area

5

This section outlines policies that apply only to the South McGregor policy area.

5-1 GENERAL POLICIES

The South McGregor Policy Area consists primarily of Crown owned lands with limited road access. Given the extent of Crown ownership it is not anticipated that this area will accommodate significant residential growth. Country residential development may be feasible on privately owned lands. Residential development should adhere to architectural controls aimed at protecting rural character. Mitigating development impacts on surrounding natural areas is a primary consideration for this area. There may be some potential for rural industrial development to occur within private lands located in this area if access can be shown to be feasible and such development is separated from any proposed residential areas by appropriate distance or buffers. Residential development will generally be limited to minimum lot sizes of 1.6 hectares. The area will continue to accommodate agricultural uses and agri-business proposals shall be evaluated on a case by case basis.

Recommended Uses

- Limited Country Residential Development
- Limited Rural Industrial
- Agriculture

Policy 5.1.1	Future development should not negatively impact the quality of existing development.
Policy 5.1.2	Country Residential lots shall be at least 1.6 hectares in size.

Policy 5.1.3	Grouped Country Residential development or housing clusters with lots less than 1.6 hectares in size may be considered as a part of a Conceptual Scheme.
Policy 5.1.4	Landscaping treatment shall be included at each point of access into Rural Industrial sites.
Policy 5.1.5	Landscaping of individual Rural Industrial sites shall visually enhance the industrial area and, where applicable, provide a visual screen from roads or adjacent residential or recreational uses. Only one single family dwelling shall be permitted on a country residential lot unless the lot is subdivided to accommodate additional dwellings. The resulting lot sizes shall comply with the County's LUB.
Policy 5.1.6	Rural industrial subdivisions may be considered in suitable areas and will require a Conceptual Scheme.
Policy 5.1.7	Agri- business proposals shall be considered on a case by case basis.
Policy 5.1.8	A servicing strategy including water, sanitary and stormwater management options shall be submitted as part of a Conceptual Scheme application.
Policy 5.1.9	Public Engagement shall be required for Conceptual Schemes.

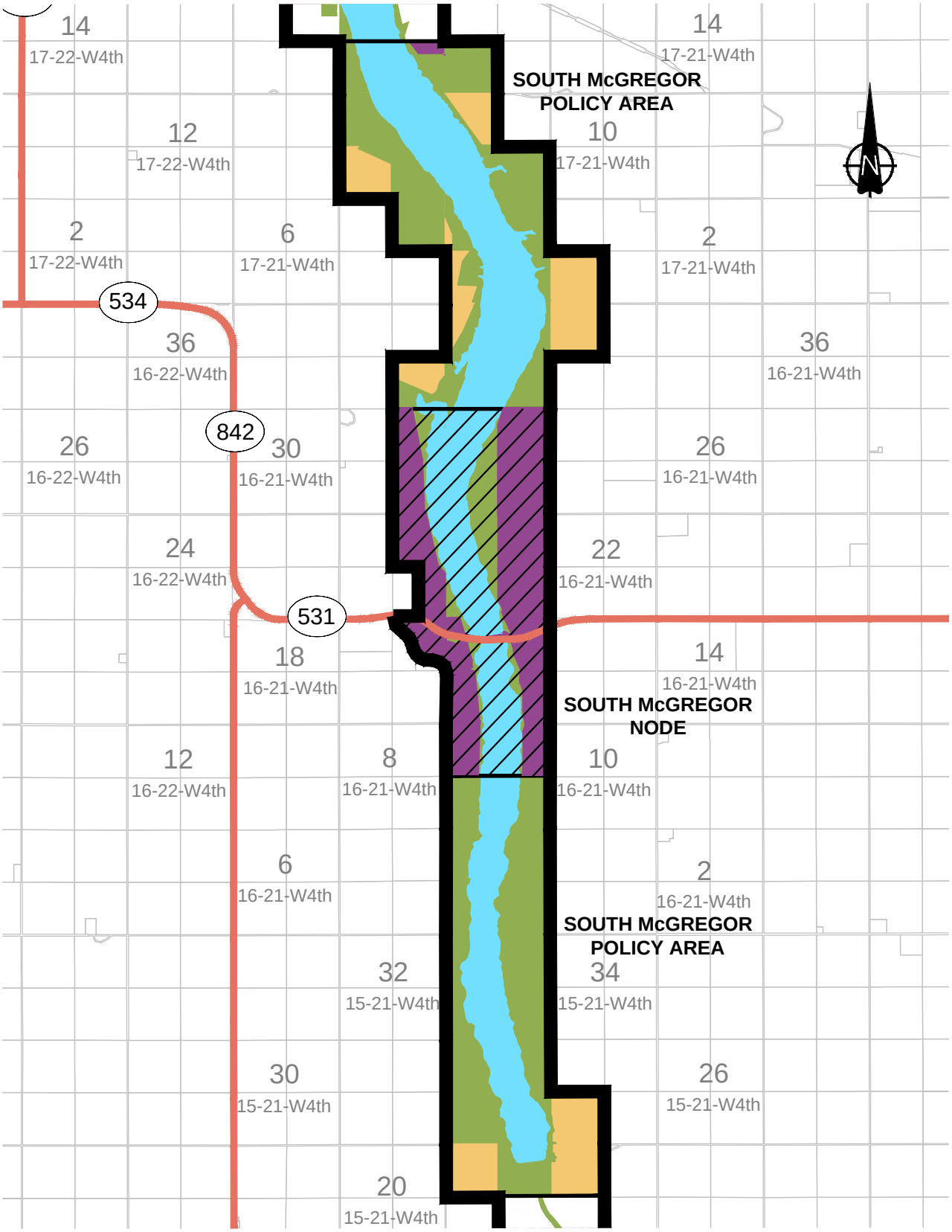
5-2 SOUTH MCGREGOR NODE

The South McGregor Node Policy Area is home to existing development in the form of the Lake McGregor Country Estates subdivision on the west side of Lake McGregor. This Node provides an opportunity for additional moderate intensity residential development as Highway 531 provides convenient access to the area. While the South McGregor Node is not envisioned as being as intensive as the North McGregor Node, can potentially support comprehensive residential development. The Node also provides an opportunity to establish communal recreation infrastructure which could include a boat launch in proximity to the bridge that accommodates the Highway 531 crossing.

Recommended Uses

- Comprehensive Residential
- Recreational
- Agriculture

Policy 5.2.1	Country Residential lots shall be at least 0.4 hectares in size.
Policy 5.2.2	Grouped Country Residential development or housing clusters with lots less than 0.4 hectares in size may be considered as a part of a Conceptual Scheme.
Policy 5.2.3	Redevelopment of existing Country Residential lots shall be permitted if the newly created lots are at least 0.4 ha.
Policy 5.2.4	The development of new recreation facilities for both active and passive uses is encouraged in the policy area.



NTS

LEGEND

- ASP Boundary
- Highway
- Future Development Type 1 Min lot size TBD
- Future Development Type 2 Min lot size 1 ac±
- Future Development Type 3 Min lot size 4 ac±
- Crown Owned Lands

FIGURE 8
SOUTH McGREGOR DEVELOPMENT CONCEPT

SECTION SIX

Travers Policy Area

6

This section outlines policies that apply only to the Travers policy area.

The Travers Policy Area includes the lands in proximity to the Travers Reservoir including the Little Bow Reservoir on the eastern edge of the ASP area.

6-1 WEST TRAVERS

The West Travers Policy Area is significantly constrained by steep sloped terrain. Existing development in this area includes the Travers Ridge RV Resort. Policy direction specific to this development is contained in **Appendix D – Travers Ridge RV Park Area Structure Plan.**

The feasibility of development here in the West Travers area is significantly constrained by steep topography and limited available access. This area is best suited for low intensity residential uses, limited recreational uses, agricultural uses which may include livestock grazing leases. Residential development will generally be limited to minimum lot sizes of 1.6 hectares.

Recommended Uses

- Limited Country Residential
- Limited Recreational
- Agriculture

Policy 6.1.1	Future development should not negatively impact the quality of existing development.

Policy 6.1.2	Any future RV Park development within the Travers Ridge RV Resort shall conform to the policies within Travers Ridge RV Park ASP.
Policy 6.1.3	Any Country Residential or RV Park development within the Policy Area shall not negatively impact existing development or natural areas.
Policy 6.1.4	Country Residential lots shall be permitted if the newly created lots are at least 1.6 hectares in size.
Policy 6.1.5	Grouped Country Residential development or housing clusters with lots less than 1.6 hectares in size may be considered as a part of a Conceptual Scheme.
Policy 6.1.6	Existing access to the Travers Ridge RV Resort shall not be impacted by future development unless alternate access has been provided to the satisfaction of the Approval Authority.
Policy 6.1.7	Existing servicing to the Travers Ridge RV Resort shall not be negatively impacted by future development.
Policy 6.1.8	Only one single family dwelling shall be permitted on a country residential lot unless the lot is subdivided to accommodate additional dwellings. The resulting lot sizes shall comply with the County's LUB
Policy 6.1.9	Areas of unstable slopes should be dedicated as Environmental Reserve or environmental easements.
Policy 6.1.10	A servicing strategy including water, sanitary and stormwater management options shall be submitted as part of a Conceptual Scheme application.
Policy 6.1.11	Public Engagement shall be required for Conceptual Schemes.

6-2 EAST TRAVERS

The East Travers Policy Area consists primarily of Crown Owned Lands. The potential for moderate or high intensity residential development is limited. The area holds some potential for limited industrial or recreational uses on Crown-lease. The East Travers Policy Area includes the Little Bow Reservoir. Residential development will generally be limited to minimum lot sizes of 1.6 hectares. A portion of the East Travers Policy Area falls within the Vulcan County/Municipal District of Taber Intermunicipal Development Plan (IDP) boundary.

Recommended Uses

- Limited Country Residential
- Limited Rural Industrial
- Limited Recreational

Policy 6.2.1	Development shall comply with IDP policies.
Policy 6.2.2	Country Residential lots shall be permitted if the newly created lots are at least 1.6 hectares in size.
Policy 6.2.3	Grouped Country Residential development or housing clusters with lots less than 1.6 hectares in size may be considered as a part of a Conceptual Scheme.
Policy 6.2.4	Landscaping treatment shall be included at points of access into Rural Industrial sites.

Policy 6.2.5	Landscaping of individual rural industrial sites shall visually enhance the area and, where applicable, provide a visual screen from roads or other sensitive adjacencies such as residential, environmental or recreational uses.
Policy 6.2.6	Any proposals for innovative energy generation (solar power, wind energy generation), shall be circulated to appropriate Provincial Authorities.
Policy 6.2.7	A servicing strategy including water, sanitary and stormwater management options shall be submitted as part of a Conceptual Scheme application.
Policy 6.2.8	Public Engagement shall be required for Conceptual Schemes.

6-3 TRAVERS NODE

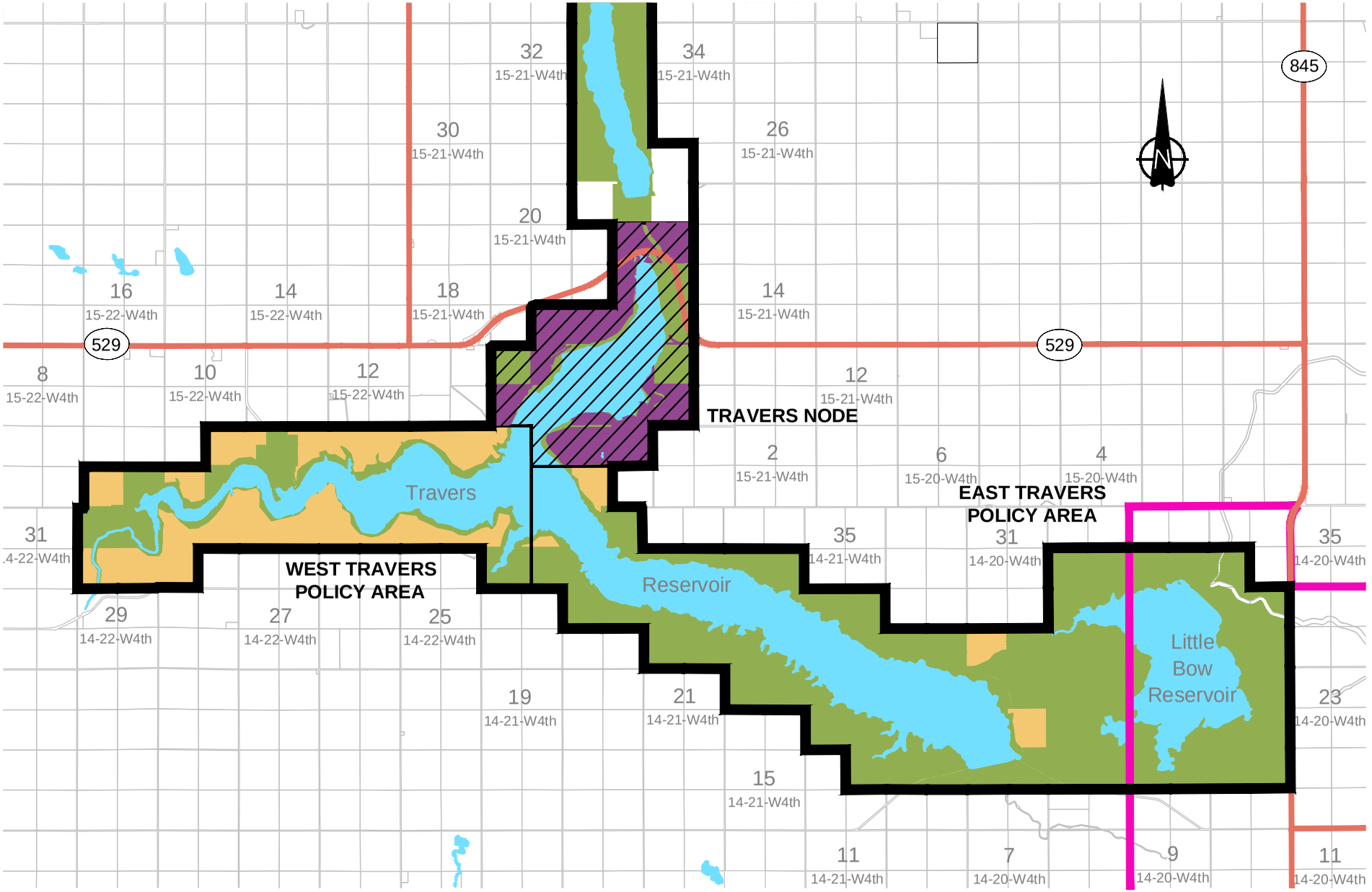
Access to the Travers Policy Area is provided from Highway 529. This area is suited for medium intensity grouped county residential development or clustered housing. Existing development in this area includes the Southern Alberta Bible Camp and the Little Bow Resort.

Based on the nature of existing development within the Node and availability of convenient access, the area is anticipated to accommodate a higher level of development intensity focused on supporting recreational amenities. This may be achieved through seasonal residences and vacation rental properties.

Recommended Uses

- Grouped County Residential
- Potential Commercial/ Private Recreation
- Agriculture

Policy 6.3.1	Grouped Country Residential development or housing clusters with lots less than 1.6 hectares in size may be considered as part of a Conceptual Scheme.
Policy 6.3.2	Commercial vacation homes may be considered within the Node.
Policy 6.3.3	Home-based businesses with limited outside storage may be considered within the Node.



NTS

LEGEND

- ASP Boundary
- Vulcan County/MD of Taber IDP Boundary
- Highway
- Future Development Type 1 Min lot size TBD
- Future Development Type 2 Min lot size 1 ac±
- Future Development Type 3 Min lot size 4 ac±
- Crown Owned Lands

FIGURE 9
TRAVERS DEVELOPMENT CONCEPT

SECTION SEVEN 7

Agriculture and Industry

This section outlines plan-wide policies that address existing and future agricultural operations and potential industrial uses within the plan area.

A significant portion of the ASP area accommodates extensive agricultural operations. High quality agricultural lands should be protected. Enhancement of agricultural operations and development of associated agri-business opportunities should be supported as long as proposed development does not negatively impact existing development or environmentally sensitive areas. Existing grazing leases on Crown lands shall operate according to provincial direction and comply with applicable provincial environmental regulations.

7-1 AGRICULTURE

The reservoirs were constructed to provide irrigation water for agriculture, and although the use of the reservoirs also includes recreational activities, recreational development should not compromise water supply function.

Policy 7.1.1	Redesignation and subdivision for new or expanded agricultural uses that preserve the integrity of riparian areas and reservoir water quality may be considered.
Policy 7.1.2	New agricultural uses and development should not negatively impact adjacent development.
Policy 7.1.3	The introduction of confined feeding operations shall not be permitted.

Policy 7.1.4	Agri- business proposals shall be considered on a case by case basis.
Policy 7.1.5	The size and location of any proposed residential or industrial lots or parcels shall not significantly affect the irrigation infrastructure of the area or any farm irrigation systems.

7-2 INDUSTRY

Portions of the ASP area are appropriate for the development of industrial uses including oil and gas and renewable resource sectors. Future development should be supported as long as proposed development does not negatively impact existing development or environmentally sensitive areas.

Policy 7.2.1	Proposed industrial uses will require a Land Use Amendment.
Policy 7.2.2	Redesignation and subdivision for new or expanded industrial uses that preserve the integrity of riparian areas and reservoir water quality may be considered.
Policy 7.2.3	New industrial development should not negatively impact adjacent development

SECTION EIGHT

Open Space and Environment 8

This section outlines plan-wide policies designed to protect the local environment and provide recreational amenities within the plan area.

Environmental stewardship is a key principle of the ASP. Negative effects of development should be minimized to protect the reservoirs and environmentally sensitive areas within the area. Policies have been developed to avoid damage to natural areas and prohibit overuse of amenities.

8-1 PUBLIC OPEN SPACE AND RECREATION

Public Open Space is defined as an undeveloped green space either privately owned or operated by a municipality.

Development within the ASP area should maximize recreational opportunities afforded by the reservoirs while protecting the integrity of the natural landscape and existing development. These policies address the integration of recreational amenities into the natural environment.

Policy 8.1.1	Open space/natural areas may be used for camping or other recreation initiatives at the discretion of the Development Authority.
Policy 8.1.2	Municipal Reserves shall generally be taken as cash-in-lieu at the discretion of the County.
Policy 8.1.3	When Municipal Reserves are dedicated as land, the location and function should provide opportunities for improving or enhancing the communal recreation, public facilities and access to the reservoirs.

Policy 8.1.4	Public open spaces intended to provide for organized recreational activities should be located within close proximity of existing or proposed public facilities.
Policy 8.1.5	Public open spaces shall be maintained.

8-2 ENVIRONMENTAL PROTECTION

The purpose of the policies below is to ensure the natural environment is respected as future development occurs within the Plan area.

Policy 8.2.1	Impacts of development on the natural environment or identified sensitive environmental areas should be mitigated.
Policy 8.2.2	Wherever possible, development should attempt to minimize disturbance and significant removal of vegetation within the plan area.
Policy 8.2.3	Developments shall comply with provincial and federal regulations that restrict development activities that are likely to impact fish and fish habitat.
Policy 8.2.4	Developments on slopes steeper than 15% are discouraged.
Policy 8.2.5	A Geotechnical Report will be required for any development proposals for lands with slopes greater than 15 percent.
Policy 8.2.6	Environmental Reserve shall be dedicated per the MGA.

8-3 RESERVOIR PROTECTION

Reservoirs have unique operational and maintenance characteristics that differentiate them from natural lakes. Unlike lakes, reservoirs may have extreme water level fluctuations and therefore the potential for erosion and instability. Alberta Environment and the BRID typically plan for annual over land runoff and adjust discharge rates to prevent downstream flooding on the Little Bow and Bow River. The prime function of reservoirs is to supply water for irrigation purposes. Development on lands adjacent to the reservoirs should not impact the water supply function of the reservoirs.

Policy 8.3.1	Future development should not negatively impact the water supply function of the reservoirs.
Policy 8.3.2	Development on lands adjacent the reservoirs shall not impact the operation or maintenance of the reservoirs.
Policy 8.3.3	Ongoing opportunities for public education programs designed to promote an understanding and awareness of the important water supply function of the reservoirs should be encouraged.
Policy 8.3.4	An erosion control strategy shall be prepared as part of all Conceptual Scheme applications.

8-4 RIPARIAN AREAS

Riparian areas are strips of land that border water bodies. Healthy riparian areas function to maintain water quality, slow runoff, reduce flood damage, encourage groundwater recharge, help to control erosion and sediment or contaminants from entering the water, provide fish habitat and sustain biodiversity for a variety of wildlife species.

Policy 8.4.1	Subdivision within a riparian buffer shall provide appropriate measures to ensure the protection of the riparian buffer, including, but not limited to restrictive covenants, or environmental easements.
Policy 8.4.2	Environmental easements shall be dedicated to preserve and maintain habitat and natural connectivity between riparian areas.
Policy 8.4.3	Development proposals in or near riparian areas shall comply with Alberta's long-term water strategy.
Policy 8.4.4	An erosion control strategy shall be prepared as part of all Conceptual Scheme applications.

SECTION NINE

Crown Lands

9

This section outlines plan-wide policies designed to address how development can occur on Crown owned lands.

9-1 CROWN LANDS

Provincial Crown lands comprise almost 36 percent of the land base in the proposed area structure plan. These lands are administered and managed by a number of provincial agencies which have different mandates. Various types of dispositions (lease arrangements, licences and permits) are issued for the use of surface and subsurface resources on public land, primarily for grazing, cultivation, and mineral exploration and development.

Provincial agencies may engage in planning exercises to provide management direction for provincial Crown land and resources located within the ASP.

Policy 9.1.1	Private individuals or interest groups obtaining Crown leases shall be bound by the Alberta Environment and Parks regulations and best management practices.
Policy 9.1.2	Development on Crown lands shall be compatible with adjacent private lands wherever possible in order to minimize conflict.
Policy 9.1.3	Development occurring in proximity to the provincial lease lands located within the Plan area shall provide appropriate buffers.
Policy 9.1.4	Development occurring in proximity to Little Bow and McGregor Provincial Parks shall respect and buffer the integrity and nature of the park.

SECTION TEN 10

Servicing

This section outlines how water, sanitary and stormwater services are provided for throughout the plan area.

10-1 GENERAL SERVICING

The following policies apply to the development of infrastructure servicing within the plan area. Further details on servicing requirements are provided in **Appendix C – Servicing Review**.

Policy 10.1.1	A developer shall provide, or enter into an agreement to provide, the utility rights-of-way or easements necessary to accommodate the extension of infrastructure through or adjacent to a site to allow for servicing.
Policy 10.1.2	Servicing shall be aligned to avoid environmentally sensitive areas. Temporary disturbance shall be reclaimed to the satisfaction of the Development Authority.
Policy 10.1.3	Detailed design of shallow utilities shall be determined at the Subdivision stage.
Policy 10.1.4	The developer shall be responsible for the provision of these services and extension from adjacent developed/developing areas.

10-2 WATER SERVICING

The water servicing policies have been developed to provide a framework for the design of water supply, treatment and distribution infrastructure. These facilities may need to be upgraded as development proceeds in other areas of the ASP to ensure adequate water supply.

Policy 10.2.1	Further analysis shall be required at the Conceptual Scheme stage to demonstrate that the proposed distribution system is adequate.
Policy 10.2.2	Water consumption reduction measures shall be considered where possible.

10-3 SANITARY SEWER SERVICING

The sanitary servicing policies have been developed to provide a framework for the design of wastewater conveyance, treatment and disposal infrastructure.

Policy 10.3.1	Wastewater flow reduction measures shall be considered where possible.
Policy 10.3.2	Further analysis shall be required at the Conceptual Scheme stage to demonstrate that the proposed waster water collection system is adequate.

10-4 STORMWATER MANAGEMENT

Appropriate facilities for stormwater management are proposed throughout the plan area to control stormwater runoff release rates and quality as well as alleviate the impact of post-development flows on water bodies and drainage courses.

Policy 10.4.1	The maximum allowable area release rate from proposed stormwater management facilities shall be 1.16 L/s/ha.
Policy 10.4.2	Stormwater quality treatment of stormwater management facilities shall be at minimum 85% removal of particles 75 microns and larger on an annual basis under the 1:100 year rainfall event.
Policy 10.4.3	Erosion mitigation measures shall be incorporated by developers to ensure there are no adverse impacts to existing drainage channels and surrounding areas.
Policy 10.4.4	A localized Master Drainage Plan or Stormwater Management Report shall be required at the Conceptual Scheme stage to demonstrate that the proposed stormwater conveyance system and stormwater management facilities are adequate a well as detail any localized erosion risks and provide mitigation options focused on naturalized techniques.
Policy 10.4.5	The use of source control Best Management Practices shall be encouraged to reduce the total runoff volume and enhance stormwater treatment
Policy 10.4.6	Engineered natural stormwater wetlands may be integrated within environmentally sensitive areas to ensure long-term sustainability in a manner that continues to provide viable habitat.

SECTION ELEVEN 11

Transportation

This section outlines how access is provided for future development and how pedestrians and cyclists will be accommodated within the plan area.

11-1 TRANSPORTATION

The provision of a safe and efficient road network is essential to provide access to existing and future development and to assure public and private access to the reservoirs.

Roads within the transportation network have been divided into five categories based on their physical characteristics and role as transportation routes. The hierarchy of roads in the plan area should accommodate the safe and efficient flow of traffic through the area. This hierarchy consists of:

- **Level 1 Provincial Highways** focus on the movement of people, goods and services inter-provincially and internationally. Access onto Level 1 highways is restricted and typically via arterial roads. There are no Level 1 highways in the ASP area.
- **Level 2 Provincial Highway (arterial roads)** focus on the movement of people, goods and services within and between provinces only. Level 2 highways are typically connected to other highways or collector roads. Within the ASP area, Highway 845 is a Level 2 highway.
- **Level 3 Provincial Highways** provide connections between communities and commercial and industrial developments. Level 3 highways are typically connected to arterial and local roads. Within the ASP area, Highway 842 (except section between Highway 531 and Highway 529), Highway 534, Highway 531, Highway 529 are Level 3 highways.

- **Level 4 Provincial Highway (local roads)** provide access for localized traffic. Highway 842 between Highway 531 and Highway 529 are Level 4 highways.

- **Paved and Gravel County roads** typically provide direct access to residential homes and businesses. The county roads are connected to Level 2 and Level 3 Highway.

Policy 11.1.1	Any upgrading or new construction of roads to accommodate a proposed use shall be built to municipal standards, taking into account ditch drainage capacity and direction of drainage, and these standards shall be specified in a development agreement.
Policy 11.1.2	New road construction which would have an adverse effect on critical wildlife habitats or environmentally significant areas shall be discouraged.
Policy 11.1.3	Vehicular access points to developments shall have regard for traffic safety.
Policy 11.1.4	Adequate parking for recreational or country residential developments shall be provided on site.
Policy 11.1.5	A roadside development permit from Alberta Transportation is required when a development is located within Alberta Transportation's development control zone, which is 300m from a provincial right-of-way and more than 800 metres from the centerline of a highway and public road intersection.
Policy 11.1.6	A transportation impact assessment shall be prepared for a major residential or recreational development which generates over 100 vehicular trips per hour during the peak hour to the satisfaction of Vulcan County and/or Alberta Transportation.
Policy 11.1.7	Notwithstanding **Policy 11.1.6**, a Traffic Impact Assessment (TIA) may be required even if the development generate less than 100 trips in the peak hour due to specific conditions or requirements to be determined at later stages of development.

11-2 CONNECTIVITY

Connectivity for pedestrians and cyclists is an important component to future residential development in the Reservoirs ASP. Developers are encouraged to provide pedestrian and cycling routes and trails as part of Conceptual Scheme applications to provide an integrated network within their comprehensive development.

Policy 11.2.1	At the Conceptual Plan stage, pedestrian and cyclist connectivity shall be identified.
Policy 11.2.2	Trail standards and associated signage shall be consistent with County standards.
Policy 11.2.3	Shoreline Trails shall be encouraged.

SECTION TWELVE 12

Plan Implementation

This section outlines the proposed sequence of development and the process required to proceed with future planning applications.

12-1 CIRCULATION AND COLLABORATION

The encouragement of responsible development within the ASP boundary entails the making of decisions with the best information available as some areas are more appropriate to locate specific developments than others due to environmental constraints, ease of servicing, legal and physical access and compatibility with adjacent land uses. In order to obtain the best information available, a thorough circulation system to agencies and provincial departments with professional expertise is essential for land use redesignation, subdivisions and, when appropriate, development applications. As noted, a portion of the ASP Plan area in the north falls within the Vulcan County/Village of Milo Intermunicipal Development Plan (IDP) boundary and a portion of the Plan area in the southeast falls within the Vulcan County/Municipal District of Taber IDP boundary. These municipalities will be circulated on applications within their specific IDP referral areas and where any conflict arises between the policies of the Reservoir ASP and a specific IDP, the IDP will take precedent.

Policy 12.1.1 When making decisions on subdivision and development applications consideration shall be given to

- applicable provincial regulation, municipal plans or bylaws, and

- comments of any provincial government departments or agencies that were circulated the application.

Policy 12.1.2 Alberta Environment and Parks shall be circulated on all development adjacent to Crown land.

Policy 12.1.3 The Bow River Irrigation District shall be circulated on all development applications.

Policy 12.1.4 The Alberta Energy Regulator (AER) shall be circulated on all development within 100 metres of an oil/gas well and 1.5 kilometres of a sour gas facility.

Policy 12.1.5 The County shall be informed of any disposition of Crown lands.

12-2 CONCEPTUAL SCHEMES

Conceptual Schemes are an important component of long-range planning and are intended to establish a plan and rationale for future development, based on a comprehensive analysis of the site opportunities and constraints. Given the size and complexity of the ASP area, future development will be subject to the approval of a Conceptual Scheme which will address site specific servicing strategies and development details.

Requirements for Conceptual Schemes are outlined in **Appendix A – Conceptual Scheme Requirements**.

Policy 12.2.1 Development proposals for areas larger than 2.0 hectares will require a Conceptual Scheme.

Policy 12.2.2 The density for comprehensive residential developments larger than 2.0 hectares will be determined through a Conceptual Scheme.

Policy 12.2.3 Development Proposals with lot sizes that do not conform to the specific policy areas will require a conceptual scheme.

Policy 12.2.4 Parcel sizes for non-residential development shall be considered on a case by case basis.

Policy 12.2.5 Comprehensive developments should provide effective emergency response access.

Policy 12.2.6 Notwithstanding policy 12.2.1, redesignation and subdivision may proceed in the absence of a Conceptual Scheme when the following criteria are met:

- direct road access is available,
- one (1) lot is being created from a parcel whose boundaries are defined at the time of adoption of this plan,
- the proposed lot is less than 2 hectares,
- the creation of the new lot will not adversely affect or impede future subdivision of the balance lands,
- servicing details are provided, and
- lot sizes are adequate to accommodate the proposed servicing.

Policy 12.2.7	Within a comprehensive residential development outside of the Node areas, a Conceptual Scheme shall be required to support all redesignation and/or subdivision applications.
Policy 12.2.8	Conceptual schemes shall be adopted by Council, by Bylaw.

12-3 SEQUENCE OF DEVELOPMENT

Development within the Plan area shall occur in a manner that is consistent with the opportunities and constraints of the existing transportation and servicing network.

Policy 12.3.1	The sequence of development of the Reservoir ASP: • shall be informed by patterns of growth management that consider infrastructure, servicing availability, environmental stewardship, and the topography of land, and • shall occur through a staged approach.
Policy 12.3.2	At the Conceptual Scheme stage, variances to the proposed sequence of development shall be permitted so long as an acceptable strategy to provide the required infrastructure has been supplied and the development is justified to the satisfaction of the Development Authority.

Appendix A

Conceptual Scheme Requirements

Appendix A

Conceptual Scheme Requirements

The following items identified by Administration comprise a complete Conceptual Scheme Application:

- ☐ A copy of the Certificate(s) of Title
- ☐ Copies of any restrictive covenants, utility rights-of-way, easements or caveats registered on the Title(s)
- ☐ All required application fees
- ☐ A letter of authorization from the landowner if the applicant is not the landowner
- ☐ Abandoned well declaration form (if applicable)
- ☐ Ten (10) copies of the proposed Conceptual Scheme (map) and a digital (PDF) copy, at a minimum scale of 1:2000, with all dimensions and areas in metric showing:
  - north arrow
  - legal description
  - Conceptual Scheme boundary
  - ownership boundaries (if different from Conceptual Scheme boundary)
  - the plan location
  - proposed land uses
  - land development statistics
  - proposed street names
  - existing contours with a minimum contour interval of 1.5 metres
  - the proposed road system identifying road standards, any road closures, and any temporary and emergency access roads and turnarounds
  - layout of proposed and existing utility systems (water, sanitary and storm), including high-pressure gas lines, pipelines, and overhead powerlines and associated setbacks

    Note: Detailed design of shallow utility alignments shall be determined at the subdivision stage
  - proposed reserve land such as municipal reserve (MR) and environmental reserve (ER) etc.
  - existing vegetation, water bodies and any unique species or topographical features
  - offsite infrastructure required to service and access the Outline Plan area, and
  - any public facilities identified in the ASP

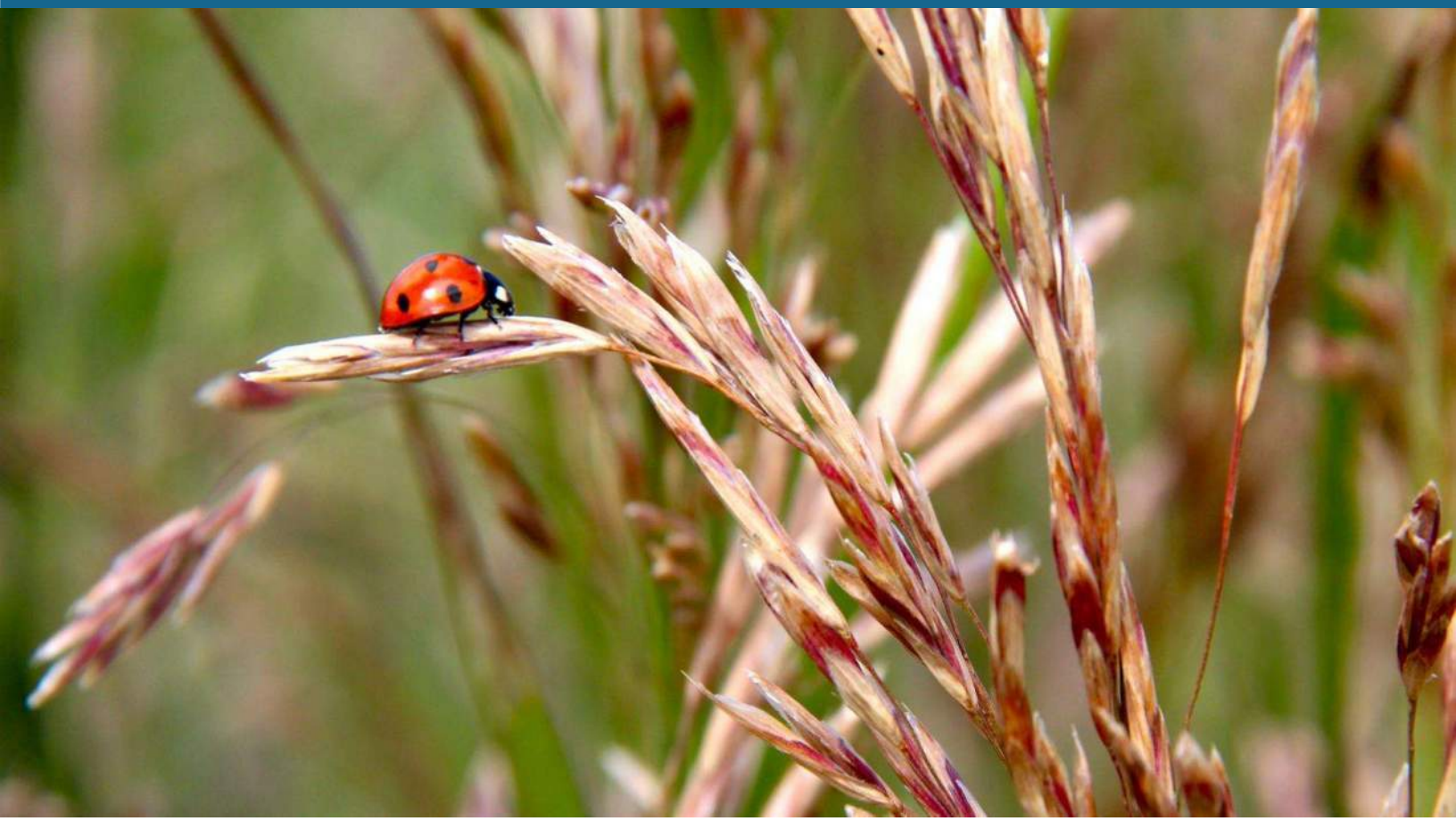
- □ Six (6) copies of the Conceptual Scheme Report and a digital (PDF) copy which includes:
  - design rationale
  - explanation of any unique design features of the Conceptual Scheme
  - justification for proposed land uses
  - reserve analysis that determines the amount of reserve owing
  - any buffering and nuisance mitigation measures
  - phasing plan (map) that identifies the sequence of development for the Conceptual Scheme
  - information on existing edge conditions that may have an influence on the Conceptual Scheme
  - location of sour gas wells and facilities within 1.5 kilometres of the Conceptual Scheme area
  - public engagement process
- □ Historical Resource Overview (HRO), and if required, a Historical Resource Impact Assessment (HRIA)
- □ Biophysical Impact Assessment (BIA)
- □ Geotechnical Report (including Slope Stability Analysis if any slopes are greater than 15%)
- □ Stormwater Management Plan
- □ Water/Wastewater Servicing Strategies
- □ Traffic Impact Assessment (TIA)

The following studies may also be required to be prepared in support of Conceptual Scheme:

- □ Phase 1 Environmental Site Assessment (ESA)
- □ Groundwater Impact Analysis and Soils Study
- □ Erosion Control Strategy
- □ Architectural Control Guidelines
- □ Any other information required by Council

Appendix B

Desktop Environmental Review



Desktop Environmental Analysis

Reservoir Area Structure Plan

Vulcan County

September 2019

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1.0 Introduction

1.1 Project Description

The Reservoir Area Structure Plan (ASP) area is approximately 19927 hectares in size and surrounds the Travers Reservoir, McGregor Lake and Little Bow Reservoir, located east of the town of Vulcan and west of the Village of Lomond, Alberta. The ASP will address long term planning and development of the anticipated future use of the area, which is currently planned for managing and regulating development around the reservoirs. This Desktop Environmental Analysis is a contributing background report to the ASP.

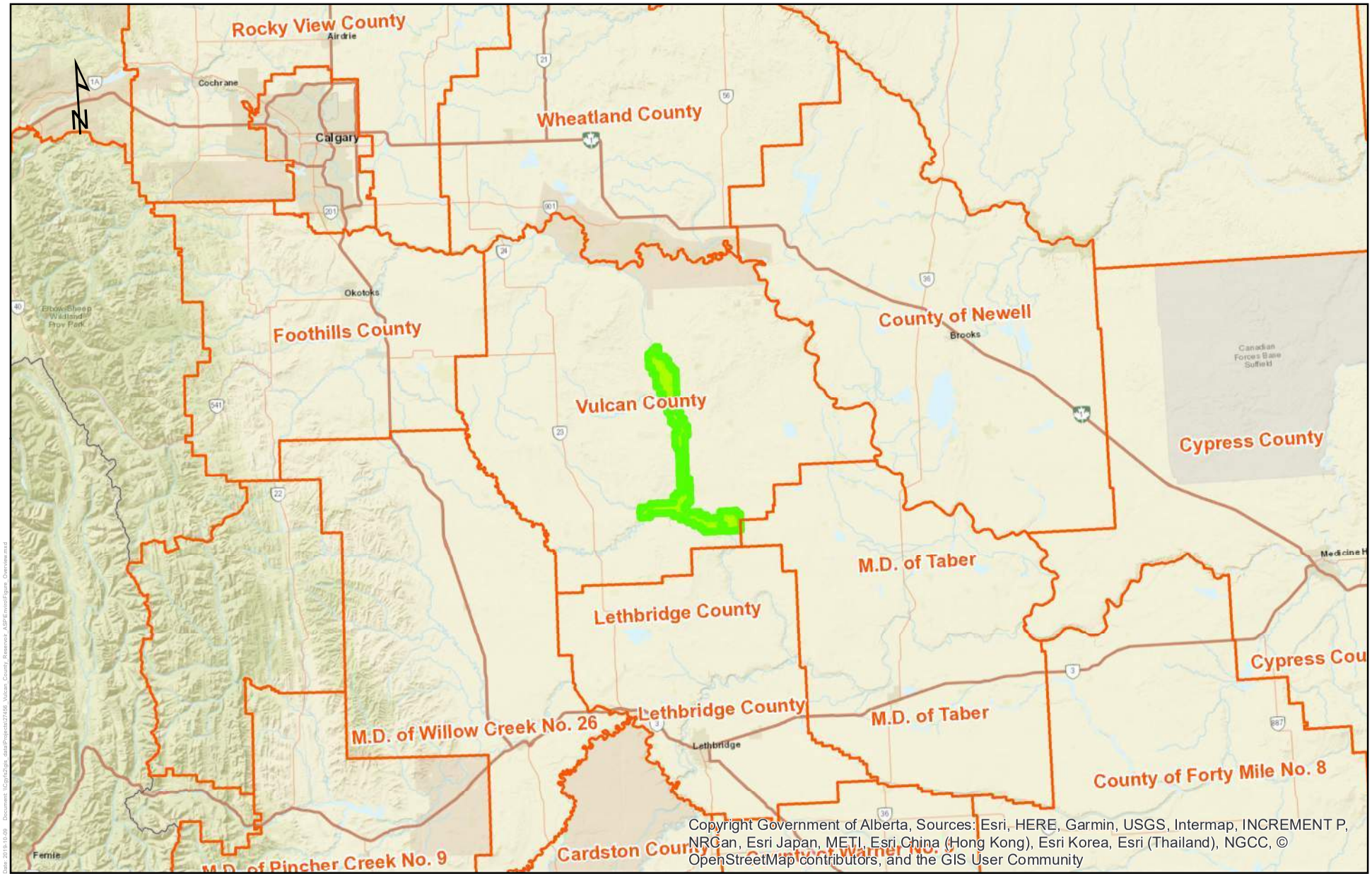
1.2 Desktop Environmental Analysis

The purpose of the Desktop Environmental Analysis is to provide information for future land use planning and engineering decisions as part of the Reservoir ASP.

The review includes:

- A review of provincial databases (e.g., Alberta Conservation Information Management System [ACIMS], Fish and Wildlife Management Information System [FWMIS], Alberta Merged Wetland Inventory [AMWI]),
- A description of recommended environmental features for retention,
- A discussion on regulatory requirements potentially required.

The Desktop Environmental Analysis for the ASP identifies potentially sensitive biological and physical features that may be impacted by future development in the ASP area. The Study Area for this desktop review is defined in Figure 1.1.



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Legend

Approximate ASP Area

0 7,000 14,000 28,000 42,000 m

1:1,300,000

NAD 1983 UTM Zone 12N

FIGURE 1.1

OVERVIEW

2.0
Desktop Methodology

2.1.1 Species of Management Concern Definitions

Species of management concern are any that meet the following criteria:

- Species for which provincial and/or federal restricted activity periods or setback distances exist (Government of Alberta 2011; Environment and Climate Change Canada [ECCC] 2014)
- Species listed to be of Special Concern, Threatened, or Endangered under the *Species at Risk Act (SARA;* Government of Canada 2002), Committee on the Status of Endangered Wildlife (COSEWIC; Government of Canada 2019a) and/or the Alberta Endangered Species Conservation Committee (ESCC; Government of Alberta 2017)
- Species listed as Threatened or Endangered under Schedule 6 of the Wildlife Regulation of the Alberta *Wildlife Act* (Province of Alberta 2000a)
- Wildlife species listed as Sensitive, may be at Risk, or At Risk, according to the General Status of Alberta Wild Species (GSAWS; Alberta Environment and Parks [AEP] 2015)
- Previously identified fish and wildlife species provided by Alberta's Fish and Wildlife Management Information System (FWMIS; AEP 2019a)
- Vegetation species and ecological communities listed on the ACIMS list of Tracked and Watched Elements (ACIMS 2017a-f).

Additional biophysical elements have been included if thought to be of potential concern given their presence or potential presence in the ASP area.

2.1.1 Vegetation

Alberta Conservation Information Management System (ACIMS) element occurrence data was reviewed to identify known rare plant and rare ecological community occurrences in the vicinity of the ASP Area.

2.1.2 Wildlife

ISL conducted a review of the FWMIS database to determine known species occurrences within the ASP Area.

2.1.3 Fish

To determine the presence of fish, and potential for fish habitat in the ASP area, a review of FWMIS and the Base Water Features provincial dataset was conducted.

2.1.4 Wetlands

The Alberta Merged Wetland Inventory (AMWI) is a merged dataset containing a number of wetland delineation products of varying resolution, age, and accuracy. It is not intended to replace fieldwork, however can be used to inform proponents of potential wetlands. The AMWI was examined and is provided in Appendix A.

3.0
Desktop Results

3.1 Land use and Habitat

3.1.1 Natural Subregions

The project is located in the Grassland Natural Region and in two Natural Subregions; the Dry Mixedgrass and the Mixedgrass (Figure 1.2)

Dry Mixedgrass
The Dry Mixedgrass is the largest of the four grassland subregions and is located in the southeast corner of the province. Landscapes in this area are commonly level to gently undulating. This subregion combines the warmest summers and least precipitation of any Natural Subregion in Alberta and is subject to long cold winters with little snow cover. Chinooks are less common than in more westerly subregions. The vegetation in native areas in the subregion is dominated by mixed-height grasslands comprised of blue grama, needle-and-thread, June grass and western wheat grass. Shrublands comprised of silver sagebrush, prickly rose, buckbrush and silverberry occur in depressions or slopes with northerly or easterly aspects. Few trees are present in the subregion and mainly occur in the river valleys and in deep coulees (Natural Regions Committee 2006).

Mixedgrass
The Mixedgrass Natural Subregion is a broad, north-south band of fertile, intensively cultivated prairie in south-central Alberta. It receives slightly higher precipitation than the Dry Mixedgrass to the east and less than the Foothills Fescue to the west. Undulating and hummocky till plains, level lacustrine areas and undulating to hummocky eolian deposits are typical landforms. The Mixedgrass Natural Subregion occurs on well drained, loamy Dark Brown Chernozemic soils. On scattered native prairie remnants northern wheat grass, western wheat grass, needle-and-thread and June grass are dominant. On dry, sandy sites, sand grass form part of the communities. Moister sites are characterized by the addition of blue grama grass to the community. Shrub communities, including buckbrush, silver sagebrush, silverberry and prickly rose, occur in depressions, ravines, and coulees. Adjacent to rivers, tall shrub and forest communities of willows, thorny buffaloberry and narrow-leaf cottonwood or balsam poplar develop. Moisture deficiencies during the summer months may be limiting to crop production and irrigation is sometimes necessary (Natural Regions Committee 2006).

Local Habitat

Vegetation surrounding the ASP area is mainly cultivated. Within the ASP, the land nearest the reservoir appears to be largely native grassland and coulees oriented toward the reservoir.

3.2 Vegetation

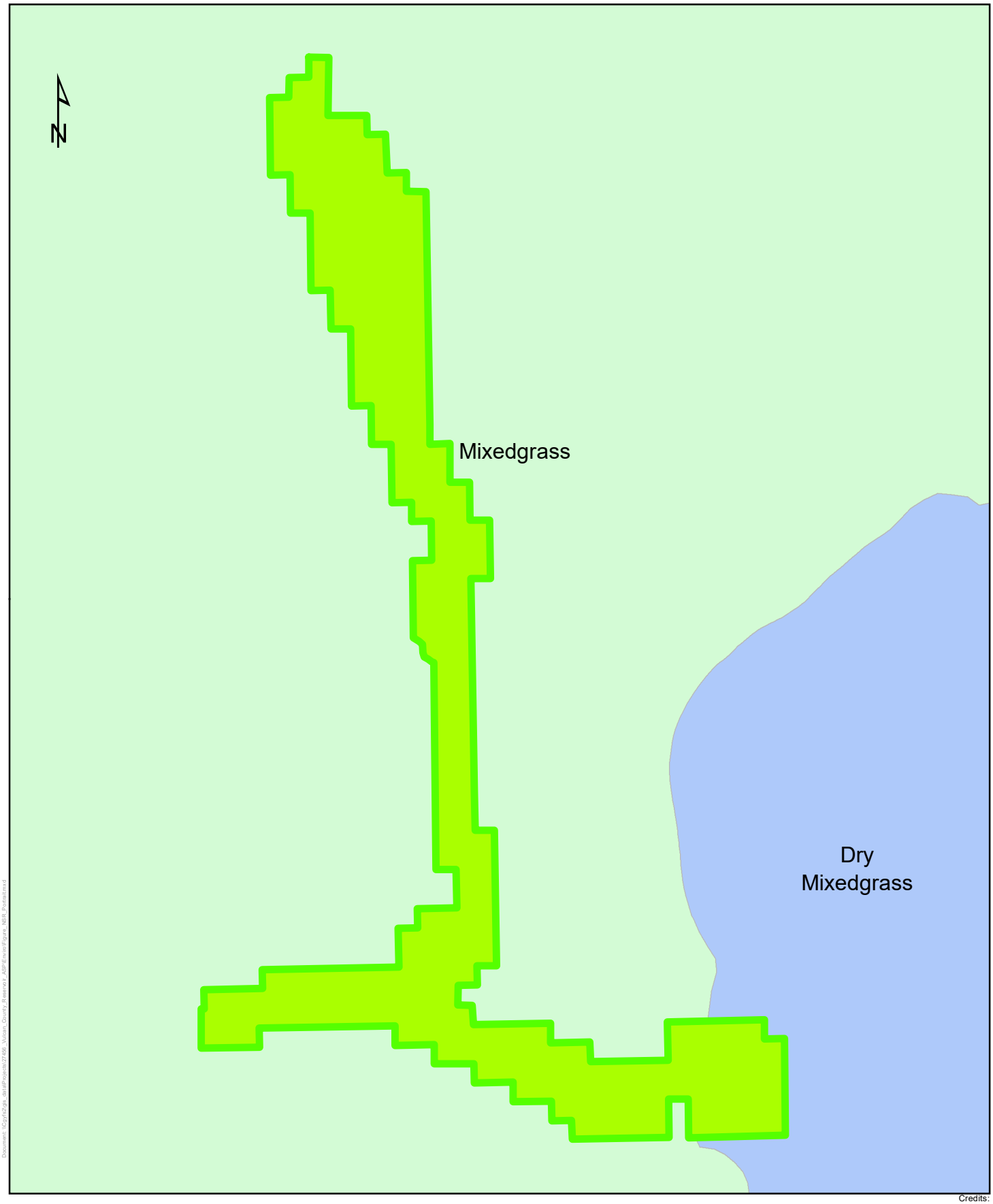
3.2.1 Rare Species

Two rare vascular species historical occurrences are present in the ASP Area; Tumblegrass (*Schedonnardus paniculatus*; Ranked S2) and common beggarticks (*Bidens frondosa*; Ranked S3) (ACIMS 2017a-f). The output from ACIMS is provided in Appendix B and depicted in Figure 1.3. A table of rare vascular plant species known to be in the Dry Mixedgrass and Mixedgrass Natural Subregion is provided in Appendix C.

Numerous species in the Mixedgrass and Drymixedgrass Natural subregions are listed by the *Species At Risk Act* (Government of Canada 2002, 2019a) (Appendix C).

Weeds

Vulcan County has listed Absinthe wormwood (*Artemesia absinthium*) as an increasingly problematic weed species in the County (Vulcan County 2019).



Credits:

ISL

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0 900 1,800 3,600 5,400 7,200 Metres

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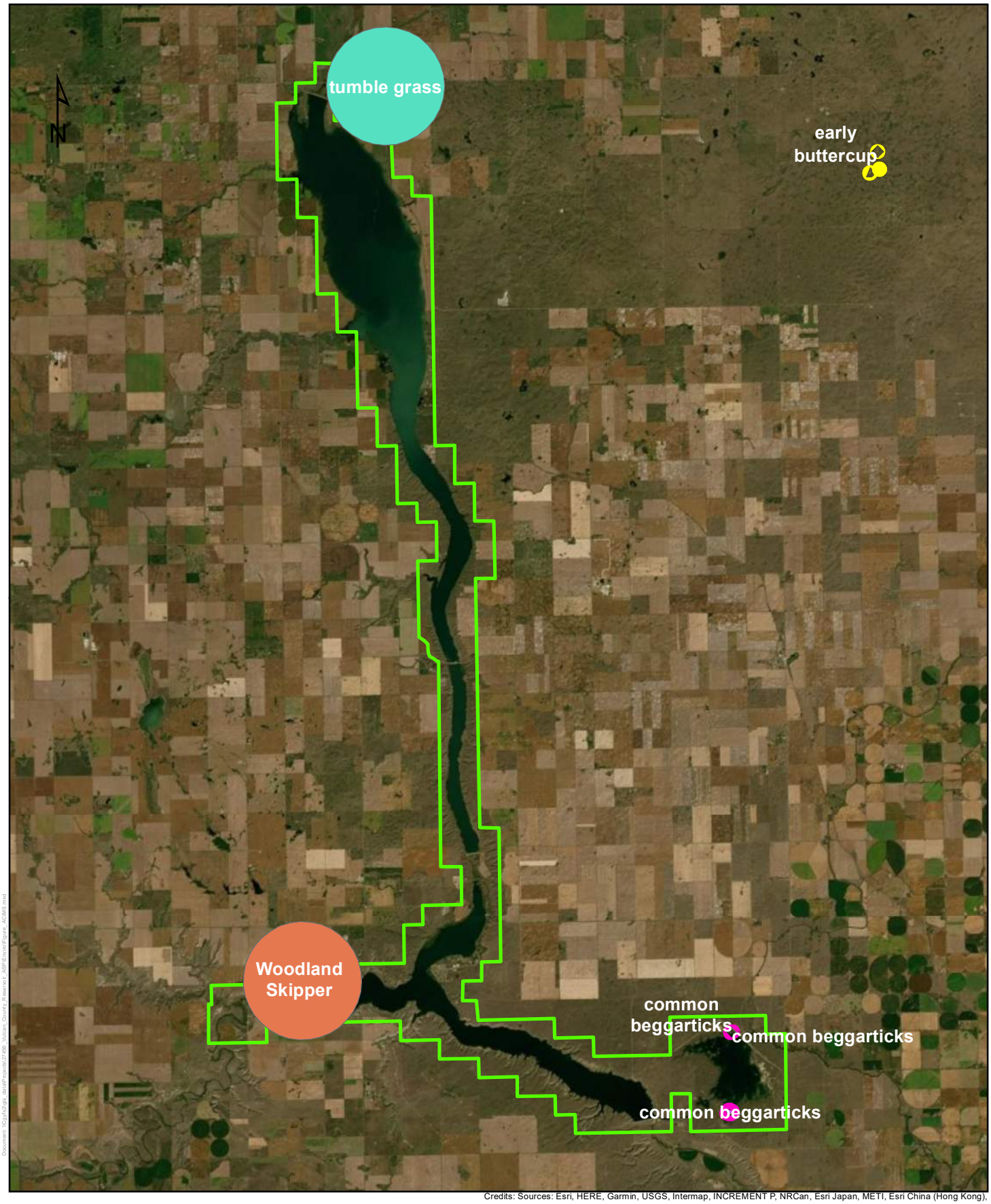
Legend

- Approximate ASP Area
- Dry Mixedgrass
- Mixedgrass

Figure 1.2

NATURAL SUBREGIONS



Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong),

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Legend

ACIMS

Common Name

- Woodland Skipper (invertebrate)
- common beggarticks
- early buttercup
- tumble grass

Vulcan County Reservoir ASP

ACIMS HISTORICAL RARE SPECIES OCCURENCES

3.3 Wildlife

3.3.1 Important Wildlife Habitats

The ASP area is not located within or immediately adjacent to any:

- Ramsar Wetlands of International Importance (Bureau of the Convention on Wetlands 2016);
- Migratory Bird Sanctuaries (Environment and Climate Change Canada 2017a);
- World Biosphere Reserves (United Nations Educations, Scientific Cultural Organization 2015);
- Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network 2019);
- National Wildlife Areas (Government of Canada 2019b);
- Ducks Unlimited Canada Projects (Ducks Unlimited Canada 2019),

The ASP area is located within or immediately adjacent to:

- AB016: McGregor Lake and Travers Reservoir is an Important Bird Area (Bird Studies Canada and Nature Canada 2019);
- Thee Provincial Recreation Areas (PRAs) and one Provincial Park (PP) are in or adjacent to the ASP Area; Little Bow Reservoir PRA, Travers Dam PRA, Lake McGregor PRA, and Little Bow PP (Alberta Environment and Parks 2019b).
- The ASP area is located within Sensitive Raptor Ranges for Ferruginous Hawk, Golden Eagle, and Prairie Falcon, and McGregor Lake is a Piping Plover waterbody (Appendix D). Additionally, the ASP area contains one clonal bird nesting area and is within the Sharp-tailed Grouse Survey area (Appendix D).

3.3.2 Wildlife Species of Concern

Wildlife species listed as ‘tracked’ by ACIMS within the Mixedgrass and Dry Mixedgrass natural subregions are provided in Appendix C. Historical wildlife occurrences within 5km of the ASP area centre are provided in Table 3.1 below and in Appendix E. Numerous Species at Risk have potential to be located in the ASP area, as they are known to exist in the natural subregion.

Table 3.1: Wildlife Species with Historical Occurrences within approximately 5km radius of the ASP Area Centre

Common Name	Scientific Name	Provincial Rank[1,2]	Global Rank; SARA Listing	Notes
Birds				
American Kestrel	*Falco sparverius*	S5B; Sensitive	G5	Track on a watch list only
American White Pelican	*Pelecanus erythrorhynchos*	S2S3B; Sensitive	G4	Track all extant and selected historical EOs
Badger	*Taxidea taxus*	S4; Sensitive	G5; Special Concern	Track on a watch list only
Baird's Sparrow	*Ammodramus bairdii*	S3B; Sensitive	G4; Special Concern	Track all extant and selected historical EOs
Bank Swallow	*Riparia riparia*	S4B; Sensitive	G5; Threatened	Track on a watch list only
Barn Swallow	*Hirundo rustica*	S3B; Sensitive	G5; Threatened	Track on a watch list only
Brewer's Sparrow	*Spizella breweri*	S3S4B; Sensitive	G5	Track on a watch list only
Burrowing Owl	*Athene cunicularia*	S2B; At Risk	G4; Endangered	Track all extant and selected historical EOs
Chestnut-Collared Longspur	*Calcarius ornatus*	S3S4B; At Risk	G5; Threatened	Track all extant and selected historical EOs
Clarks Grebe	*Aechmophorus clarkii*	S1B; May be at Risk	G5	Track all extant and selected historical EOs
Eastern Kingbird	*Tyrannus tyrannus*	S4S5B; Sensitive	G5	-
Ferruginous Hawk	*Buteo regalis*	S2S3B; At Risk	G4; Threatened	Track all extant and selected historical EOs
Grasshopper Sparrow	*Ammodramus savannarum*	S3S4B; Sensitive	G5	-
Great Blue Heron	*Ardea herodias*	S3B; Sensitive	G5	-
Golden Eagle	*Aquila chrysaetos*	S3B,S4N; Sensitive	G5	Track all extant and selected historical EOs
Least Flycatcher	*Empidonax minimus*	S5B; Sensitive	G5	Track on a watch list only
Loggerhead Shrike	*Lanius ludovicianus*	S3B; Sensitive	G4; Threatened	Track all extant and selected historical EOs
Long-billed curlew	*Numenius americanus*	S3B; Sensitive	G5; Special Concern	Track all extant and selected historical EOs
McCown's Longspur	*Rhynchophanes mccownii*	S3S4B; May be at Risk	G4; Threatened	Track all extant and selected historical EOs

Peregrine Falcon	*Falco peregrinus*	S2S3B; At Risk	G4	Track all extant and selected historical EOs
Prairie Falcon	*Falco mexicanus*	S3; Sensitive	G5	Track on a watch list only
Pied-billed Grebe	*Podilymbus podiceps*	S4B; Sensitive	G5	Track on a watch list only
Piping Plover	*Charadrius melodus*	S2B; At Risk	G3; Endangered	
Sharp-tailed Grouse	*Tympanuchus phasianellus*	S3S4; Sensitive	G5	Track on a watch list only
Sprague's Pipit	*Anthus spragueii*	S3S4B; Sensitive	G3G4; Threatened	Track all extant and selected historical EOs
Upland Sandpiper	*Bartramia longicauda*	S3B; Sensitive	G5	Track on a watch list only
Western Grebe	*Aechmophorus occidentalis*	S3B; At Risk	G5; Special Concern	Track all extant and selected historical EOs
Mammals				
Little Brown Bat	*Myotis lucifugus*	S3S4; May be at Risk	G3; Endangered	Track on a watch list only
Silver-haired Bat	*Lasionycteris noctivagans*	S3S4B; Sensitive	G3G4	Track on a watch list only
Red bat	*Lasiurus borealis*	S3B; Sensitive	G3G4	Track all extant and selected historical EOs
Swift Fox	*Vulpes velox*	S1S2; At Risk	G3; Threatened	Track all extant and selected historical EOs
Amphibians				
Great Plains Toad	*Anaxyrus cognatus*	S2S3; Sensitive	G5	Track all extant and selected historical EOs

Source: FWMIS (AEP 2019a), Government of Canada 2019a, Nomenclature as per ACIMS 2017f

Notes:

1. See notes for Appendix C.
2. General status from the Wild Species Status Search (AEP 2015).

3.3.3 Fish and Fish Habitat

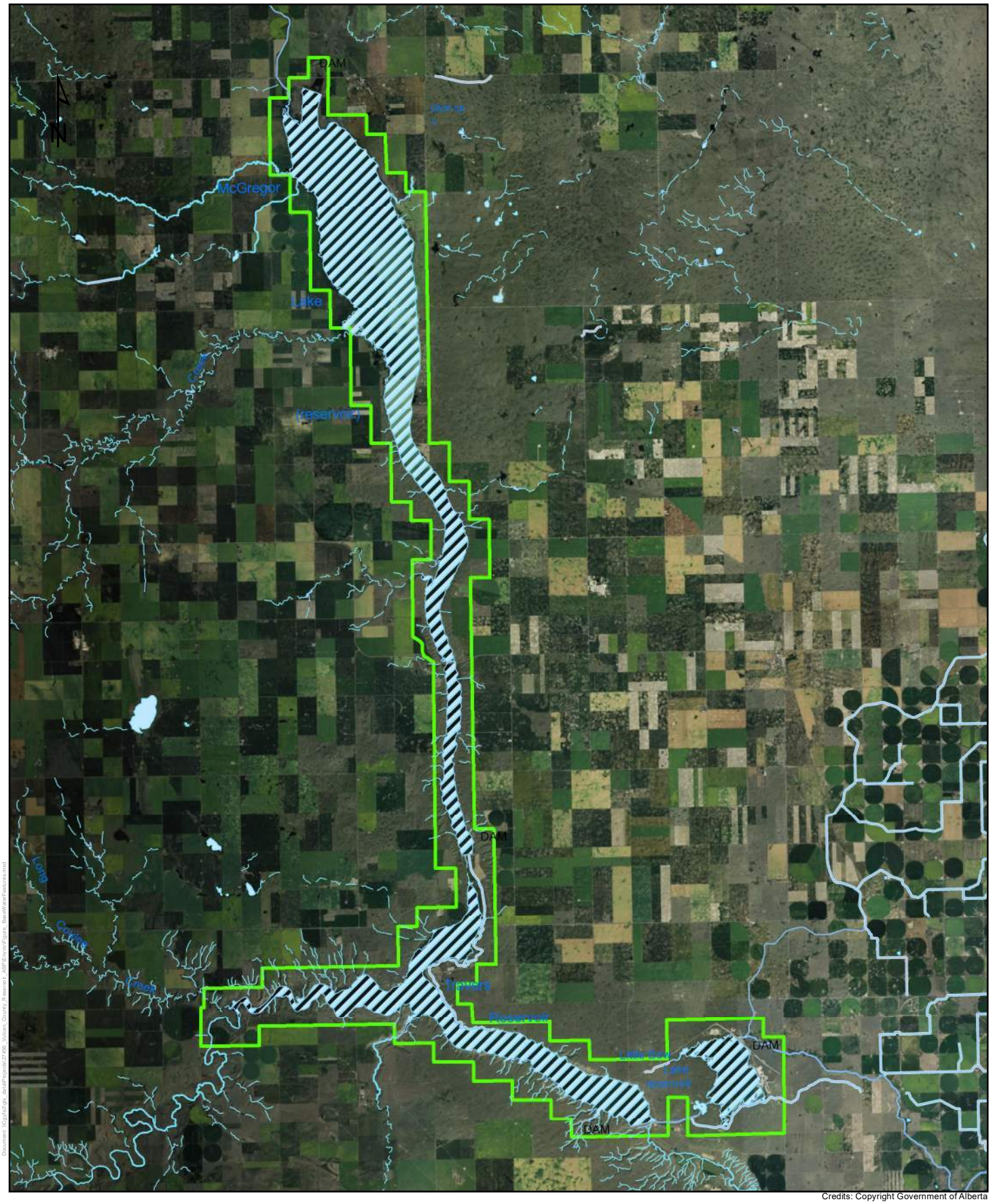
Potential fish habitat in the ASP area is limited to waterbodies which contain water on a year-round basis and do not freeze to the bed, of which the ASP area contains the Little Bow River, McGregor Lake and Travers Reservoir. The FWMIS database returned 21 occurrences of fish species (Appendix E; Table 3.2). A map of Base Water features showing drainages and waterbodies is provided in Figure 3.3 below.

Table 3.2: Fish Species with Historical Occurrences within approximately 5km radius of the ASP Area Centre

Common Name	Scientific Name	Provincial Rank[1,2]	Global Rank	Notes
Fish				
Brown Trout*	*Salmo Trutta*	Exotic/Alien	-	-
Burbot	*Lota lota*	S5; Secure	G5	-
Emerald Shiner	*Notropis atherinoides*	S5; Secure	G5	-
Fathead Minnow	*Pimephales promelas*	S4S5; Secure	G5	-
Kokanee*	*Oncorhynchus nerka*	-	-	-
Lake Chub	*Couesius plumbeus*	S5; Secure	G5	-
Lake Trout	*Salvelinus namaycush*	S3; Sensitive	G5	Track on watch list only
Lake Whitefish*	*Coregonus clupeaformis*	S5; Secure	G5	-
Longnose Dace	*Rhinichthys cataractae*	S5; Secure	G5	-
Longnose Sucker	*Catostomus catostomus*	S5; Secure	G5	-
Mountain Whitefish	*Prosopium williamsoni*	S5; Secure	G5	-
Northern Pike	*Esox lucius*	S5; Secure	G5	-
Northern Redbelly Dace	*Chrosomus eos*	S3; Sensitive	G5	Track on watch list only
Shorthead Redhorse	*Moxostoma macrolepidotum*	S5; Secure	G5	-
Spottail Shiner	*Notropis hudsonius*	S5; Secure	G5	-
Trout-perch	*Percopsis omiscomaycus*	S4S5; Secure	G5	-
Tullibee (Cisco)	*Coregonus artedi*	-	-	-
Walleye*	*Sander vitreus*	S5; Secure	G5	-
White Sucker	*Catostomus commersonii*	S5; Secure	G5	-
Yellow Perch	*Perca flavescens*	S5; Secure	G5	-
Rainbow Trout*	*Oncorhynchus mykiss*	S2; At Risk	G5	Rank applies to Native Populations

Source: FWMIS (AEP 2015), Nomenclature as per ACIMS 2017f

Notes:
1. See notes for Appendix C.
2. General status from the Wild Species Status Search (AEP 2015).
* Denotes Stocked or Introduced Inventory



Credits: Copyright Government of Alberta

Legend

Approximate ASP Area

Integrated Expertise. Locally Delivered.

0 900 1,800 3,600 5,400 7,200 Metres

CANA83-3TM114 1:215,000

Vulcan County
Reservoir ASP

BASE
WATER
FEATURES

3.3.4 Wetlands

Wetland Classification

Wetlands are areas where the soil is inundated with water at an ephemeral to permanent time scale, such that the soils become reduced (i.e., hydric) and hydrophytic vegetation is dominant. Based on hydrologic, ecological, and soil (e.g., biogeochemical) properties, wetlands can be further grouped and classified. The methodology used to classify wetlands for Alberta is the Alberta Wetland Classification System (AWCS) (Alberta Environment and Sustainable Resource Development [ESRD] 2015)

Within the AWCS there are five wetland classes divided into forms based on vegetation. Wetland forms are further subdivided into types based on biological, hydrologic, or biogeochemical attributes. Stewart and Kantrud (1971) Classes are comparable to the Water Permanency Type. It should be noted that to determine the full wetland Class, Form, and Type according to the AWCS, field assessment at the appropriate time of year (i.e., the growing season) is required, in addition to an assessment of multiple years of historical imagery as per the Alberta Wetland Identification and Delineation Directive (GOA 2018a).

The following provides definitions of each wetland Class. For more information on wetland Classification see the AWCS (ESRD 2015).

Marshes are mineral wetlands with water levels near, at or above the ground surface for variable periods during the year, and which supports graminoid vegetation in the deepest portion of the wetland in the majority of years.

Shallow open water wetlands are mineral wetlands with water levels near, at or above the ground surface of variable periods of the year, which is less than two metres deep at mid-summer and that contains an open water zone in the deepest wetland zone covering greater than 25% of the total area in the majority of years. The open water zone is an expanse of open, mostly unshaded water in marshes and shallow open waters that typically supports submersed, or floating vegetation and is less than two metres deep at mid-summer.

Swamps are mineral wetlands with water levels near, at or above the ground surface for variable periods during the year; and contains either more than 25% tree and/or shrub cover of a variety of species.

Bogs are peatlands fed by ombrogenous waters originating from precipitation with low concentrations of dissolved minerals. Bogs are not expected within the Study Area.

Fens are minerogenous peatlands with surface or subsurface water flow that range from moderately-acidic or basic. Fens are not expected within the Study Area.

Wetland Valuation

The Study Area falls within Relative Wetland Value Assessment Units (RWVAU) 13 and 21 and *in-lieu* fee rates of $17,700/ha. If wetland infilling is planned, a *Water Act* approval is required. In-lieu compensation fee rates are calculated from the area of impact, the multiplier that is based on the result of the AEP wetland valuation model, and the RWVAU rate (Government of Alberta 2018b).

Wetland Desktop Results

In the Study Area, AMWI was examined to provide information on potential wetlands (AEP 2018). Wetland features in the ASP are overwhelmingly Marshes with the Travers Reservoir, Little Bow Reservoir and McGregor Lake classed as Open Water. The AMWI maps are provided in Appendix A.

4.0 Regulatory Information

4.1 Framework

All federal and provincial regulations must be followed during development. Provincial regulations that have potential to be applicable in the ASP Area are described below. This list should not be considered comprehensive and may be reduced or increased as the ASP project evolves and post ASP when development occurs. Regulations often change over time, new ones introduced or repealed and requirements may change by the time of construction. Fieldwork approximately two years prior to ground disturbance, and well prior to vegetation stripping, is recommended to re-assess the regulatory requirements that are applicable at that time.

4.2 Federal

Migratory Birds Convention Act

The *Migratory Birds Convention Act (MBCA)* is administered by ECCC to ensure protection of migratory birds, their nests, and their eggs. Birds protected by the *MBCA* include waterfowl (such as ducks, geese, and swans), insectivorous birds (such as wrens, robins, shrikes, and woodpeckers), and some nongame birds (such as herons and gulls) (ECCC 2014).

To protect migratory birds, ECCC provides general nesting periods based on geographic location (ECCC 2014). The general nesting period covers the majority of species covered under the *MBCA*; however, it may not be accurate for species that can breed at any time during optimal conditions (*e.g.* crossbill species), or species that may nest earlier or later (ECCC 2014).

The general migratory bird-nesting period for the Project (located within zone B4) is mid-April to late August (ECCC 2017b). During this period, construction activities require a pre-construction sweep to avoid disturbance and nest sweeps every 3-7 days where habitat occurs. In the event that nesting migratory birds are identified during the nest sweep, a setback may be identified through consultation with ECCC where feasible, or a permit would be required to remove the nest.

Species at Risk Act

SARA includes several prohibitions to protect species listed on Schedule 1 of *SARA*. Under Sections 32 and 33 of *SARA*, it is an offence to:

- Kill, harm, harass, capture, or take an individual of a species listed under *SARA* as extirpated, endangered, or threatened
- Possess, collect, buy, sell, or trade an individual of a species listed under *SARA* as extirpated, endangered, or threatened, or any part or derivative of such an individual
- Damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction into the wild in Canada

Canadian Navigable Waters Act

The *Canadian Navigable Waters Act (CNWA)*includes a List of Scheduled Waters under which Transport Canada regulates works and activities that have the potential to affect navigation. Non-scheduled waterways also may be covered under the *Act*, if the works pose a risk to public navigation. Impacts to navigation (i.e., impacts to boating within either reservoir) would require a CNWA Approval.

Fisheries Act

The provisions of the new *Fisheries Act* came into force at the end of August 2019. While guidance documents are still being developed, important changes include the new prohibitions:

- 34.4 (1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish
- 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat
  - Harmful Alteration: any change to fish habitat that reduces its long-term capacity to support one or more life processes of fish but does not permanently eliminate the habitat.
  - Disruption: any change to fish habitat occurring for a limited period of time that reduces its capacity to support one or more life processes of fish.
  - Destruction: any permanent change of fish habitat, which completely eliminates its capacity to support one or more life processes of fish

Impacts to fish and fish habitat within the ASP area would potentially require review by DFO, to determine if any of the Act prohibitions would occur, therefore requiring an Authorization.

4.3 Provincial

4.3.1 Wildlife Act

In addition to the federal MBCA, birds may be protected provincially under the *Wildlife Act*. AEP administers the *Wildlife Act*, which influences and controls human activities that may have adverse effects on wildlife or wildlife habitat on both Crown and privately-owned land. Section 36(1) of the *Wildlife Act* states that a person shall not willfully molest, disturb, or destroy a house, nest, or den of prescribed wildlife or beaver dam in prescribed areas and prescribed times. This applies to nests and dens of endangered wildlife, migratory birds, snakes (except prairie rattlesnakes), bats, and prairie rattlesnake hibernacula. Additionally, Section 36(1) also applies to beaver dens and houses on land that is not privately owned as well as houses, nests, and dens of all wildlife in a wildlife sanctuary and nests of game birds in game bird sanctuaries. As a result of the *Wildlife Act*, setbacks and Restricted Activity Dates (RADs) have been defined for important species.

RADs are based on existing knowledge of species-specific seasonal life history traits such as breeding, nesting, and rearing activities. Generally, inter-annual climate variation is captured within the dates; however, there may be occurrences where the RAD does not cover the entire trait (*i.e.* young still in the nest) (Government of Alberta 2011). As a result, the RAD should be extended to avoid disturbance. Setback distances are based on thresholds where human disturbance will adversely affect key wildlife areas or sites (Government of Alberta 2011).

4.3.2 Weed Control Act

The *Weed Control Act* protects stakeholders from economic and invasive losses caused by weeds (Government of Alberta 2010). Some weed species exhibit extreme growth habits, which can have consequences for line of sight at intersections, wildlife control along roadways, culvert and outfall maintenance, agricultural production, livestock forage quality, and many others. The *Act* prescribes activities that must be undertaken, should a noxious or restricted weed be encountered. Each municipality is responsible for administering the *Act.*

4.3.3 Water Act

The *Water Act* regulates Alberta's water resources. Through AEP the *Act* governs activities affecting waterbodies in Alberta, including construction activities, water diversions and permanent alterations of waterbodies including wetlands. *Water Act* approval is required to alter flow or level of water; change the location of water; change the direction of water flow, cause the siltation of water; cause erosion of bed or shore of any waterbody or any effect on the aquatic environment (Province of Alberta 2000b).

Code of Practice

Activities that will disturb a waterbody requires *Water Act* approval. The exception are those activities that are regulated under the Codes of Practices (COPs) (AESRD 2012a):

- *Temporary diversion of water for hydrostatic testing*
- *Pipelines and telecommunication lines crossing a waterbody*
- *Watercourse crossings*
- *Outfall structures on waterbodies*

A COP notification is required for works within a watercourse (i.e., a waterbody with defined bed and banks) and work is expected to be competed outside of the RAP. If work is required within the RAP, additional P. Biol. recommendations from the Contractor's P. Biol. will be required, such as completing a spawning survey.

Wetland Policy

Under the authority of the *Water Act*, wetlands must be identified and delineated according to the Wetland Identification and Delineation Directive (Government of Alberta 2018a; classified using the Alberta Wetland Classification System (AESRD 2015 and Table 1.1); and assigned an ecological wetland value using the Alberta Wetland Rapid Evaluation Tool (ABWRET-A). A *Water Act* application requires a Wetland Assessment and Impact Report (WAIR) or a Wetland Assessment and Impact Form (WAIF). In addition to the above information, a WAIR will include the required *in-lieu* fee replacement value, based on the AB-WRET-A results (*i.e.* wetland value) as well as the Relative Wetland Assessment Unit (RWVAU) value pursuant to the Alberta Wetland Mitigation Directive (Government of Alberta 2018b).

4.3.4 Public Lands Act

Section 3 of the *Public Lands Act* defines public lands to include the bed and shores of all permanent and naturally occurring bodies of water unless a grant or title expressly conveys such rights to the land holder.

Some wetlands are regulated by the *Public Lands Act (PLA)*, if they are deemed to be crown-claimed. This requires that a surface disposition be issued for the use of them if they are located on public lands in Alberta. The *PLA* is the guiding policy for administering lands owned by the Crown. The Water Boundary Group for AEP makes a determination of Crown claimed waterbodies under the *PLA*. All watercourses are assumed to be claimed by the Crown; however, all reasonably permanent wetlands must be submitted to the Water Boundary Group for determination of Crown ownership as per the Guide for Assessing Permanence of Wetland Basins (AEP 2016). A decision regarding Crown ownership of a reasonably permanent wetland must be reached before any *Water Act* application submissions.

Surveyed road allowances that cross a Crown-owned water body or watercourse are considered to be highways or roads under Schedule 14 of the *Government Organization Act* and therefore fall under the administration of Alberta Transportation (AESRD 2013).

4.3.5 Historical Resource Act

The *Historical Resource Act* is administered by Culture, Multiculturalism and the Status of Women (CMSW) to preserve and study Alberta's historical resources (Province of Alberta 2000c). *Historical Resource Act* clearance must be obtained from CMSW before development.

4.3.6 Agricultural Pests Act

Clubroot, caused by *Plasmodiophora brassicae*, is a serious disease of cruciferous crops (*i.e*. mustards, canola, etc.) which can result in reduced to severe yield losses. Clubroot is a listed pest under Alberta's *Agricultural Pests Act* (Province of Alberta 2000d). Sanitation procedures for equipment and a soil management plan should be implemented at the time of construction.

5.0 Recommendations

5.1 Wetland Conservation and Protection

Generally, ISL recommends retention of reasonably permanent, large, and/or complex wetlands due to the potential landscape hydrologic impact. Typically, these basins have limited anthropogenic disturbance resulting in native plant communities, high potential for rare species, and stable wildlife habitat for waterfowl, shorebirds, amphibians, and invertebrate species. Additionally, these basins typically hold more water than other wetlands and may be significant to catchment hydrology. To infill them during development would not only displace this water, but also likely impact the overland flow dynamics, which could lead to flooding and/or spring melt and stormwater management issues.

It should also be noted that less permanent wetlands also provide important wetland functions such as stormwater retention, sediment and nutrient retention, as well as wildlife habitat, however, they occur as smaller features on the landscape within the ASP area. ISL recommends that during development, conservation of these wetlands be considered.

5.1.1 Setbacks

Wetland setbacks are important to consider for development planning. Setbacks provide a buffer of vegetation and help to filter water and other inputs, provide habitat for wildlife, and help protect the wetland from disturbance.

The Alberta government recommends 20 m for glacial till or 50 m for coarse textured sands and gravels adjacent to Class III (Stewart and Kantrud 1971) and above wetlands as well as lakes, rivers, streams, seeps and springs (AESRD 2012b). Class II wetlands (Stewart and Kantrud 1971) have a recommended 10 m setback (AESRD 2012b).

5.2 Waterbody Protection

ISL recommends planning to avoid impacts (direct and indirect) to the Travers Reservoir, Little Bow Reservoir and McGregor Lake, and any permanent watercourses to avoid regulatory approvals related to the waterbody. Development should be set back, preferably well beyond the expected high-water level. Additionally, development should not be placed on any flow paths to the reservoir (*e.g.* at the base of a coulee where spring meltwater could potentially flow through). Erosion prevention should be a concern for any development, and preventative actions implemented prior to ground-breaking.

5.3 Retention of Coulees and Native Prairie Grassland

Coulees are comparatively unique features in the prairies and as such provide niche habitats for rare species (i.e., rare plants, rare wildlife). Native prairie grassland habitats are dwindling, generally due to agriculture, therefore planning for retention of existing native habitat, including coulee slopes is recommended. ISL recommends not developing coulee areas or native grassland habitats and instead prioritizing development on areas of existing cultivation.

5.4 Regulatory Requirements

Regulatory requirements most likely for construction within the ASP Area include; the *Species at Risk Act*, *Migratory Birds Convention Act*, *Fisheries Act*, *Wildlife Act*, *Water Act*, *Public Lands Act*, and *Historical Resources Act*. These and other potentially applicable regulatory requirements are briefly described in Section 4.0, however a conclusive determination is dependent on the results of field studies, project planning and design and construction techniques.

5.4.1 Field Study Recommendations

Field studies prior to the time of ground disturbance will be required be meet regulatory requirements. Data collected during fieldwork is generally considered expired 2-3 years from collection. Prior to development, ISL recommends:

- Wildlife studies, specifically; sharp-tailed grouse surveys, Ferruginous Hawk surveys, Golden Eagle Surveys, Prairie Falcon and Piping Plover surveys.
- Migratory bird, amphibian, and reptile assessments during the spring season to assess for protected species and the need for mitigation specific to those species and to remain in compliance with the Alberta *Wildlife Act, Species at Risk Act* and *Migratory Bird Convention Act*.
- Rare plant field assessments for every development (an early season and late season) to determine if Species at Risk or rare species are present and to recommend mitigation measures.
- Wetland field assessments, conducted during the growing season and following AEP directives, to support either avoidance planning or *Water Act* applications for wetland disturbance.
- Fish and fish habitat studies should be conducted on a case-by-case basis to determine fish presence potential to ensure compliance with the *Fisheries Act.*
- A Historical Resources Overview for every development within the ASP should be conducted to determine requirements under the *Historical Resources Act*.
- Pre-construction weed assessment should be conducted to remain in compliance with the Weed Act, in addition to control measures if warranted. Follow up weed assessments and control should occur post construction.

6.0 References

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APPENDIX A
Alberta Merged Wetland Inventory

Credits: Copyright Government of Alberta

Integrated Expertise. Locally Delivered.

0 210 420 840 1,260 1,680 Metres

CANA83-3TM114 1:50,000

Legend

- Approximate ASP Area

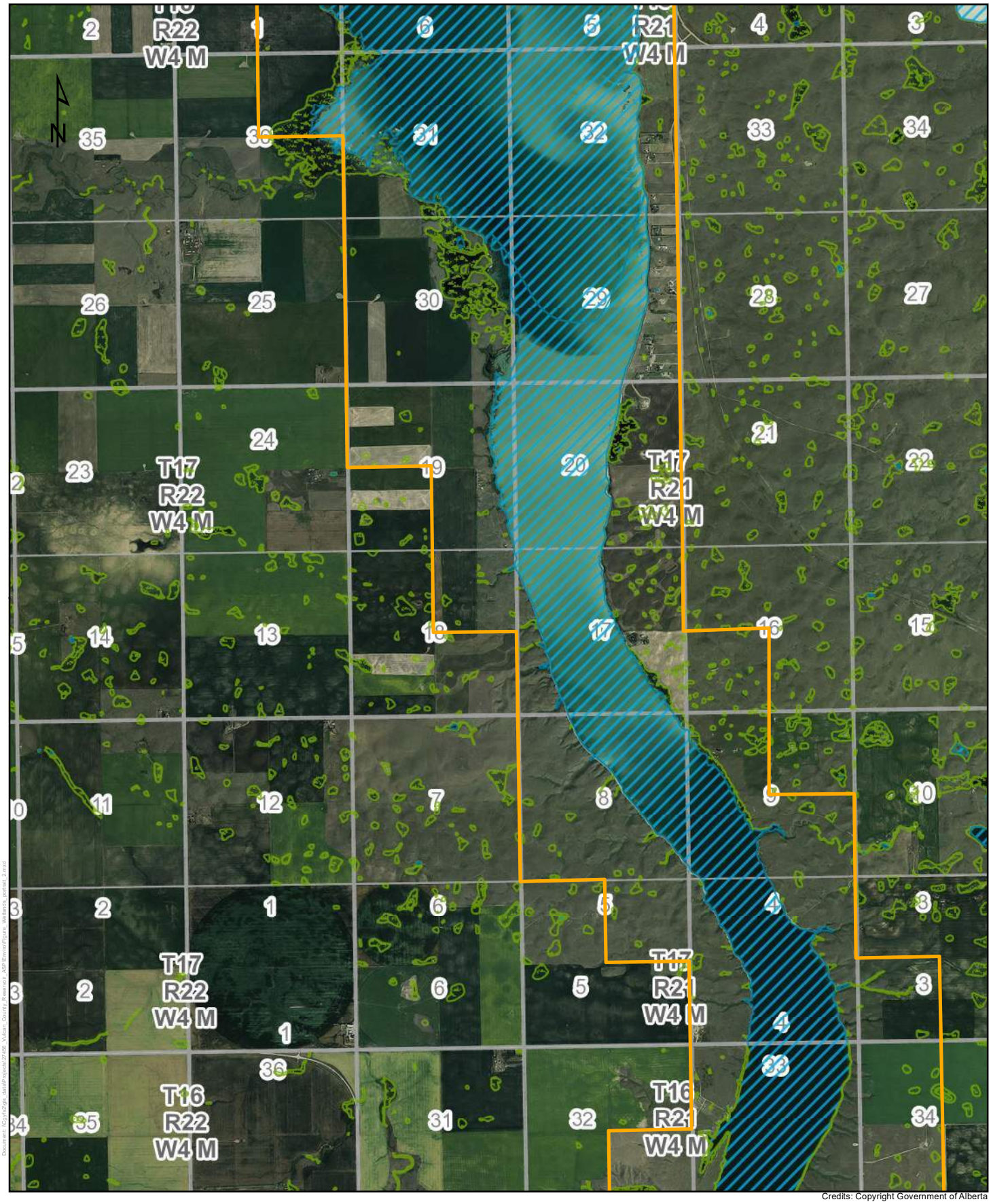
Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

Vulcan County Reservoir ASP

ALBERTA MERGED WETLAND INVENTORY



Credits: Copyright Government of Alberta

ISL

Integrated Expertise. Locally Delivered.

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Legend

- Approximate ASP Area

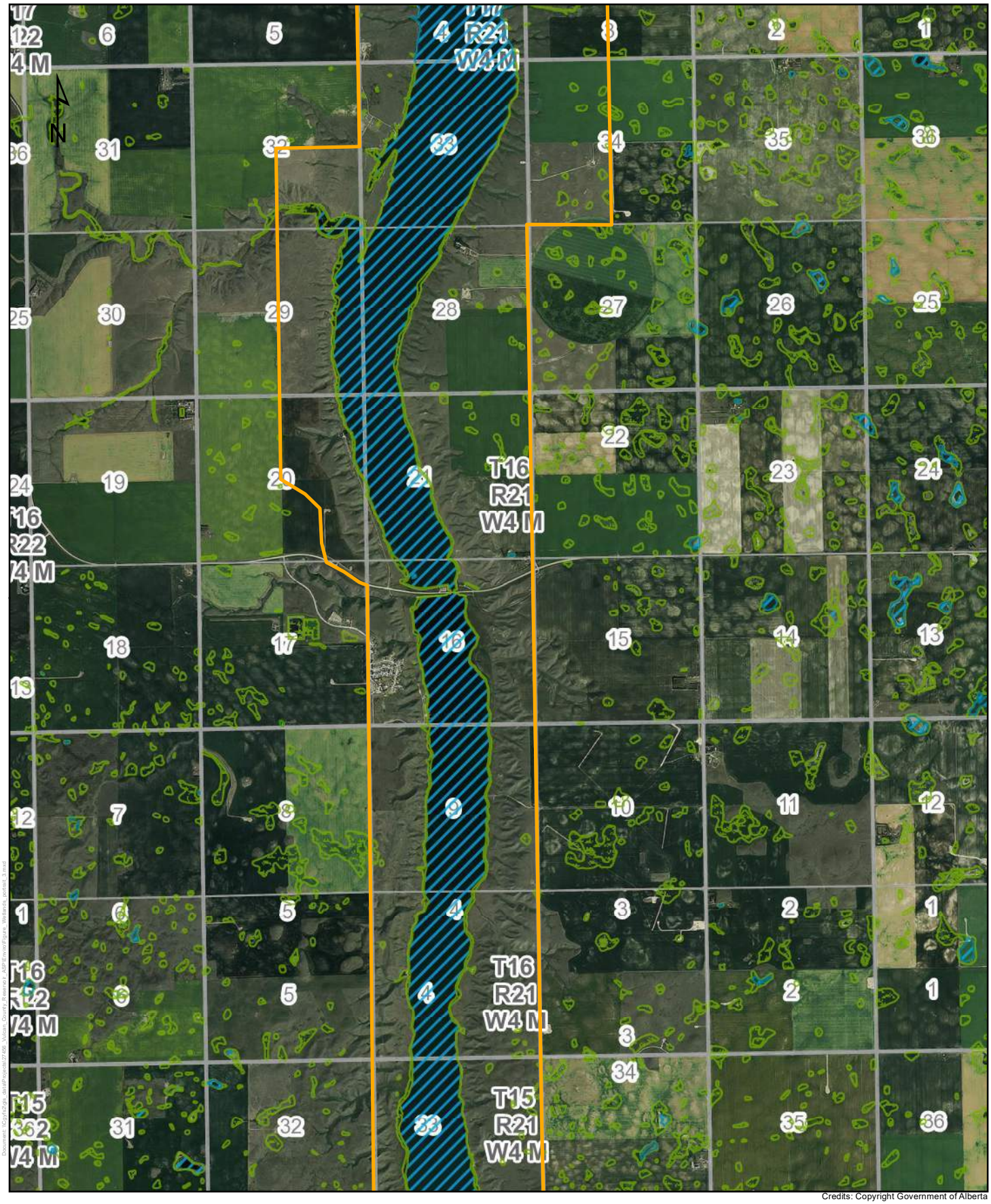
Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

Vulcan County Reservoir ASP

ALBERTA MERGED WETLAND INVENTORY



Credits: Copyright Government of Alberta

Integrated Expertise. Locally Delivered.

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CANA83-3TM114 1:50,000

Legend

Approximate ASP Area

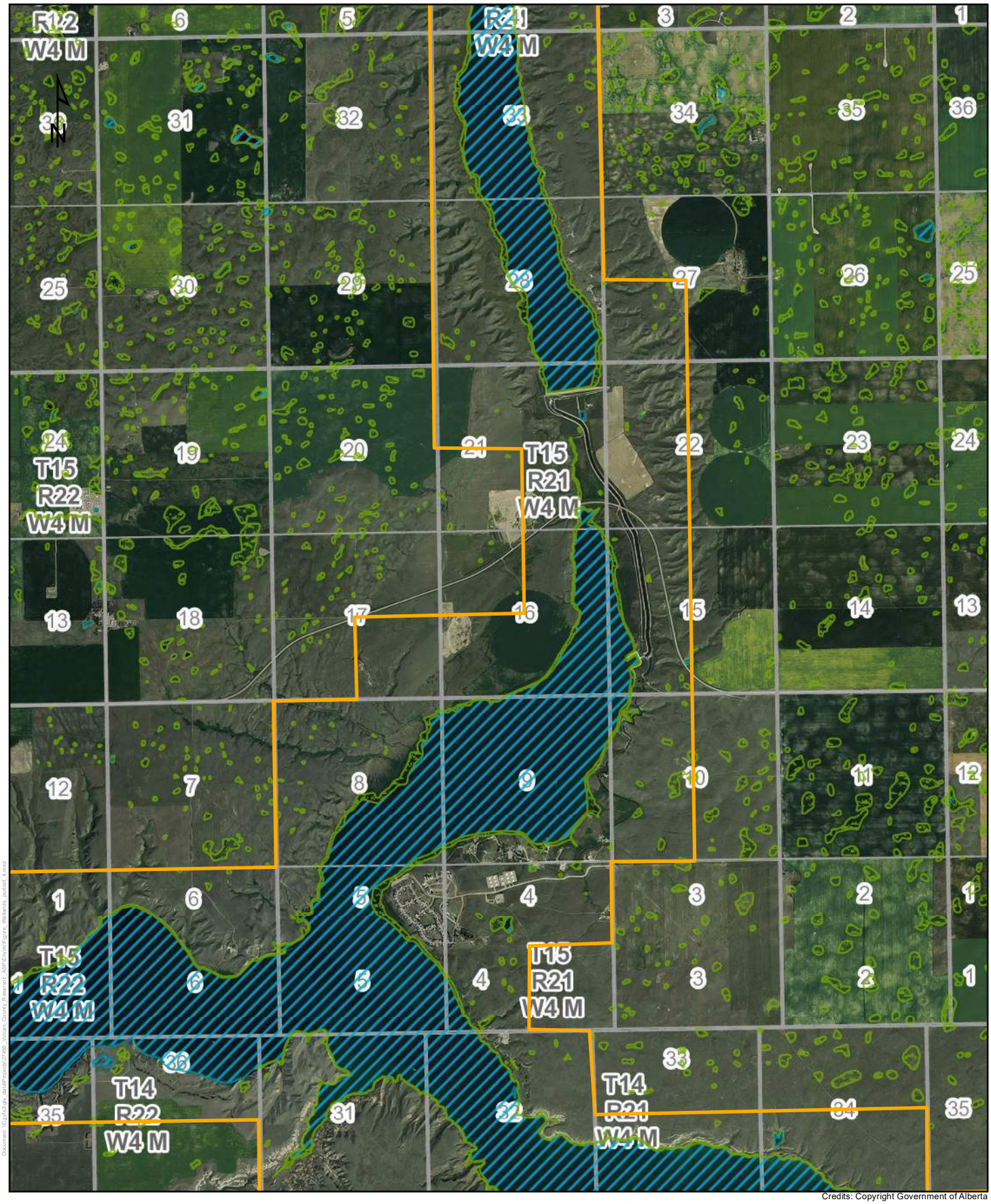
Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

Vulcan County
Reservoir ASP

ALBERTA MERGED
WETLAND INVENTORY



Credits: Copyright Government of Alberta

Integrated Expertise. Locally Delivered.

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Legend

Approximate ASP Area

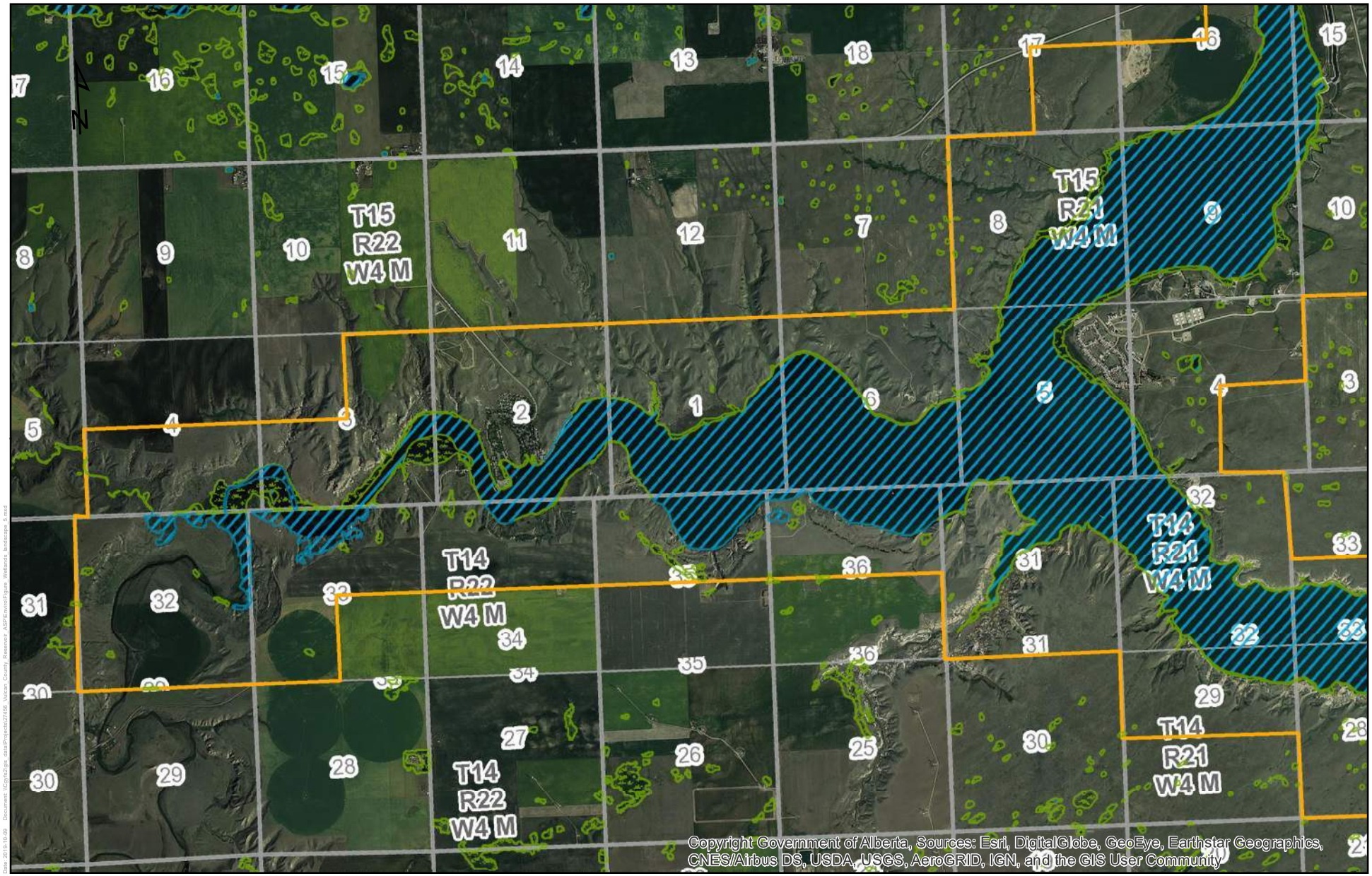
Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

Vulcan County Reservoir ASP

ALBERTA MERGED WETLAND INVENTORY



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1:50,000

NAD 1983 UTM Zone 12N

Legend

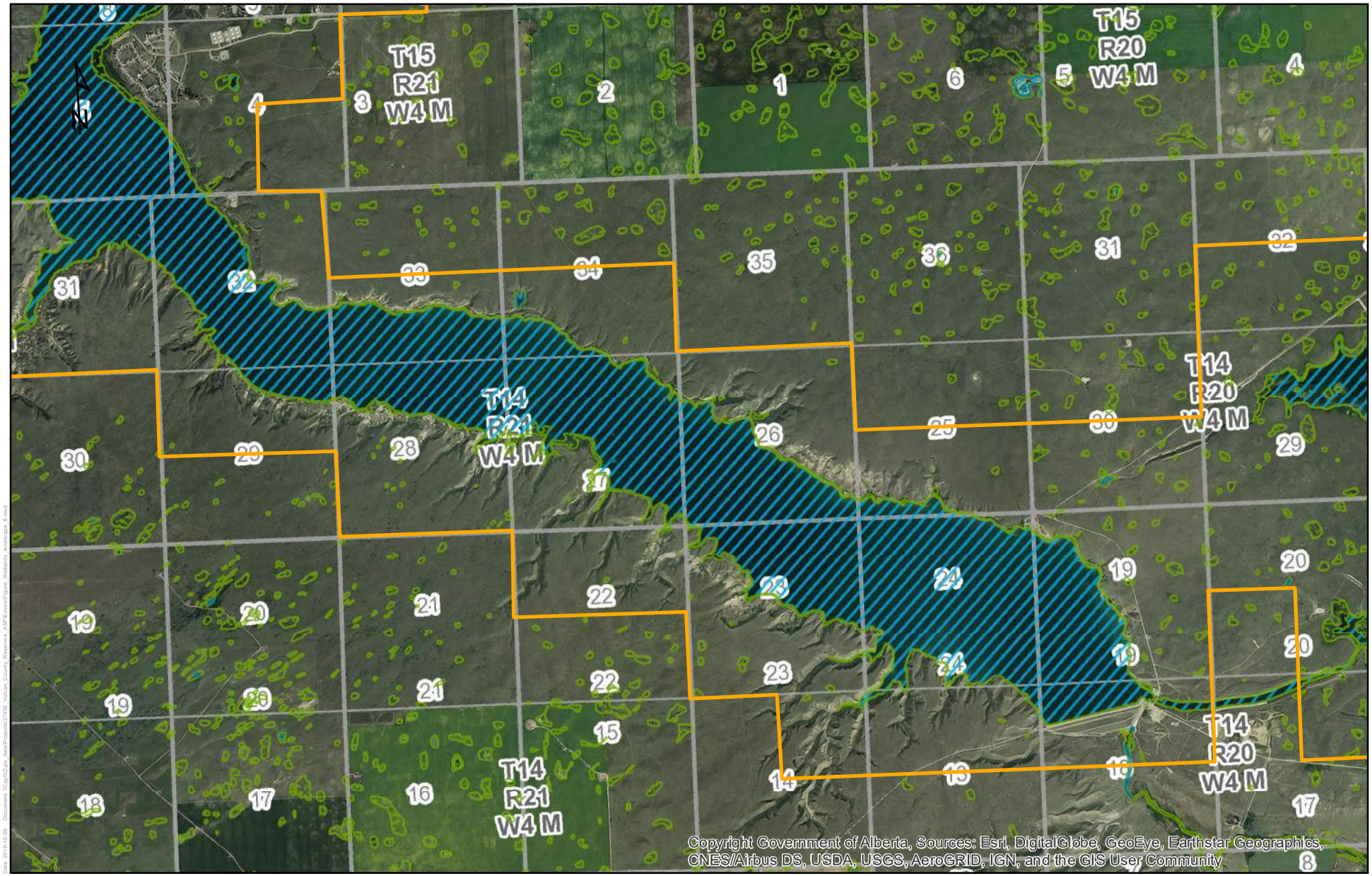
- Approximate ASP Area

Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

ALBERTA MERGED WETLAND INVENTORY



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NAD 1983 UTM Zone 12N

Legend

Approximate ASP Area

Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

ALBERTA MERGED WETLAND INVENTORY

Integrated Expertise. Locally Delivered.

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1:50,000

NAD 1983 UTM Zone 12N

Legend

- Approximate ASP Area

Alberta Merged Wetland Inventory Class

Canadian Wetland Classification System Class

- Bog
- Fen
- Marsh
- Open Water
- Swamp

ALBERTA MERGED WETLAND INVENTORY

APPENDIX B
ACIMS Output

Search ACIMS Data

≡MENU

1 Select Requestor: *
Consultant

2 Select Reason for Request: *
Element Occurrence Search

3 SEC | TWP* | RGE | MER
-- | 018 | 22 | W4M

(option) Convert Lat/Long to Township

Submit

Note: If the map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) or try viewing in Google Chrome or Firefox

Layers

- Element Occurrence (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results Print Results

Date: 21/9/2019
Requestor: Consultant
Reason for Request: Element Occurrence Search
SEC: -- **TWP:** 018 **RGE:** 22 **MER:** 4

Alberta Parks

Non-sensitive EOs: 2 (*Data Updated:October 2017*)

M-RR-TTT-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
4-22-018-25	24703	PMPOA5A010	S2	Schedonnardus paniculatus	tumble grass	1989-07-14
4-22-018-36	24703	PMPOA5A010	S2	Schedonnardus paniculatus	tumble grass	1989-07-14

Next Steps: See FAQ

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 6 (*Data Updated:October 2017*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN
4-22-018-25	Lake McGregor	PRA	NR
4-22-018-25	Lake McGregor - 100m proximity	n/a	n/a
4-22-018-36	Lake McGregor	PRA	NR
4-22-018-36	Lake McGregor - 100m proximity	n/a	n/a
4-22-018-36	Lake McGregor	PRA	NR
4-22-018-36	Lake McGregor - 100m proximity	n/a	n/a

Next Steps: Email Parks or See FAQ

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE

No Crown Reservations/Notations Found

Search ACIMS Data

MENU

1 Select Requestor: *
Consultant

2 Select Reason for Request: *
Element Occurrence Search

3

Sec	TWP	RGE	Mer
--	017	22	W4M

(option) Convert Lat/Long to Township

Submit

Note: If this map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) or try viewing in Google Chrome or Firefox

Layers

- Element Occurrences (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results Print Results

Date: 2/5/2019
Requestor: Consultant
Reason for Request: Element Occurrence Search
Sec: -- **TWP:** 017 **RGE:** 22 **Mer:** 4

Alberta Parks

Non-sensitive EOs: 0 (*Data Updated:October 2017*)

M4BR-111-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D

No Non-sensitive EOs Found: Next Steps - See FAQ

Sensitive EOs: 0 (*Data Updated:October 2017*)

M4BR-111	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 0 (*Data Updated:October 2017*)

M4BR-111-SS	PROTECTED AREA NAME	TYPE	IUCN

No Protected Areas Found

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M4BR-111-SS	NAME	TYPE

No Crown Reservations/Notations Found

Search ACIMS Data

☰MENU

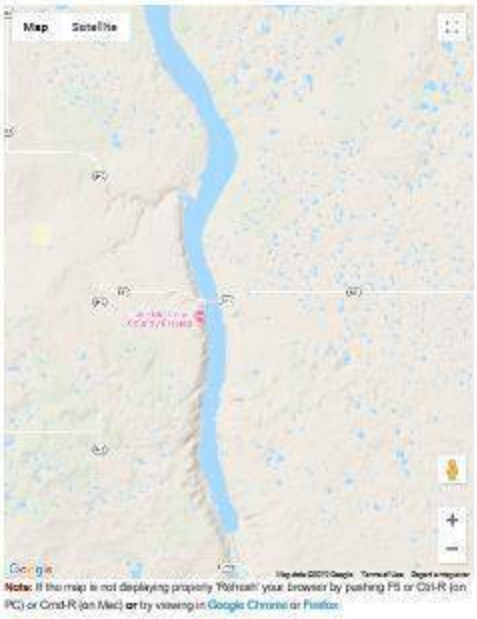
1 Select Requestor: *
Consultant

2 Select Reason for Request: *
Element Occurrence Search

3 Sec: -- Twp: 016 Rge: 21 Mer: 4

(option) Convert Lat/Long to Township

Submit



Layers

- Element Occurrence (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results Print Results

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Requestor: Consultant
Reason for Request: Element Occurrence Search
Sec: -- **Twp:** 016 **Rge:** 21 **Mer:** 4

Alberta Parks

Non-sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
No Non-sensitive EOs Found: Next Steps - See FAQ						

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
No Sensitive EOs Found: Next Steps - See FAQ						

Protected Areas: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN
No Protected Areas Found			

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE
No Crown Reservations/Notations Found		

Search ACIMS Data

≡MENU

1. Select Requestor: * ⓘ
   Consultant
2. Select Reason for Request: *
   Element Occurrence Search
3.

SEC	TWP*	RGE	MER
--	015	21	W4M

(option) Convert Lat/Long to Township

Submit

Note: If the map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) **or** try viewing in Google Chrome or Firefox

Layers

- ☑ Element Occurrence (part one, non-sensitive) ⓘ
- ☑ Element Occurrence (part two, sensitive) ⓘ
- ☑ Protected Areas ⓘ
- ☑ 100 m Proximity - Protected Areas ⓘ
- ☑ Crown Reservation/Notation ⓘ
- 100 m Proximity - Crown Reservation/Notation ⓘ

* *Required*

Table of Results Print Results

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Reason for Request: Element Occurrence Search
SEC: -- **TWP*:** 015 **RGE:** 21 **MER:** 4

Alberta Parks

Non-sensitive EOs: 0 (*Data Updated:October 2017*)

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No Non-sensitive EOs Found: Next Steps - See FAQ						

Sensitive EOs: 0 (*Data Updated:October 2017*)

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No Sensitive EOs Found: Next Steps - See FAQ						

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4-21-015-15	Travers Reservoir	PRA	NR
4-21-015-15	Travers Reservoir - 100m proximity	n/a	n/a
Next Steps: Email Parks or See FAQ			

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE
No Crown Reservations/Notations Found		

AlbertaParks.ca

Search ACIMS Data

≡MENU

1 Select Requestor: *
Consultant

2 Select Reason for Request: *
Element Occurrence Search

3

Sec	Twp	Rge	Mer
--	015	22	W4M

(option) Convert Lat/Long to Township

Submit

Note: If the map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) **or** try viewing in Google Chrome or Firefox

Layers

- Element Occurrence (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results Print Results

Date: 2/6/2019
Requestor: Consultant
Reason for Request: Element Occurrence Search
Sec: -- **Twp:** 015 **Rge:** 22 **Mer:** 4

Alberta Parks

Non-sensitive EOs: 10 (*Data Updated:October 2017*)

M-RR-TTT-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
4-22-015-01	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-02	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-03	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-04	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-09	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-10	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-11	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-12	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-14	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24
4-22-015-15	1845	ILEPT2010	S2	Ochlodes sylvanoides	Woodland Skipper	1996-06-24

Next Steps: See FAQ

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 5 (*Data Updated:October 2017*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN
4-22-015-02	Little Bow	PP	NR
4-22-015-02	Little Bow - 100m proximity	n/a	n/a
4-22-015-03	Little Bow - 100m proximity	n/a	n/a
4-22-015-11	Little Bow	PP	NR
4-22-015-11	Little Bow - 100m proximity	n/a	n/a

Next Steps: Email Parks or See FAQ

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE

No Crown Reservations/Notations Found

Search ACIMS Data

☰MENU

1. Select Requestor: *
   Consultant
2. Select Reason for Request: *
   Element Occurrence Search
3. Sec | TWP | RGE | MER
   -- | 014 | 21 | W4M
   (option) Convert Lat/Long to Township
   Submit

Layers

- Element Occurrence (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

Note: If the map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) or try viewing in Google Chrome or Firefox

* Required

Table of Results Print Results

Date: 2/6/2019
Requestor: Consultant
Reason for Request: Element Occurrence Search
Sec: -- **TWP:** 014 **RGE:** 21 **MER:** 4

Alberta Parks

Non-sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
No Non-sensitive EOs Found: Next Steps - See FAQ						

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-RR-TTT	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
No Sensitive EOs Found: Next Steps - See FAQ						

Protected Areas: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	PROTECTED AREA NAME	TYPE	IUCN
No Protected Areas Found			

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-RR-TTT-SS	NAME	TYPE
No Crown Reservations/Notations Found		

Search ACIMS Data

MENU

1 Select Requestor: *
Consultant

2 Select Reason for Request: *
Element Occurrence Search

3 Sec: Twp: Rge: Mer:
-- 014 20 W4M
(option) Convert Lat/Long to Township

Submit

Note: If the map is not displaying properly 'Refresh' your browser by pushing F5 or Ctrl-R (on PC) or Cmd-R (on Mac) **or** try viewing in Google Chrome or Firefox

Layers

- Element Occurrence (part one, non-sensitive)
- Element Occurrence (part two, sensitive)
- Protected Areas
- 100 m Proximity - Protected Areas
- Crown Reservation/Notation
- 100 m Proximity - Crown Reservation/Notation

* Required

Table of Results Print Results

Date: 2/19/2019
Requestor: Consultant
Reason for Request: Element Occurrence Search
Sec: -- **Twp:** 014 **Rge:** 20 **Mer:** 4

Alberta Parks

Non-sensitive EOs: 3 (*Data Updated:October 2017*)

M-AB-111-SS	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D
4-20-014-16	16877	PDAST150R0	S3	Bidens frondosa	common beggarticks	2007-08-16
4-20-014-21	16877	PDAST150R0	S3	Bidens frondosa	common beggarticks	2007-08-16
4-20-014-33	16876	PDAST150R0	S3	Bidens frondosa	common beggarticks	2007-08-09

Next Steps: See FAQ

Sensitive EOs: 0 (*Data Updated:October 2017*)

M-AB-111	EO ID	ECODE	S RANK	SNAME	SCOMNAME	LAST OBS D

No Sensitive EOs Found: Next Steps - See FAQ

Protected Areas: 4 (*Data Updated:October 2017*)

M-AB-111-SS	PROTECTED AREA NAME	TYPE	IUCN
4-20-014-22	Little Bow Reservoir	PRA	NR
4-20-014-22	Little Bow Reservoir - 100m proximity	n/a	n/a
4-20-014-27	Little Bow Reservoir	PRA	NR
4-20-014-27	Little Bow Reservoir - 100m proximity	n/a	n/a

Next Steps: Ismail Parks or See FAQ

Crown Reservations/Notations: 0 (*Data Updated:October 2017*)

M-AB-111-SS	NAME	TYPE

No Crown Reservations/Notations Found

APPENDIX C
Rare Species Tables

Table A: Rare Vascular Plant Species within the Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
annual skeletonweed	*Shinnersoseris rostrata*	S3	G5?
arctic bladderpod	*Physaria arctica*	S3	G4G5
biscuit-root	*Lomatium cous*	S1	G5
blue phlox	*Phlox alyssifolia*	S2	G5
blunt-leaved watercress	*Rorippa curvipes*	S3	G5
buff fleabane	*Erigeron ochroleucus*	S1	G5
Californian amaranth	*Amaranthus californicus*	S2S3	G4
Canada wood-nettle	*Laportea canadensis*	S1	G5
Castlegar hawthorn	*Crataegus castlegarensis*	S1	G5
chaffweed	*Lysimachia minima*	S2S3	G5
clammy hedge-hyssop	*Gratiola neglecta*	S3	G5
cock's-comb cryptantha	*Cryptantha celosioides*	S2S3	G5
Collins' rockcress	*Boechera collinsii*	S1	G5T5
corymbose everlasting	*Antennaria corymbosa*	S2	G5
creeping draba	*Draba reptans*	S2	G5
crested beardtongue	*Penstemon eriantherus*	S2	G4G5
cushion everlasting	*Antennaria dimorpha*	S2	G5
downingia	*Downingia laeta*	S3	G5
dwarf woollyheads	*Psilocarphus brevissimus var. brevissimus*	S2	G4T4?
early buttercup	*Ranunculus glaberrimus*	S3	G5
flowering-quillwort	*Lilaea scilloides*	S3	G5?
Fremont's goosefoot	*Chenopodium fremontii*	S2	G5
hairy pepperwort	*Marsilea vestita*	S3	G5
hare-footed locoweed	*Oxytropis lagopus var. conjugans*	S1	G4G5T3T4; SARA Listed
lance-leaved lungwort	*Mertensia lanceolata*	S2	G5
limber pine	*Pinus flexilis*	S3	G4
linear-leaved scorpionweed	*Phacelia linearis*	S3	G5
low cinquefoil	*Potentilla plattensis*	S2	G4
low yellow evening-primrose	*Oenothera flava*	S3	G5
mealy goosefoot	*Chenopodium incanum var. incanum*	S1	G5T5
Moquin's sea-blite	*Suaeda nigra*	S3	G5
Navajo tea	*Thelesperma subnudum var. marginatum*	S1	G5T5
Nebraska sedge	*Carex nebrascensis*	S3	G5
Nevada rush	*Juncus nevadensis*	S1	G5

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
picradeniopsis	*Picradeniopsis oppositifolia*	S1	G5?
pinesap	*Hypopitys monotropa*	S3	G5
poison suckleya	*Suckleya suckleyana*	S3	G5
prairie cord grass	*Spartina pectinata*	S2	G5
prairie false dandelion	*Nothocalais cuspidata*	S2	G5
prickly milk vetch	*Astragalus kentrophyta var. kentrophyta*	S2	G5T4
red three-awn	*Aristida purpurea var. longiseta*	S3	G5T5?
rockstar	*Lithophragma glabrum*	S2	G5
short-stalk mouse-ear chickweed	*Cerastium brachypodum*	S3	G5
shrubby evening-primrose	*Oenothera serrulata*	S3	G5
side-oats grama	*Bouteloua curtipendula*	S1	G5
slender cress	*Rorippa tenerrima*	S3	G5
slender hawk's-beard	*Crepis atribarba*	S2	G5
small baby-blue-eyes	*Nemophila breviflora*	S3	G5
smooth boisduvalia	*Epilobium campestre*	S3	G5
smooth goosefoot	*Chenopodium subglabrum*	S2	G3G4
smooth sweet cicely	*Osmorhiza longistylis*	S3	G5
soapweed	*Yucca glauca*	S1	G5; SARA Listed
spatulate-leaved heliotrope	*Heliotropium curassavicum*	S3	G5
spreading yellow cress	*Rorippa sinuata*	S2	G5
tumble grass	*Schedonnardus paniculatus*	S2	G5
two-leaved waterweed	*Elodea bifoliata*	S2	G4G5
upland evening-primrose	*Neoholmgrenia andina*	S1	G4
waterwort	*Elatine triandra*	S2	G5
western blue flag	*Iris missouriensis*	S2	G5
western false gromwell	*Lithospermum occidentale*	S3	G4G5
widgeon-grass	*Ruppia cirrhosa*	S3	G5

Source: ACIMS 2017 (a-f)

Table B: Rare Lichens and Mosses within the Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
alkaline wing-nerved moss	*Pterygoneurum kozlovii*	S2	G2G3
cushion moss	*Dicranum ontariense*	S1S2	G5
desert firedot lichen	*Caloplaca trachyphylla*	S2S4	G4G5
disk lichen	*Lecidella patavina*	S1S2	GNR
soil paint lichen	*Acarospora schleicheri*	S2S3	G5?
tar jelly lichen	*Collema coccophorum*	S1S3	G3G5

Source: ACIMS 2017 (a-f)

Table C: Rare Ecological Communities in the Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
creeping juniper / sun-loving sedge - yellow umbrella-plant badland community	*Juniperus horizontalis / Carex inops ssp. heliophila - Eriogonum flavum badland community*	S1S2	GNR
lance-leaf cottonwood / buckbrush woodland	*Populus x acuminata / Symphoricarpos occidentalis woodland*	S1S2	GNR
little bluestem - mountain rough fescue grassland	*Schizachyrium scoparium - Festuca campestris grassland*	S1?	GNR
long-leaved sagewort - rabbitbrush badlands	*Artemisia longifolia - Ericameria nauseosa badlands*	S1	GNR
plains rough fescue grassland	*Festuca hallii grassland*	S1	GNR
red three-awn grassland	*Aristida purpurea grassland*	S1	GNR
round-leaved hawthorn / cow parsnip - common nettle - western Canada violet shrubland	*Crataegus chrysocarpa / Heracleum maximum - Urtica dioica - Viola canadensis shrubland*	S1S2	GNR
silver sagebrush / mountain rough fescue - western porcupine grass shrub herbaceous	*Artemisia cana / Festuca campestris - Hesperostipa curtiseta shrub herbaceous*	S1?	GNR
western wheat grass - foxtail barley saline wetland	*Pascopyrum smithii - Hordeum jubatum Herbaceous Vegetation*	S1	G4
western wheat grass - Gardner's saltbush badland community	*Pascopyrum smithii - Atriplex gardneri badland community*	S1	GNR

Source: ACIMS 2017 (a-f)

Table D: Tracked Wildlife Species in the Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
Brassy Minnow	*Hybognathus hankinsoni*	SU	G5
Burrowing Owl	*Athene cunicularia*	S2B	G4; SARA Listed
Ferruginous Hawk	*Buteo regalis*	S2S3B	G4; SARA Listed
Greater Sage-Grouse	*Centrocercus urophasianus urophasianus*	S1	G3G4T3T4Q; SARA Listed
Hoary Bat	*Lasiurus cinereus*	S3B	G3G4
Lake Sturgeon	*Acipenser fulvescens*	S1S2	G3G4
Mountain Short-horned Lizard	*Phrynosoma hernandesi*	S2	G5
Northern Leopard Frog	*Lithobates pipiens*	S2S3	G5; SARA Listed
Olive-backed Pocket Mouse	*Perognathus fasciatus*	S2S3	G5
Peregrine Falcon	*Falco peregrinus*	S2S3B	G4; SARA Listed
Piping Plover	*Charadrius melodus circumcinctus*	S2B	G3T3; SARA Listed
Sage Thrasher	*Oreoscoptes montanus*	SUB	G4; SARA Listed
Stonecat	*Noturus flavus*	S2	G5
Swift Fox	*Vulpes velox*	S1S2	G3; SARA Listed
Trumpeter Swan	*Cygnus buccinator*	S2S3B	G4
Western Silvery Minnow	*Hybognathus argyritis*	S1S2	G4
White-faced Ibis	*Plegadis chihi*	S1S2B	G5

Source: ACIMS 2017 (a-f)

Table E: Rare Invertebrate Species in the Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
Acadian Hairstreak	*Satyrium acadica*	S2	G5
Arrowhead Blue	*Glaucopsyche piasus*	S2	G5
Bert's Predaceous Diving Beetle	*Sanfilippodytes bertae*	S1	G1; SARA Listed
Icarioides Blue	*Plebejus icarioides*	S2S3	G5
Oslar's Roadside-skipper	*Amblyscirtes oslari*	S1	G4
Pacific Forktail	*Ischnura cervula*	S2S3	G5
Rocky Mountain Dotted Blue	*Euphilotes ancilla*	S2	G5
Ruddy Copper	*Lycaena rubidus*	S2	G5
Shasta Blue	*Plebejus shasta*	S3	G5
Striped Meadowhawk	*Sympetrum pallipes*	S3	G5
Twelve-spotted Skimmer	*Libellula pulchella*	S1S2	G5
Two-tailed Swallowtail	*Papilio multicaudata*	S1S2	G5
Weidemeyer's Admiral	*Limenitis weidemeyerii*	S1	G5
Woodland Skipper	*Ochlodes sylvanoides*	S2	G5

Source: ACIMS 2017 (a-f)

Table F: Rare Vascular Plant Species within the Dry Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
American bugseed	*Corispermum americanum var. americanum*	S2	G5?T5?
annual dropseed	*Sporobolus neglectus*	S2	G5
annual skeletonweed	*Shinnersoseris rostrata*	S3	G5?
arctic bladderpod	*Physaria arctica*	S3	G4G5
aridland goosefoot	*Chenopodium desiccatum*	S3	G5
awned nut-grass	*Cyperus squarrosus*	S2	G5
blunt-leaved watercress	*Rorippa curvipes*	S3	G5
bur ragweed	*Ambrosia acanthicarpa*	S3	G5
Californian amaranth	*Amaranthus californicus*	S2S3	G4
Canada toad-flax	*Nuttallanthus texanus*	S2	G4G5
Canada waterweed	*Elodea canadensis*	S2	G5
chaffweed	*Lysimachia minima*	S2S3	G5
clammy hedge-hyssop	*Gratiola neglecta*	S3	G5
cock's-comb cryptantha	*Cryptantha celosioides*	S2S3	G5
Collins' rockcress	*Boechera collinsii*	S1	G5T5
common beggarticks	*Bidens frondosa*	S3	G5
corymbose everlasting	*Antennaria corymbosa*	S2	G5
creeping draba	*Draba reptans*	S2	G5
crowfoot violet	*Viola pedatifida*	S3	G5
cushion everlasting	*Antennaria dimorpha*	S2	G5
downingia	*Downingia laeta*	S3	G5
downy paintbrush	*Castilleja sessiliflora*	S1	G5
dwarf fleabane	*Erigeron radicatus*	S3	G3G4
dwarf woollyheads	*Psilocarphus brevissimus var. brevissimus*	S2	G4T4?
early buttercup	*Ranunculus glaberrimus*	S3	G5
Engelmann's spike-rush	*Eleocharis engelmannii*	S2	G4G5
false buffalo grass	*Munroa squarrosa*	S3	G5
few-flowered aster	*Almutaster pauciflorus*	S3	G4
field grape fern	*Botrychium campestre*	S3	G3G4
flowering-quillwort	*Lilaea scilloides*	S3	G5?
Fremont's goosefoot	*Chenopodium fremontii*	S2	G5
green milkweed	*Asclepias viridiflora*	S1	G5
hairy pepperwort	*Marsilea vestita*	S3	G5

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
Hooker's bugseed	*Corispermum hookeri var. hookeri*	S2	G4G5T4T5
Kelsey's cat's eye	*Cryptantha kelseyana*	S3	G4
lance-leaved loosestrife	*Lysimachia hybrida*	S3	G5
linear-leaved scorpionweed	*Phacelia linearis*	S3	G5
little barley	*Hordeum pusillum*	SH	G5
low cinquefoil	*Potentilla plattensis*	S2	G4
low yellow evening-primrose	*Oenothera flava*	S3	G5
mealy goosefoot	*Chenopodium incanum var. incanum*	S1	G5T5
Moquin's sea-blite	*Suaeda nigra*	S3	G5
mouse-ear cress	*Eutrema salsugineum*	S1	G5?
narrowleaf umbrella-wort	*Mirabilis linearis*	S2	G5
Navajo tea	*Thelesperma subnudum var. marginatum*	S1	G5T5
Nebraska sedge	*Carex nebrascensis*	S3	G5
Nevada rush	*Juncus nevadensis*	S1	G5
nodding umbrella-plant	*Eriogonum cernuum*	S3	G5
northern linanthus	*Leptosiphon septentrionalis*	S2	G5
northern wild rice	*Zizania palustris var. palustris*	S1	G4G5T4T5
pale bulrush	*Scirpus pallidus*	S1	G5
pasture sedge	*Carex petasata*	S3	G5
picradeniopsis	*Picradeniopsis oppositifolia*	S1	G5?
poison suckleya	*Suckleya suckleyana*	S3	G5
Powell's saltbush	*Atriplex powellii*	S2	G4
prairie cord grass	*Spartina pectinata*	S2	G5
prairie false dandelion	*Nothocalais cuspidata*	S2	G5
prickly milk vetch	*Astragalus kentrophyta var. kentrophyta*	S2	G5T4
red three-awn	*Aristida purpurea var. longiseta*	S3	G5T5?
rough barnyard grass	*Echinochloa muricata var. microstachya*	S1	G5T5
saltbush	*Atriplex truncata*	S1	G5
sand verbena	*Tripterocalyx micranthus*	S2	G5
sandhills cinquefoil	*Potentilla lasiodonta*	S3	G3
short-stalk mouse-ear chickweed	*Cerastium brachypodum*	S3	G5
shrubby evening-primrose	*Oenothera serrulata*	S3	G5
slender cress	*Rorippa tenerrima*	S3	G5
slender hawk's-beard	*Crepis atribarba*	S2	G5
slender mouse-ear-cress	*Transberingia bursifolia ssp. virgata*	S2	G3
slender phlox	*Microsteris gracilis ssp. gracilis*	S1	G5T5

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
smooth boisduvalia	*Epilobium campestre*	S3	G5
smooth goosefoot	*Chenopodium subglabrum*	S2	G3G4
smooth sweet cicely	*Osmorhiza longistylis*	S3	G5
soapweed	*Yucca glauca*	S1	G5; SARA Listed
spatulate bladderpod	*Physaria spatulata*	S2S3	G5TNR
spatulate-leaved heliotrope	*Heliotropium curassavicum*	S3	G5
spreading yellow cress	*Rorippa sinuata*	S2	G5
squirreltail	*Elymus elymoides ssp. elymoides*	S2S3	G5T5
swamp dodder	*Cuscuta gronovii*	S1	G5
tall beggarticks	*Bidens vulgata*	S1	G5
taraxia	*Taraxia breviflora*	S1	G5
thorough-wax	*Bupleurum americanum*	S2	G5
tiny cryptantha	*Cryptantha minima*	S2	G5; SARA Listed
tumble grass	*Schedonnardus paniculatus*	S2	G5
two-leaved waterweed	*Elodea bifoliata*	S2	G4G5
upland evening-primrose	*Neoholmgrenia andina*	S1	G4
water hyssop	*Bacopa rotundifolia*	S1	G5
water-thread pondweed	*Potamogeton diversifolius*	SU	G5
waterwort	*Elatine triandra*	S2	G5
Watson's goosefoot	*Chenopodium watsonii*	S2	G5
western false gromwell	*Lithospermum occidentale*	S3	G4G5
western spiderwort	*Tradescantia occidentalis*	S1	G5; SARA Listed

Source: ACIMS 2017 (a-f)

Table G: Rare Lichens and Mosses within the Dry Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
alkaline wing-nerved moss	*Pterygoneurum kozlovii*	S2	G2G3
brown-eyed scale	*Psora tuckermanii*	S2S3	G5
button lichen	*Buellia badia*	S1	G3?
button lichen	*Buellia elegans*	S2	G3G5
crimson dot lichen	*Ramboldia elabens*	S2	GNR
dark shadow lichen	*Phaeophyscia sciastra*	S3	G5
fallacious screw moss	*Didymodon fallax*	S2S3	G5
grain-spored lichen	*Sarcogyne regularis*	S1S3	G5
hairy-leaved beardless moss	*Pterygoneurum ovatum*	S2S3	G5
liverwort	*Mannia fragrans*	SU	G5
liverwort	*Riccia cavernosa*	S2S4	G5
moss	*Crossidium aberrans*	S1S3	G3G5
moss	*Syntrichia caninervis*	S1	G5?
moss	*Jaffueliobryum raui*	S2	G4?
moss	*Jaffueliobryum wrightii*	S1S2	G4G5
parasitic firedot lichen	*Caloplaca epithallina*	S2	G3G5
polar sunburst lichen	*Xanthomendoza hasseana*	S3	G5
powdery jewel lichen	*Caloplaca citrina*	S1S2	G4G5
rim-lichen	*Lecanora crenulata*	S1	G3G5
rock pimples	*Staurothele elenkinii*	S1	G3G5
soil paint lichen	*Acarospora schleicheri*	S2S3	G5?
split-peg lichen	*Cladonia symphycarpia*	S2S4	G5
vagabond lichen	*Circinaria hispida*	S2S3	G3
yellow collar moss	*Splachnum luteum*	S3	G4?

Source: ACIMS 2017 (a-f)

Table H: Rare Ecological Communities in the Dry Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
buckbrush / giant wild rye shrubland	*Symphoricarpos occidentalis / Leymus cinereus shrubland*	S2S3	GNR
California oat grass - slender-beaked sedge herbaceous vegetation	*Danthonia californica - Carex brevior herbaceous vegetation*	S2	GNR
creeping juniper / sun-loving sedge - yellow umbrella-plant badland community	*Juniperus horizontalis / Carex inops ssp. heliophila - Eriogonum flavum badland community*	S1S2	GNR
greasewood / Gardner's saltbush badlands	*Sarcobatus vermiculatus / Atriplex gardneri badlands*	S2S3	GNR
greasewood / western wheat grass shrubland	*Sarcobatus vermiculatus / Pascopyrum smithii shrubland*	S2S3	GNR
greasewood silt dune shrubland	*Sarcobatus vermiculatus silt dune shrubland*	S1	GNR
lance-leaf cottonwood / buckbrush woodland	*Populus x acuminata / Symphoricarpos occidentalis woodland*	S1S2	GNR
long-leaved sagewort - rabbitbrush badlands	*Artemisia longifolia - Ericameria nauseosa badlands*	S1	GNR
long-leaved sagewort bare shale community	*Artemisia longifolia bare shale community*	S1S2	GNR
Manitoba maple / choke cherry forest	*Acer negundo / Prunus virginiana Forest*	S1S2	G3
Moquin's sea-blite - endolepis sparsely vegetated badland slopes	*Suaeda nigra - Atriplex suckleyi sparsely vegetated badland slopes*	S2?	GNR
narrow-leaf cottonwood / buckbrush woodland	*Populus angustifolia / Symphoricarpos occidentalis woodland*	S2S3	GNR
narrow-leaf cottonwood / red-osier dogwood woodland	*Populus angustifolia / Cornus stolonifera woodland*	S2S3	G4
Nevada bulrush - (seaside arrow-grass) emergent marsh	*Amphiscirpus nevadensis - (Triglochin maritima) emergent marsh*	S2S3	GNR
northern wheat grass - needle-and-thread grassland	*Elymus lanceolatus - Hesperostipa comata grassland*	S2	GNR
Nuttall's salt-meadow grass community	*Puccinellia nuttalliana community*	S3?	G3?
plains cottonwood / buckbrush woodland	*Populus deltoides / Symphoricarpos occidentalis woodland*	S2S3	G2G3
plains cottonwood / recent alluvial riparian community	*Populus deltoides / recent alluvial riparian community*	S1S3	GNR
plains cottonwood / wild licorice - wire rush woodland	*Populus deltoides / Glycyrrhiza lepidota - Juncus balticus woodland*	S2S3	GNR
plains rough fescue grassland	*Festuca hallii grassland*	S1	GNR
round-leaved hawthorn / cow parsnip - common nettle - western Canada violet shrubland	*Crataegus chrysocarpa / Heracleum maximum - Urtica dioica - Viola canadensis shrubland*	S1S2	GNR
salt grass - western wheat grass meadow	*Distichlis stricta - Pascopyrum smithii meadow*	S2	GNR
samphire emergent marsh	*Salicornia rubra emergent marsh*	S2	G2G3
sand grass - needle-and-thread grassland	*Calamovilfa longifolia - Hesperostipa comata Grassland*	S3	G3
scratch grass - Nevada bulrush - salt grass meadow	*Muhlenbergia asperifolia - Amphiscirpus nevadensis - Distichlis stricta meadow*	S1S2	GNR
seaside arrow-grass emergent marsh	*Triglochin maritima emergent marsh*	S2?	GNR
silver sagebrush - greasewood / needle-and-thread shrub herbaceous	*Artemisia cana - Sarcobatus vermiculatus / Hesperostipa comata shrub herbaceous*	S1S2	GNR
silver sagebrush / green needle grass - western wheat grass shrubland	*Artemisia cana / Nassella viridula - Pascopyrum smithii shrubland*	S2S3	GNR

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
silver sagebrush / needle-and-thread - sand grass shrub herbaceous	*Artemisia cana / Hesperostipa comata - Calamovilfa longifolia shrub herbaceous*	S3	GNR
silver sagebrush / wheat grasses - Gardner's saltbush sparsely vegetated saline flats	*Artemisia cana / Pascopyrum smithii - Elymus lanceolatus - Atriplex gardneri sparsely vegetated saline flats*	S2S3	GNR
skunkbush / needle-and-thread shrubland	*Rhus trilobata / Hesperostipa comata shrubland*	S2S3	GNR
water birch grassland riparian shrubland	*Betula occidentalis grassland riparian shrubland*	S2S3	GNR
western wheat grass - blue grama grassland	*Pascopyrum smithii - Bouteloua gracilis grassland*	S2?	GNR
western wheat grass - low sedge meadow	*Pascopyrum smithii - Carex duriuscula meadow*	S2S3	GNR
western wheat grass - prairie sagewort grassland	*Pascopyrum smithii - Artemisia ludoviciana grassland*	S1S2	GNR
wild begonia sand dune community	*Rumex venosus sand dune community*	S2S3	GNR
winter-fat / tumble grass ephemeral drainage	*Krascheninnikovia lanata / Schedonnardus paniculatus ephemeral drainage*	S1S2	GNR

Source: ACIMS 2017 (a-f)

Table I: Tracked Wildlife Species in the Dry Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
American White Pelican	*Pelecanus erythrorhynchos*	S2S3B	G4
Brassy Minnow	*Hybognathus hankinsoni*	SU	G5
Bullock's Oriole	*Icterus bullockii*	SUB	G5
Burrowing Owl	*Athene cunicularia*	S2B	G4; SARA Listed
Canadian Toad	*Anaxyrus hemiophrys*	S3	G4G5
Caspian Tern	*Hydroprogne caspia*	S2B	G5
Clark's Grebe	*Aechmophorus clarkii*	S1B	G5
Ferruginous Hawk	*Buteo regalis*	S2S3B	G4; SARA Listed
Great Plains Toad	*Anaxyrus cognatus*	S2S3	G5
Greater Sage-Grouse	*Centrocercus urophasianus urophasianus*	S1	G3G4T3T4Q; SARA Listed
Lake Sturgeon	*Acipenser fulvescens*	S1S2	G3G4
Loggerhead Shrike	*Lanius ludovicianus*	S3B	G4; SARA Listed
Mountain Plover	*Charadrius montanus*	S1B	G3; SARA Listed
Mountain Short-horned Lizard	*Phrynosoma hernandesi*	S2	G5
Northern Leopard Frog	*Lithobates pipiens*	S2S3	G5; SARA Listed
Olive-backed Pocket Mouse	*Perognathus fasciatus*	S2S3	G5
Ord's Kangaroo Rat	*Dipodomys ordii*	S1	G5; SARA Listed
Peregrine Falcon	*Falco peregrinus*	S2S3B	G4; SARA Listed
Piping Plover	*Charadrius melodus circumcinctus*	S2B	G3T3; SARA Listed
Stonecat	*Noturus flavus*	S2	G5
Swift Fox	*Vulpes velox*	S1S2	G3; SARA Listed
Western Harvest Mouse	*Reithrodontomys megalotis*	S1	G5
Western Painted Turtle	*Chrysemys picta bellii*	S2S3	G5T5
Western Silvery Minnow	*Hybognathus argyritis*	S1S2	G4; SARA Listed
White-faced Ibis	*Plegadis chihi*	S1S2B	G5

Source: ACIMS 2017 (a-f)

Table J: Rare Invertebrate Species in the Dry Mixedgrass Natural Subregion

Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
A Water Scorpion	*Ranatra fusca*	SNR	GNR
Acadian Hairstreak	*Satyrium acadica*	S2	G5
Arrowhead Blue	*Glaucopsyche piasus*	S2	G5
beautiful tiger beetle	*Cicindela formosa*	S2S3	G5
Brimstone Clubtail	*Stylurus intricatus*	S2S3	G4
Carlota Checkerspot	*Chlosyne gorgone carlota*	S2	G5T5
Common Green Darner	*Anax junius*	S3	G5
Delaware Skipper	*Anatrytone logan*	S3	G5
Dusky Dune Moth	*Copablepharon longipenne*	S2	G4
Eastern Forktail	*Ischnura verticalis*	S3	G5
Five-spotted Bogus Yucca Moth	*Prodoxus quinquepunctella*	S1	G4G5; SARA Listed
ghost tiger beetle	*Ellipsoptera lepida*	S2S4	G3G4
Gold-edged Gem Moth	*Schinia avemensis*	S2S3	G1G3
Gorgone Checkerspot	*Chlosyne gorgone*	S2S3	G5
Leonard's skipper	*Hesperia leonardus*	S1	G5
Noctuid Moth	*Copablepharon viridisparsa*	S2	G4; SARA Listed
Non-pollinating Yucca Moth	*Tegeticula corruptrix*	S1	G4G5
Oslar's Roadside-skipper	*Amblyscirtes oslari*	S1	G4
Rhesus Skipper	*Polites rhesus*	SU	G4
River Bluet	*Enallagma anna*	S1S2	G5
Rocky Mountain Dotted Blue	*Euphilotes ancilla*	S2	G5
Ruddy Copper	*Lycaena rubidus*	S2	G5
Sagebrush (Acastus) Checkerspot	*Chlosyne acastus*	S2	G4G5
Sagebrush Sheep Moth	*Hemileuca hera*	S2	G5
salt creek tiger beetle	*Cicindela nevadica*	S2S4	G5
Shasta Blue	*Plebejus shasta*	S3	G5
Small Checkered-skipper	*Pyrgus scriptura*	SH	G5
Strecker's giant-skipper	*Megathymus streckeri*	S1	G5
Striped Meadowhawk	*Sympetrum pallipes*	S3	G5
Summer Azure	*Celastrina neglecta*	SU	G5
Tule Bluet	*Enallagma carunculatum*	S3	G5
Twelve-spotted Skimmer	*Libellula pulchella*	S1S2	G5
Two-tailed Swallowtail	*Papilio multicaudata*	S1S2	G5

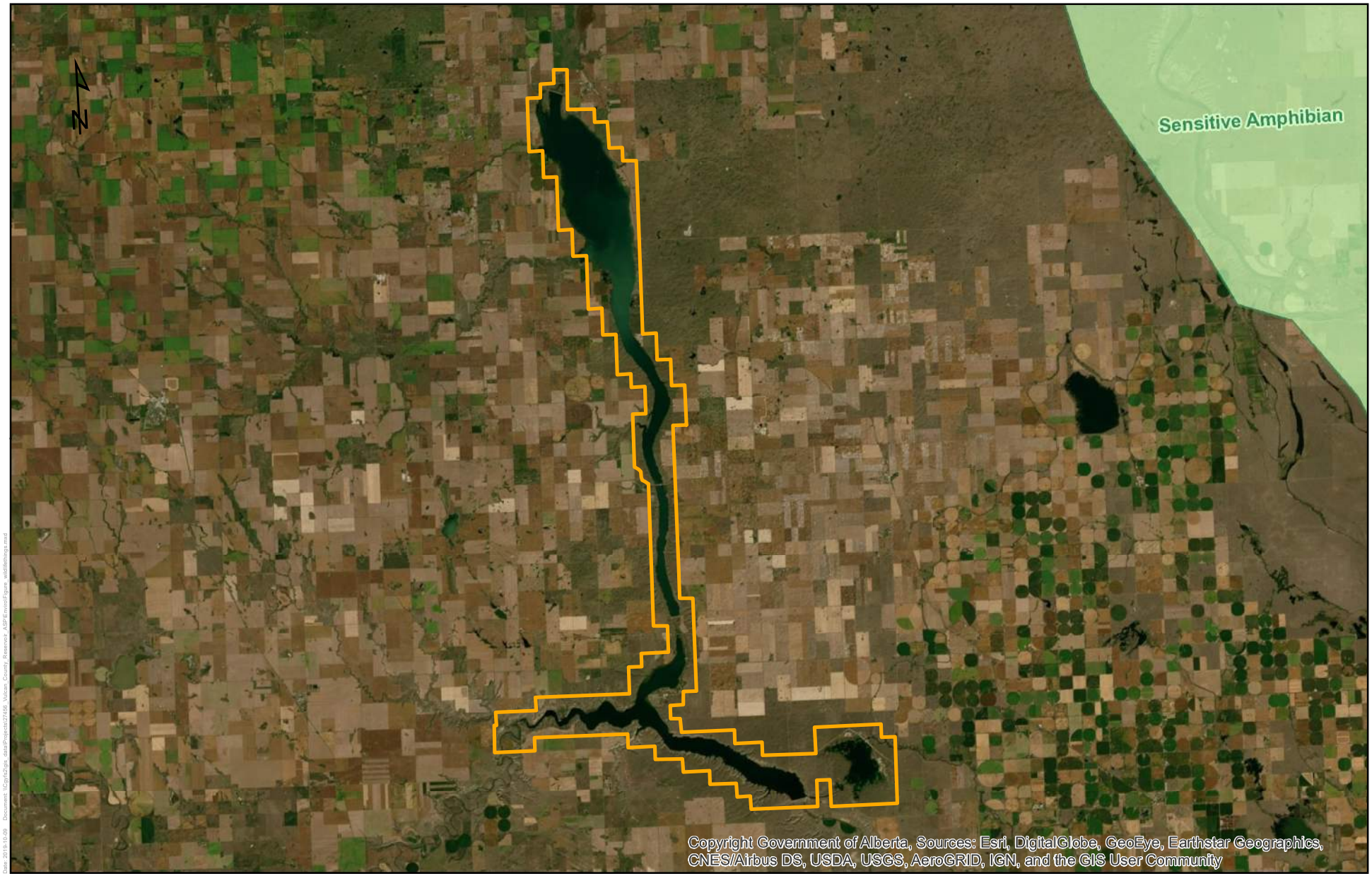
Common Name	Scientific Name	Rank (Provincial)[1]	Rank (Global)[2]
Verna Flower Moth	*Schinia verna*	S2S3	GU
Weidemeyer's Admiral	*Limenitis weidemeyerii*	S1	G5
Western Forktail	*Ischnura perparva*	S1S3	G5
Western Red Damsel	*Amphiagrion abbreviatum*	S3	G5
Woodland Skipper	*Ochlodes sylvanoides*	S2	G5
Yucca Moth	*Tegeticula yuccasella*	S1	G4G5;SARA Listed

Source: ACIMS 2017 (a-f)

Notes:

1. S1 (Critically Imperiled): Five or fewer occurrences, or especially vulnerable to extirpation due to other factor(s).
   S2 (Imperiled): Twenty or fewer occurrences, or vulnerable to extirpation due to other factor(s).
   S3 (Vulnerable): One hundred or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factor(s).
   S4 (Apparently Secure): Fairly low risk of extinction in the jurisdiction due to extensive range and/or many populations or occurrences, but with possible concern as a result of recent declines, threats or other factors.
   S_S_: Denotes the range of uncertainty about the status rank of the element.
   SNA: Not Applicable because the species or ecosystems is not a suitable target for conservation activities (e.g., introduced species).
   SU (Unrankable): Due to lack of information or substantially conflicting information.
   B (Breeding Qualifier): Refers to the breeding population of the species.
   N (Non-breeding): Refers to the non-breeding population of the species.
   H (Possibly extirpated): known only from historical records but still some hope of rediscovery.
   T (Intraspecfic Taxon): The status of subspecies or varieties are indicated by the T-Rank following the global rank.
   Q (questionable Taxonomy): Distinctiveness of this entity as a taxon at the current level is questionable.
   NR (not ranked): Rank not yet assessed
2. G ranks are similar to S ranks, on a Global scale.

APPENDIX D
Wildlife Map Compilation



Integrated Expertise. Locally Delivered.

Legend

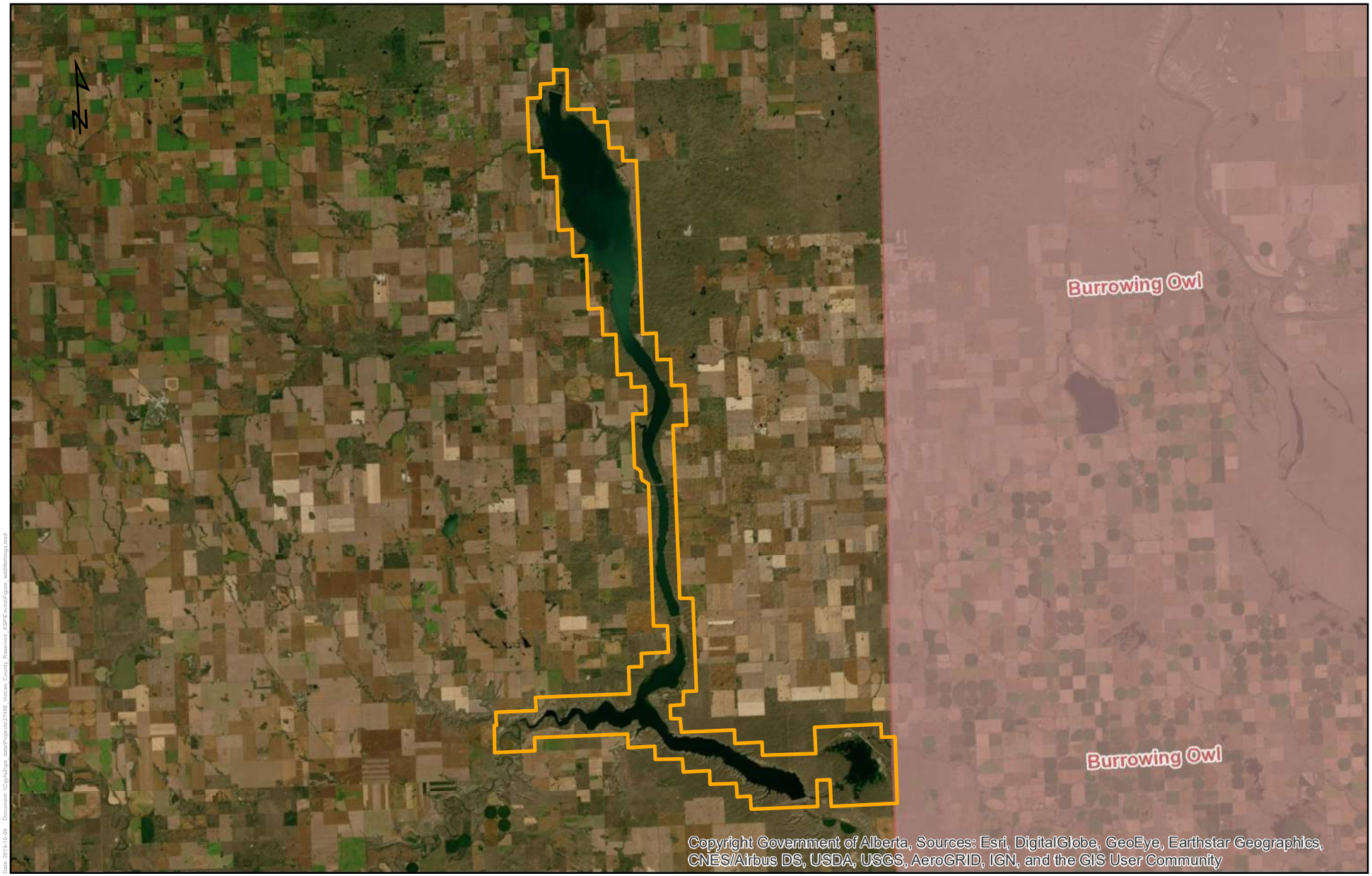
- Approximate ASP Area
- Sensitive Amphibian Range

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

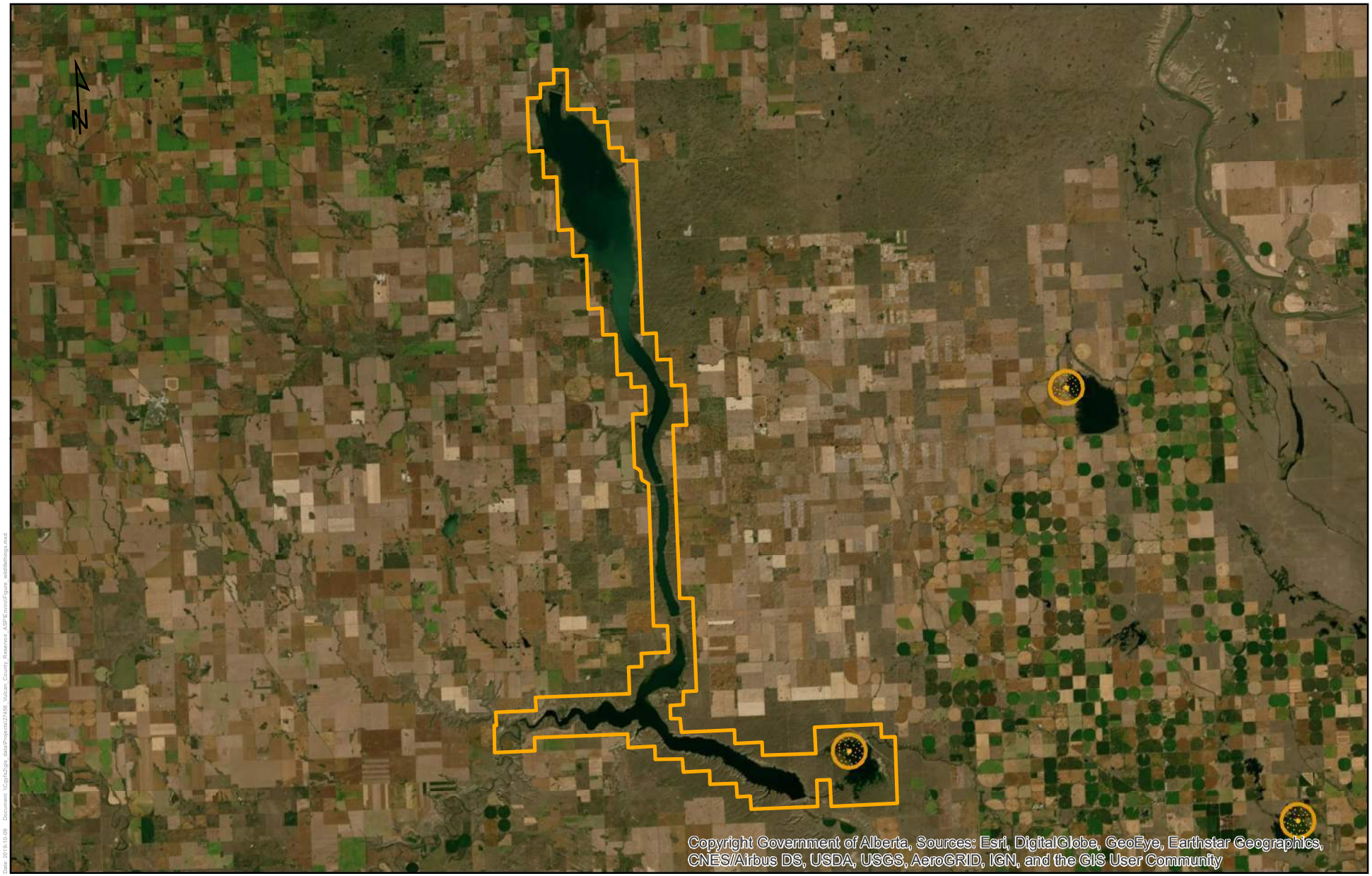
- Approximate ASP Area
- Burrowing Owl Range

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

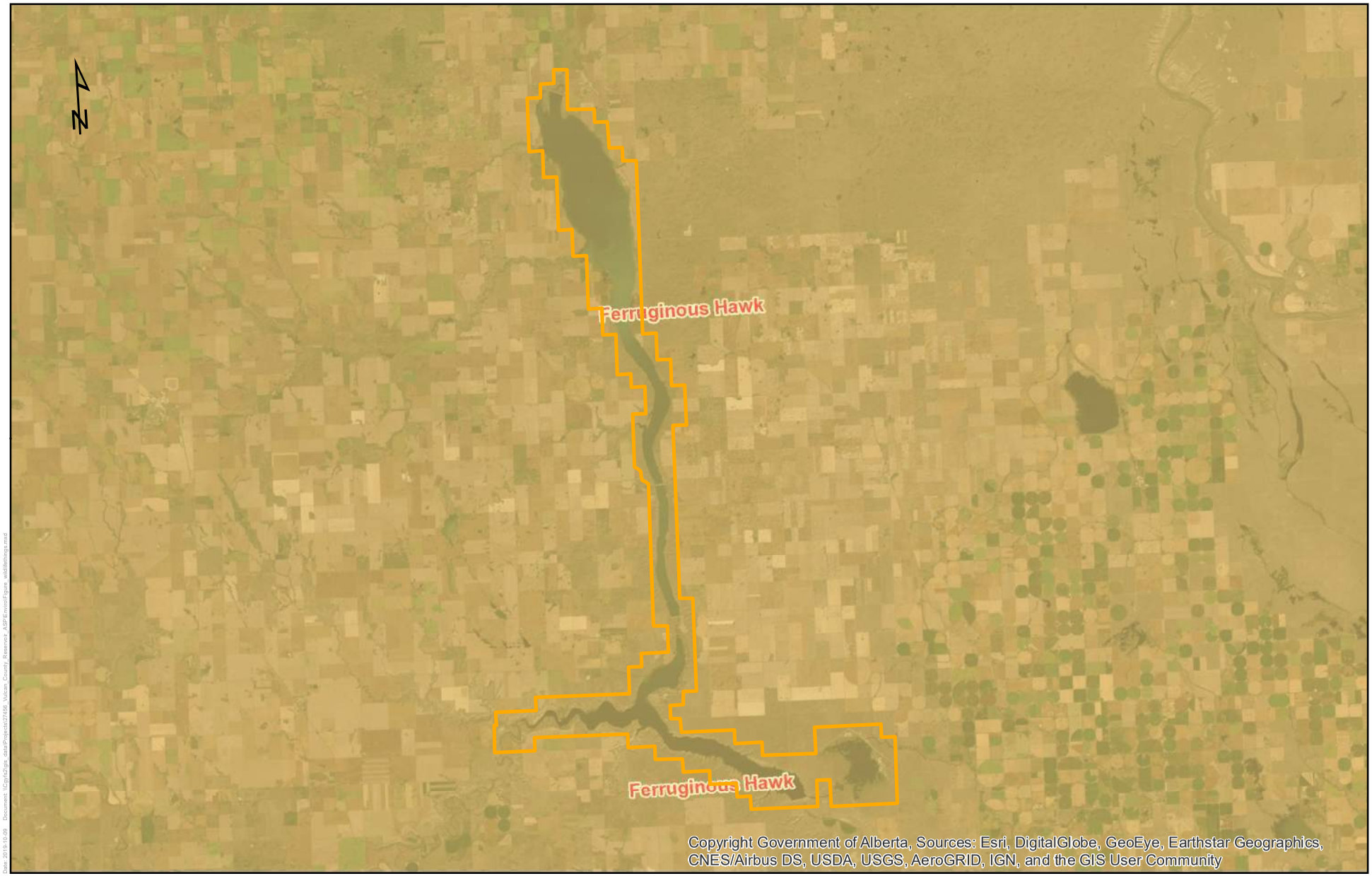
- Approximate ASP Area
- Colonial Nesting Birds Buffer - 100 meter

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

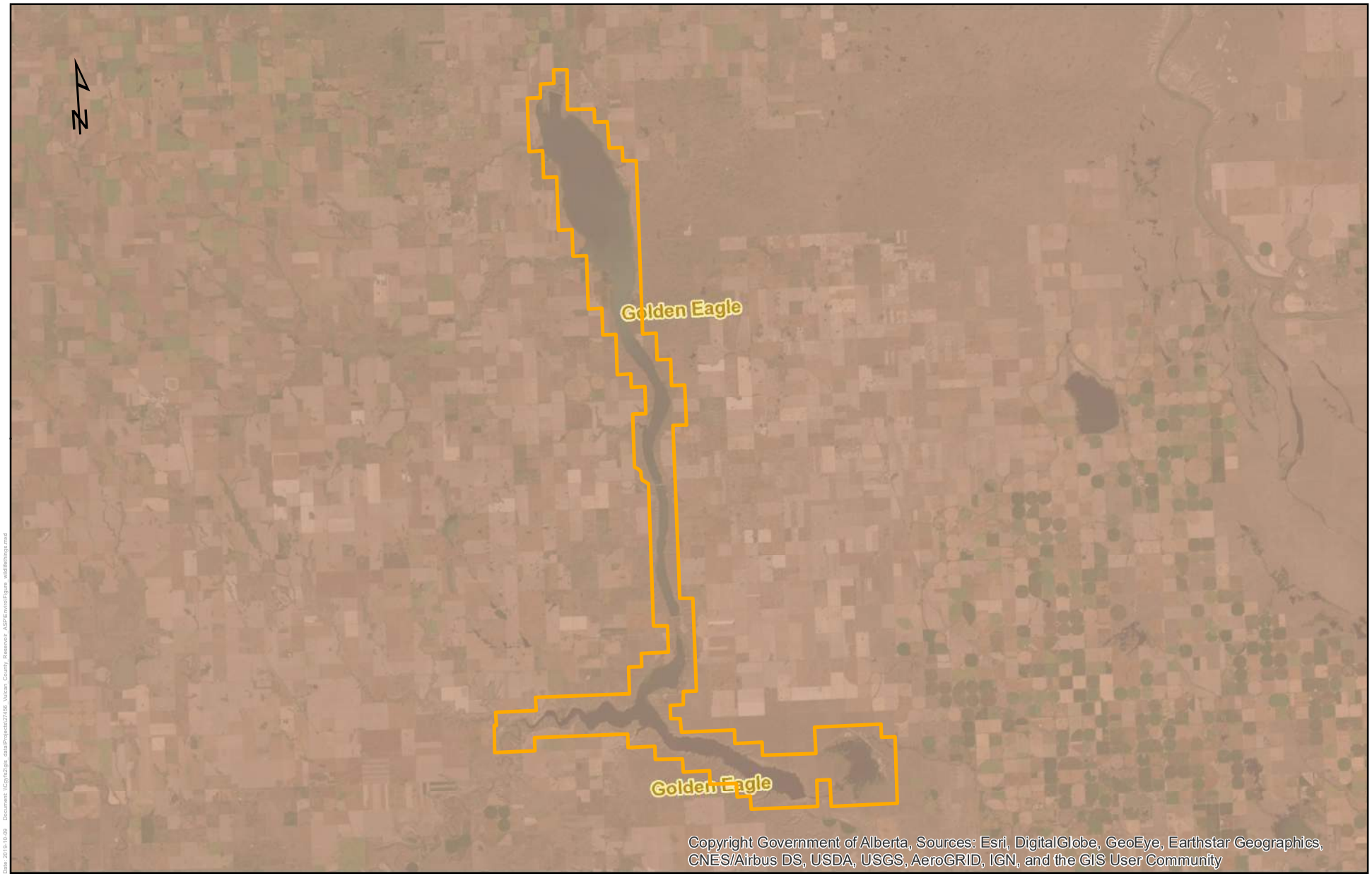
- Approximate ASP Area
- Sensitive Raptor Range - Ferruginous Hawk

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

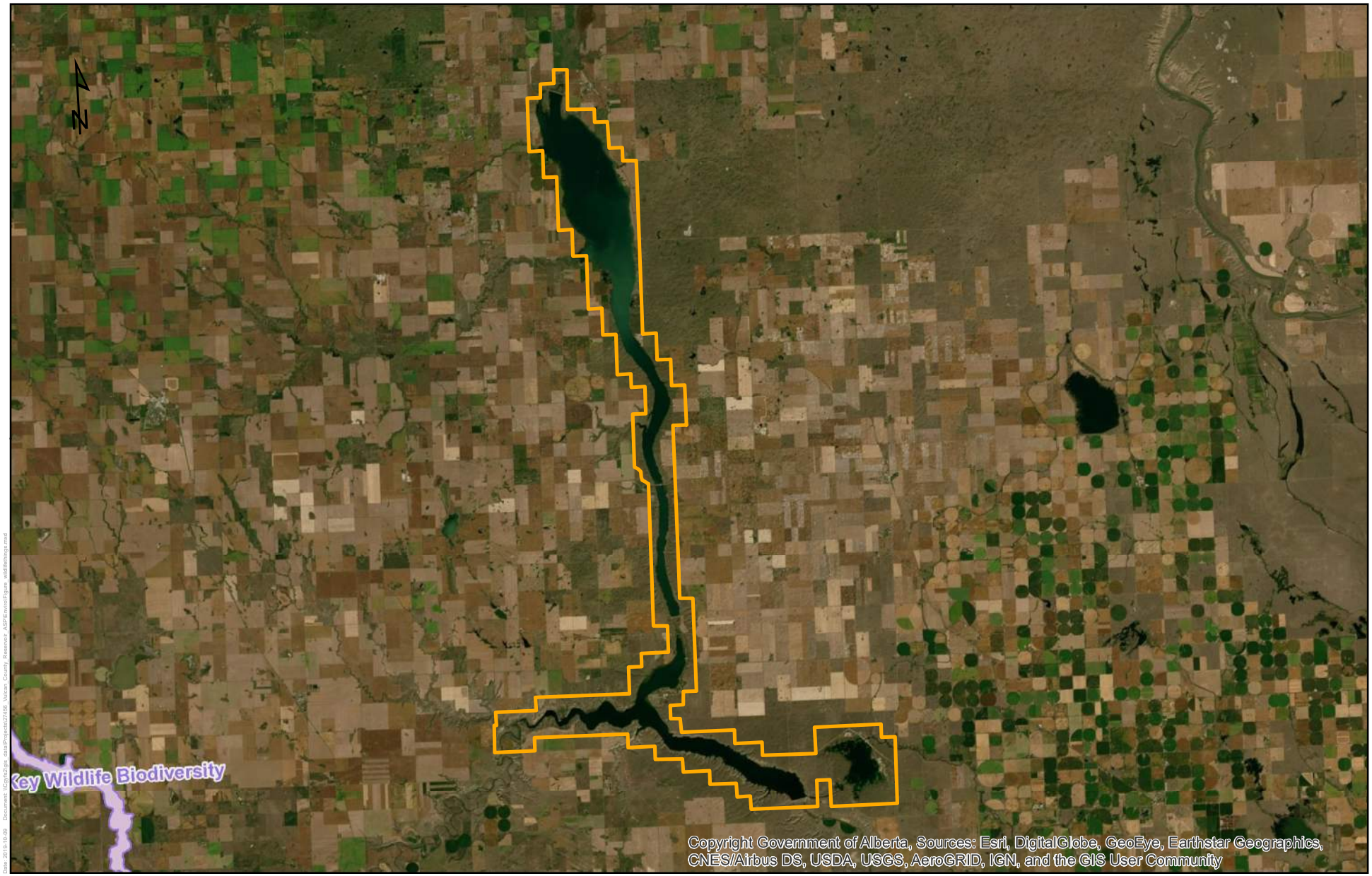
- Approximate ASP Area
- Sensitive Raptor Range - Golden Eagle

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL
Integrated Expertise. Locally Delivered.

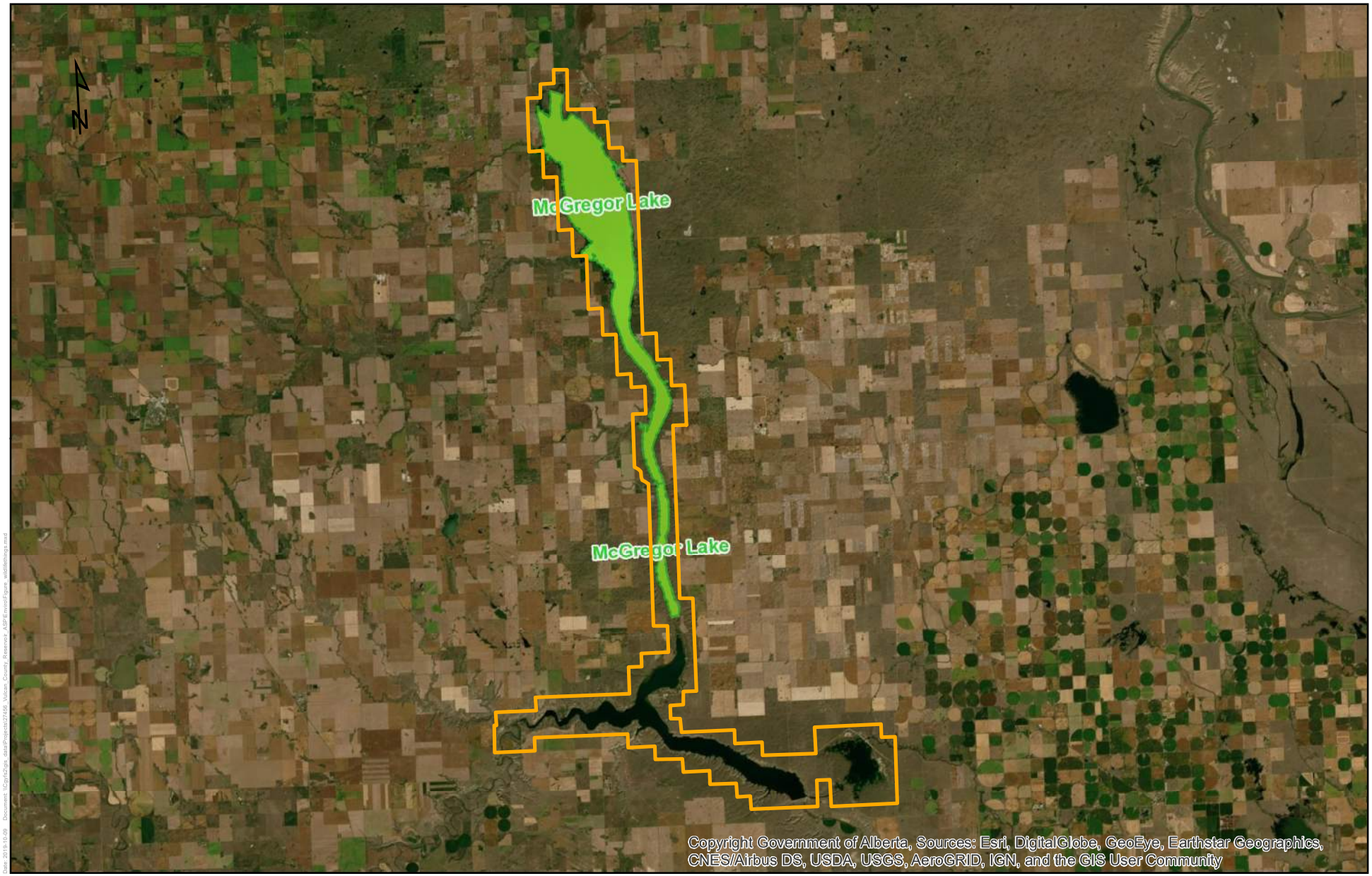
Legend
- Approximate ASP Area
- Key Wildlife and Biodiversity Zone

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

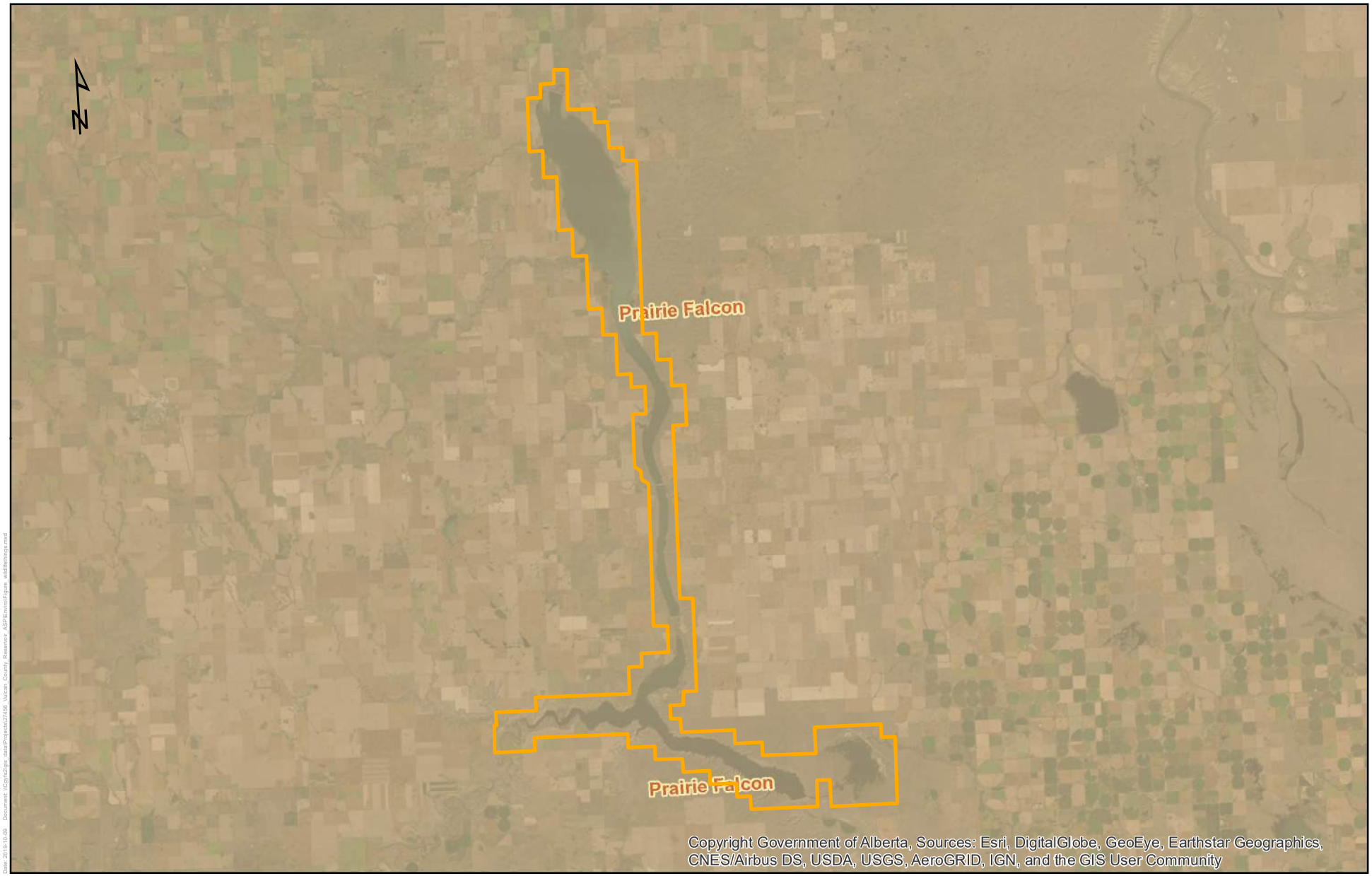
- Approximate ASP Area
- Piping Plover Waterbodies

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL
Integrated Expertise. Locally Delivered.

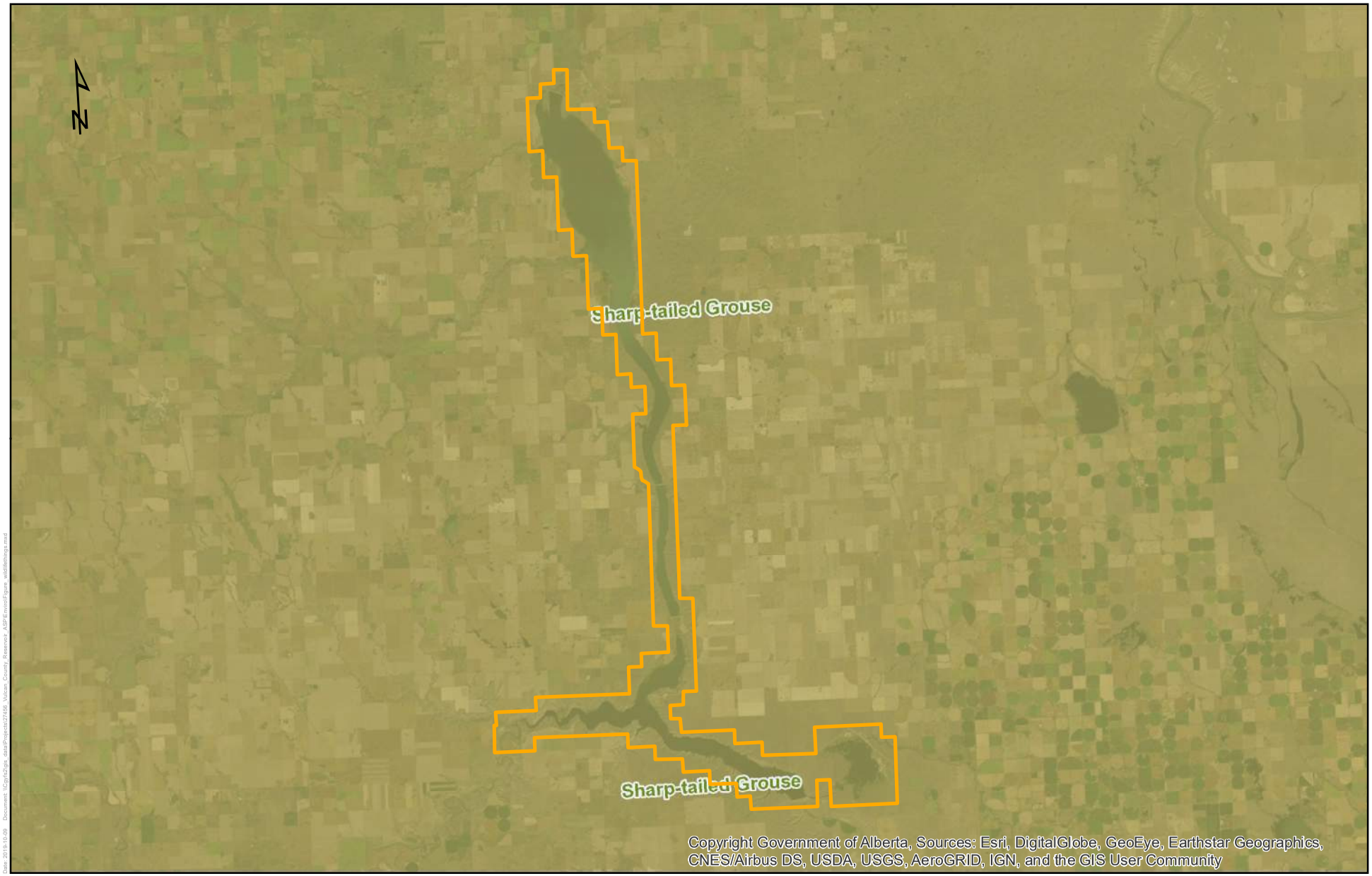
Legend
- Approximate ASP Area
- Sensitive Raptor Range - Prairie Falcon

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION



ISL

Integrated Expertise. Locally Delivered.

Legend

- Approximate ASP Area
- Sharp-Tailed Grouse Survey Area

0 1,750 3,500 7,000 10,500 m

1:325,000

NAD 1983 UTM Zone 12N

WILDLIFE INFORMATION

APPENDIX E
FWMIS Output

Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:15

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BURBOT	AMERICAN WHITE PELICAN	RAINBOW TROUT
FATHEAD MINNOW	LONG-BILLED CURLEW	
LAKE CHUB	PIED-BILLED GREBE	
LAKE WHITEFISH	SPRAGUE'S PIPIT	
LONGNOSE DACE	WESTERN GREBE	
LONGNOSE SUCKER		
NORTHERN PIKE		
SPOTTAIL SHINER		
TROUT-PERCH		
WALLEYE		
WHITE SUCKER		
YELLOW PERCH		

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
649239, 5597042	10-TM AEP Forest	NE 13 18 22 4	5 kilometers

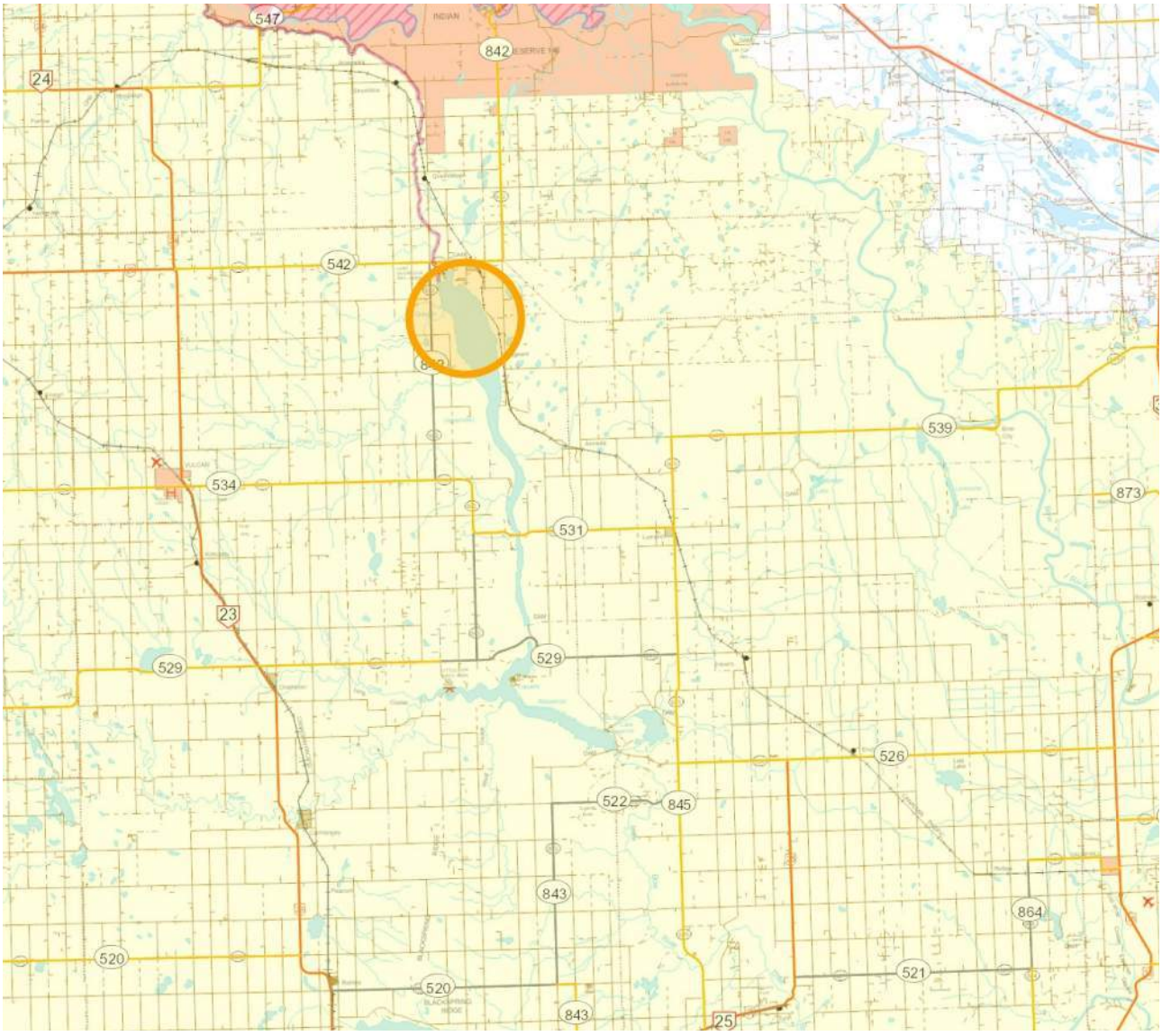
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:15

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:21

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BROWN TROUT	AMERICAN WHITE PELICAN	LAKE WHITEFISH
BURBOT	BURROWING OWL	WALLEYE
LAKE TROUT	CHESTNUT-COLLARED LONGSPUR	
LAKE WHITEFISH	FERRUGINOUS HAWK	
LONGNOSE SUCKER	LOGGERHEAD SHRIKE	
NORTHERN PIKE	LONG-BILLED CURLEW	
RAINBOW TROUT	PIPING PLOVER	
SPOTTAIL SHINER	SPRAGUE'S PIPIT	
TROUT-PERCH		
WALLEYE		
WHITE SUCKER		
YELLOW PERCH		

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
651617, 5589058	10-TM AEP Forest	NW 20 17 21 4	5 kilometers

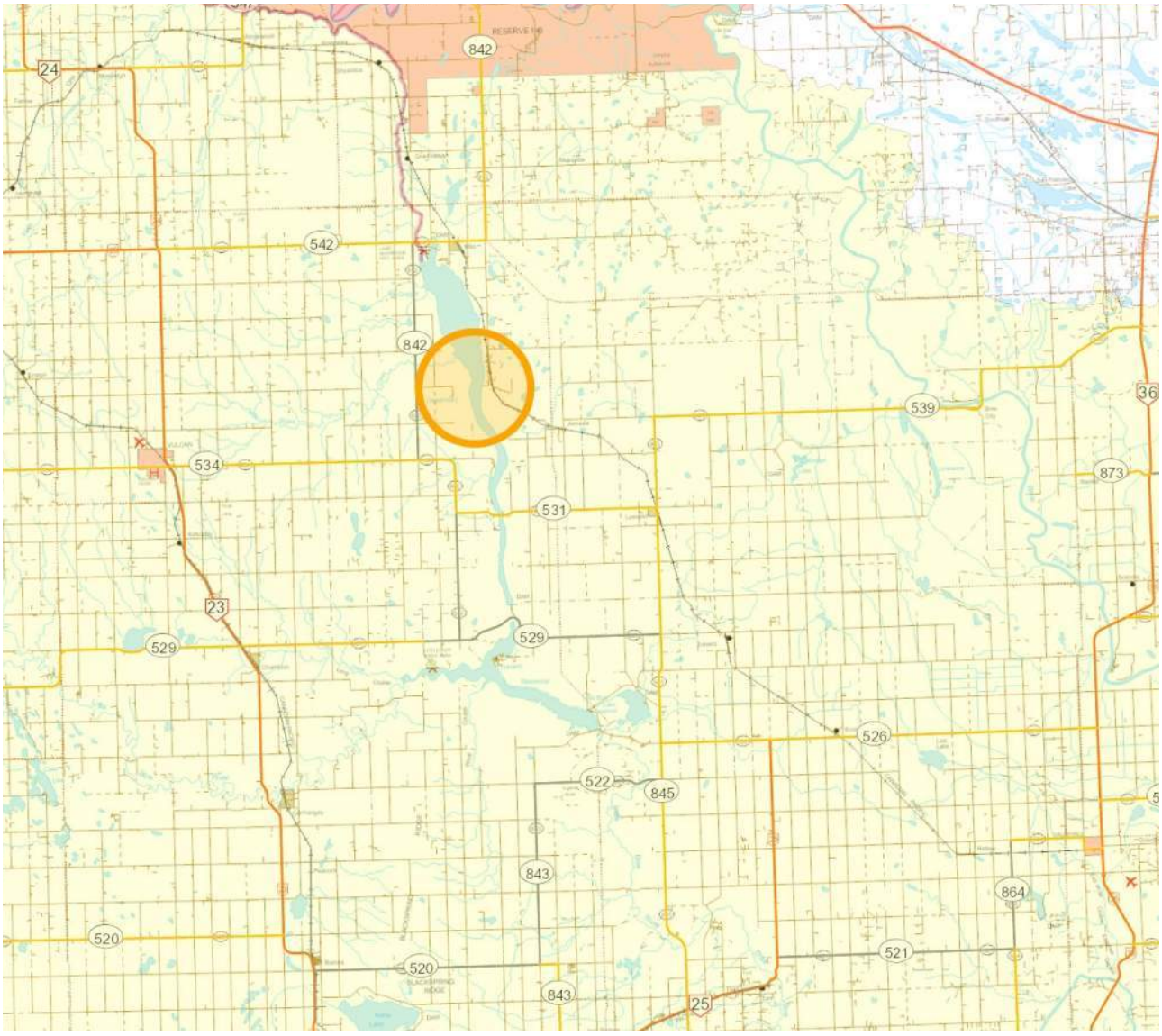
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:21

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:25

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BURBOT	BURROWING OWL	No Species Found in Search Extent
EMERALD SHINER	LOGGERHEAD SHRIKE	
LAKE WHITEFISH	SWIFT FOX	
LONGNOSE DACE		
LONGNOSE SUCKER		
MOUNTAIN WHITEFISH		
NORTHERN PIKE		
RAINBOW TROUT		
SPOTTAIL SHINER		
TROUT-PERCH		
WALLEYE		
WHITE SUCKER		
YELLOW PERCH		

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
653231, 5579970	10-TM AEP Forest	SW 28 16 21 4	5 kilometers

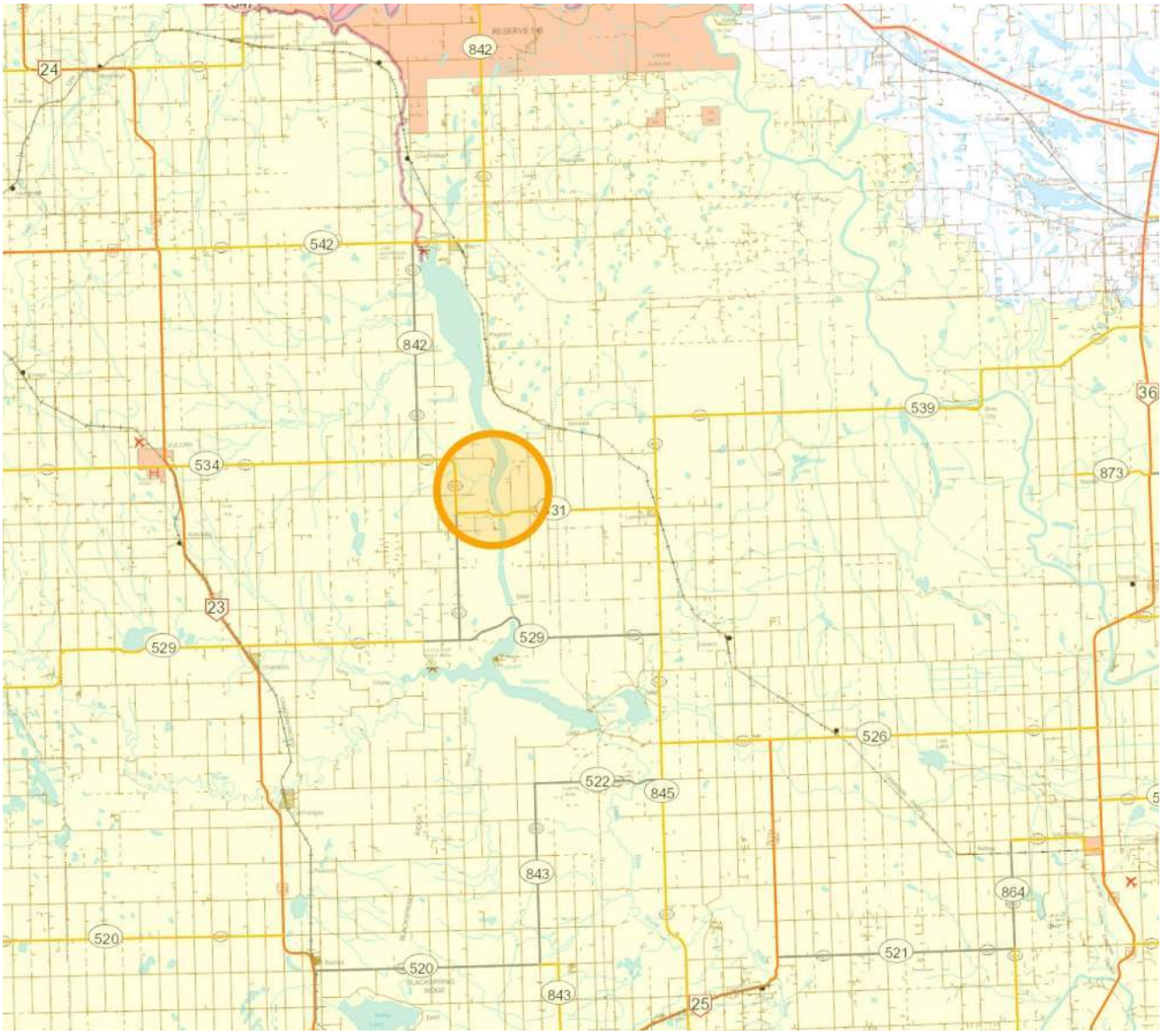
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:25

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:27

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BURBOT	AMERICAN WHITE PELICAN	No Species Found in Search Extent
EMERALD SHINER	BADGER	
LAKE WHITEFISH	BAIRD'S SPARROW	
LONGNOSE SUCKER	BARN SWALLOW	
NORTHERN PIKE	BURROWING OWL	
SHORTHEAD REDHORSE	CHESTNUT-COLLARED LONGSPUR	
SPOTTAIL SHINER	EASTERN KINGBIRD	
TROUT-PERCH	FERRUGINOUS HAWK	
WALLEYE	LEAST FLYCATCHER	
WHITE SUCKER	LONG-BILLED CURLEW	
YELLOW PERCH	MCCOWN'S LONGSPUR	
	SHARP-TAILED GROUSE	
	SPRAGUE'S PIPIT	

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
654674, 5569014	10-TM AEP Forest	SE 21 15 21 4	5 kilometers

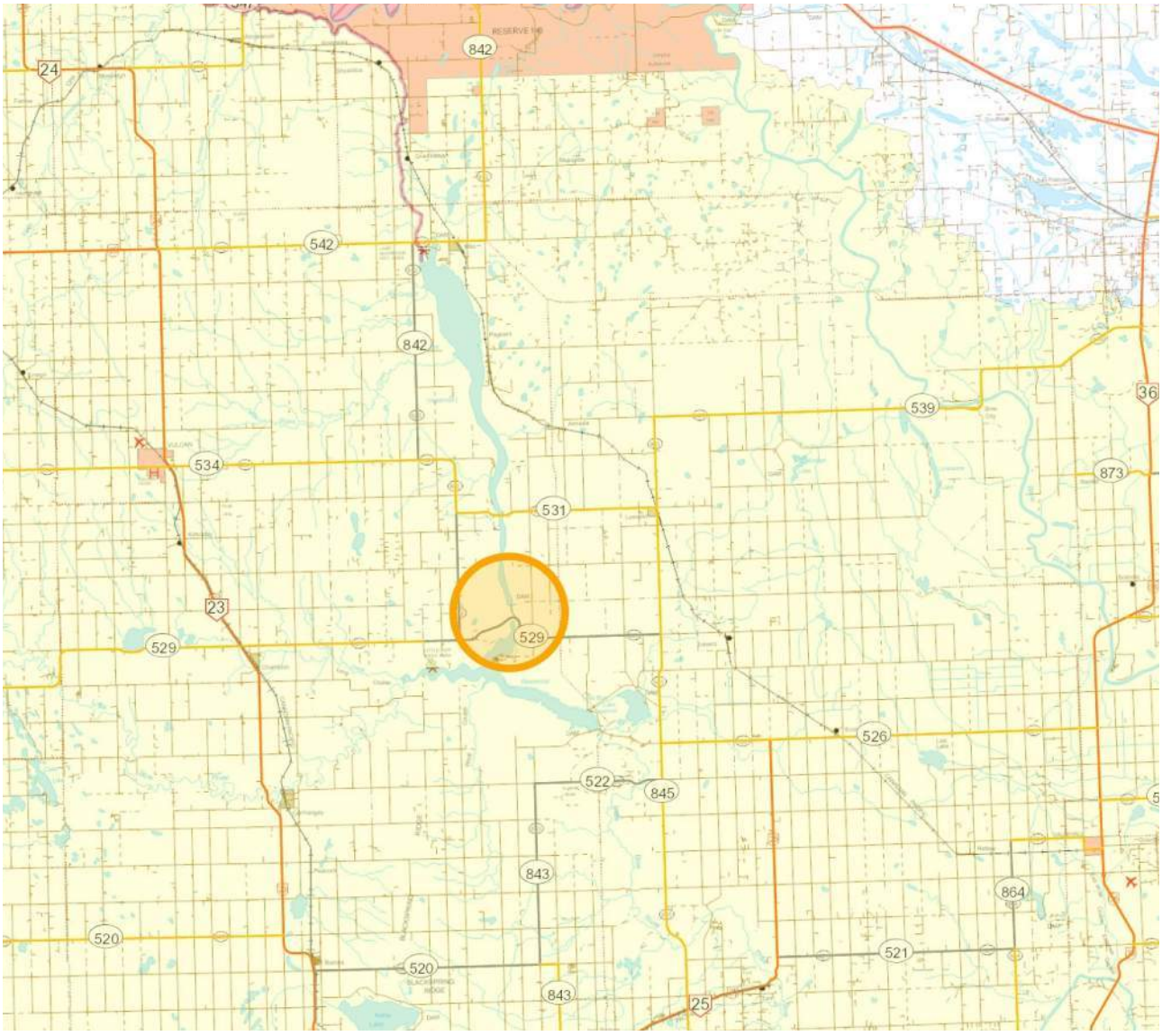
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:27

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:30

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
EMERALD SHINER	AMERICAN KESTREL	No Species Found in Search Extent
LAKE WHITEFISH	AMERICAN WHITE PELICAN	
LONGNOSE SUCKER	BANK SWALLOW	
NORTHERN PIKE	BURROWING OWL	
NORTHERN REDBELLY DACE	CHESTNUT-COLLARED LONGSPUR	
SHORTHEAD REDHORSE	EASTERN KINGBIRD	
SPOTTAIL SHINER	FERRUGINOUS HAWK	
WALLEYE	GOLDEN EAGLE	
WHITE SUCKER	LITTLE BROWN BAT	
YELLOW PERCH	LOGGERHEAD SHRIKE	
	LONG-BILLED CURLEW	
	PEREGRINE FALCON	
	PRAIRIE FALCON	
	SILVER-HAIRED BAT	
	SPRAGUE'S PIPIT	

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
648814, 5563409	10-TM AEP Forest	SW 1 15 22 4	5 kilometers

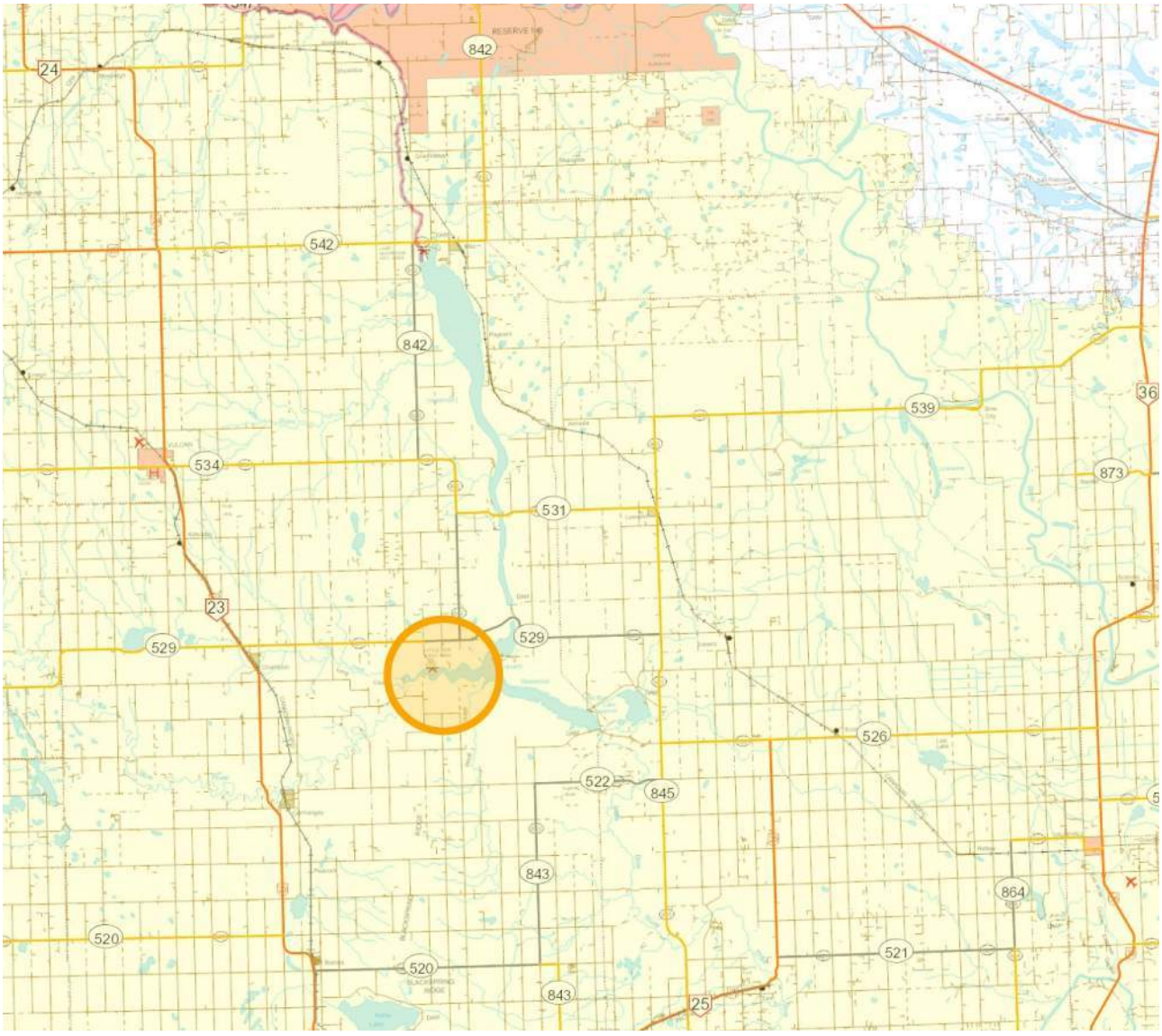
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:30

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:35

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BROWN TROUT	AMERICAN KESTREL	KOKANEE
BURBOT	BAIRD'S SPARROW	LAKE TROUT
LAKE WHITEFISH	BURROWING OWL	WALLEYE
LONGNOSE SUCKER	CHESTNUT-COLLARED LONGSPUR	
NORTHERN PIKE	EASTERN KINGBIRD	
RAINBOW TROUT	FERRUGINOUS HAWK	
WALLEYE	GOLDEN EAGLE	
WHITE SUCKER	GRASSHOPPER SPARROW	
YELLOW PERCH	GREAT PLAINS TOAD	
	LITTLE BROWN BAT	
	LONG-BILLED CURLEW	
	PRAIRIE FALCON	
	RED BAT	
	SHARP-TAILED GROUSE	
	SILVER-HAIRED BAT	
	SPRAGUE'S PIPIT	
	UPLAND SANDPIPER	
	WESTERN GREBE	

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
658241, 5561201	10-TM AEP Forest	NE 27 14 21 4	5 kilometers

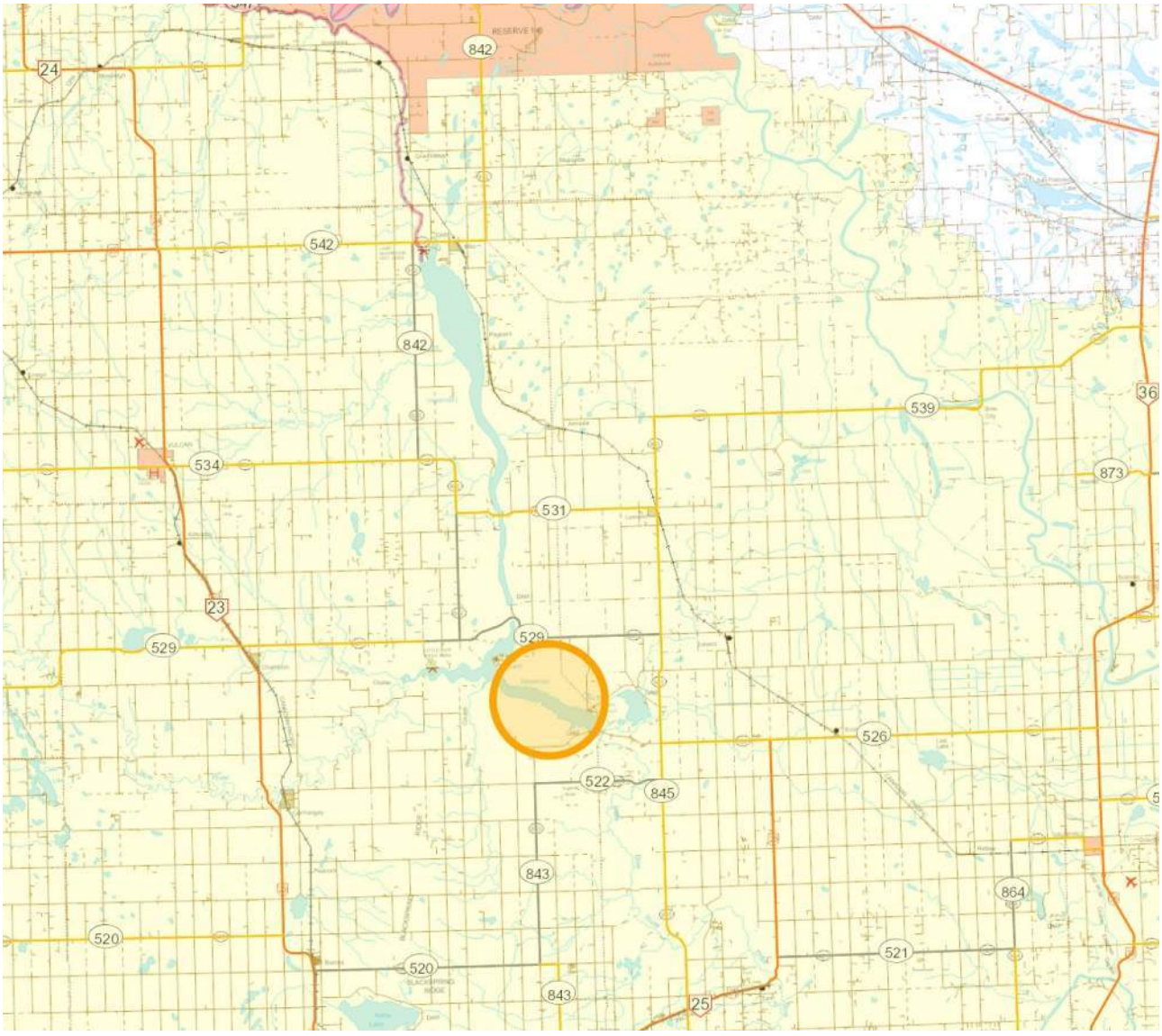
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:35

Map Results



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Fish and Wildlife Internet Mapping Tool (FWIMT)

(source database: Fish and Wildlife Management Information System (FWMIS))

Species Summary Report

Report Created: 21-Sep-2019 15:39

Species present within the current extent :

Fish Inventory	Wildlife Inventory	Stocked Inventory
BROWN TROUT	AMERICAN WHITE PELICAN	WALLEYE
BURBOT	BARN SWALLOW	
LAKE TROUT	BREWER'S SPARROW	
LAKE WHITEFISH	CHESTNUT-COLLARED LONGSPUR	
LONGNOSE DACE	CLARK'S GREBE	
LONGNOSE SUCKER	EASTERN KINGBIRD	
NORTHERN PIKE	FERRUGINOUS HAWK	
RAINBOW TROUT	GREAT BLUE HERON	
SPOTTAIL SHINER	LONG-BILLED CURLEW	
TROUT-PERCH	MCCOWN'S LONGSPUR	
TULLIBEE (CISCO)	SHARP-TAILED GROUSE	
WALLEYE	SILVER-HAIRED BAT	
WHITE SUCKER	SPRAGUE'S PIPIT	
YELLOW PERCH		

Buffer Extent

Centroid (X,Y):	Projection	Centroid: (Qtr Sec Twp Rng Mer)	Radius or Dimensions
664526, 5560606	10-TM AEP Forest	SE 29 14 20 4	5 kilometers

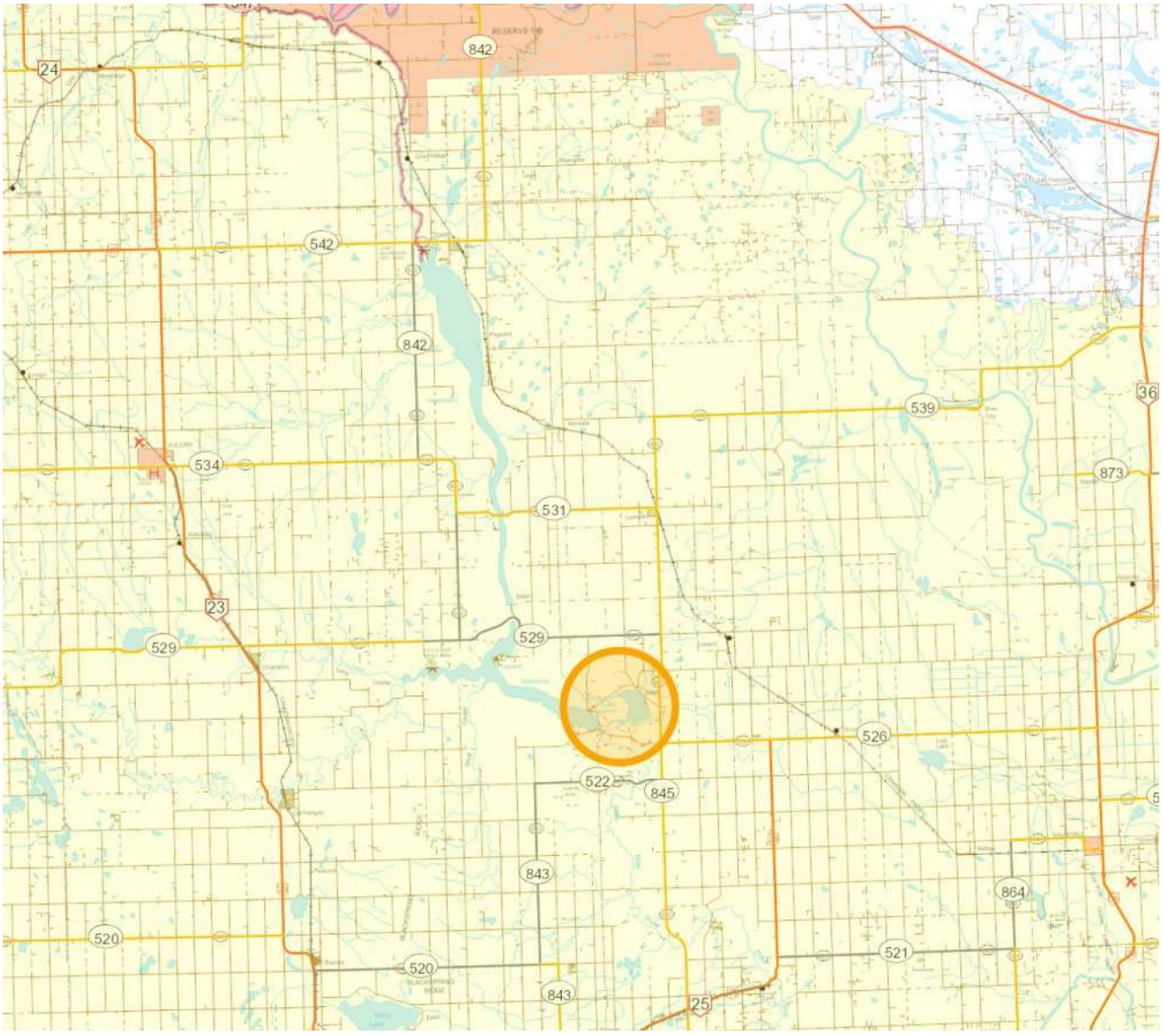
Contact Information

For contact information, please visit:

http://aep.alberta.ca/about-us/contact-us/fisheries-wildlife-management-area-contacts.aspx

21-Sep-2019 15:39

Map Results



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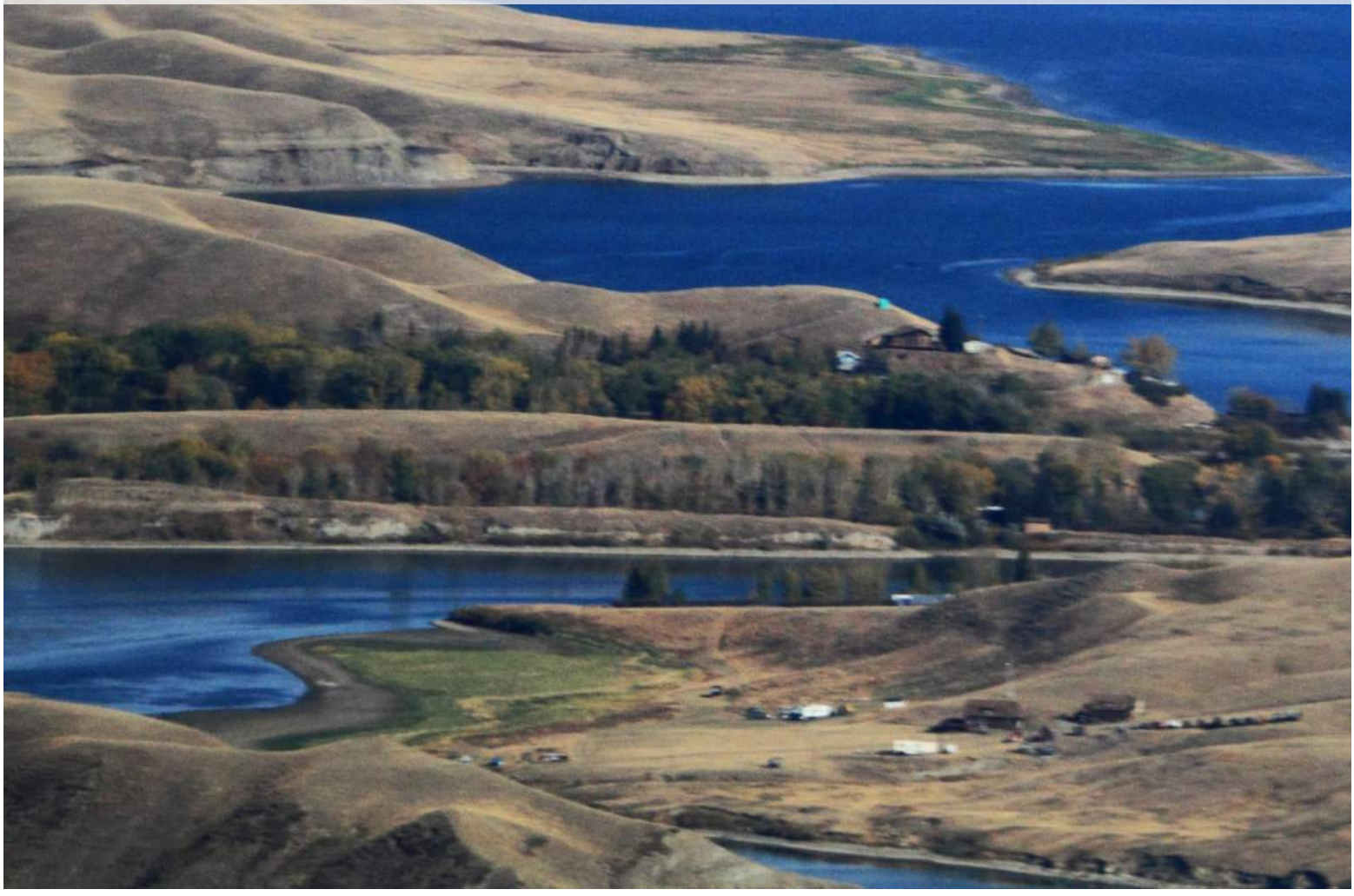
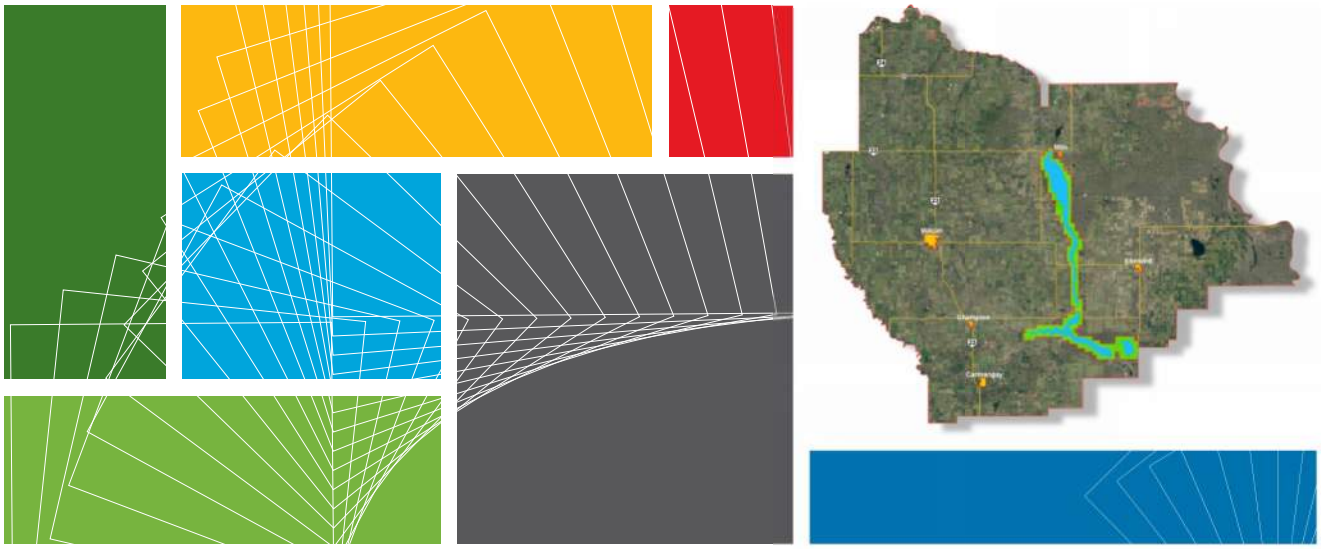
Appendix C

Servicing Review





Vulcan County

Draft Report

Reservoir ASP Servicing Review

April 2020

ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

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Executive Summary

Introduction

Vulcan County has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Review encompassing water, wastewater, and stormwater infrastructure to support the preparation of the Vulcan County Reservoir Area Structure Plan (ASP). The ultimate intent of this Servicing Review is to provide a high-level evaluation of the potential future water and wastewater servicing systems in the area as well as stormwater drainage systems. This includes the necessary parameters for the design, including recommendations for water supply and treatment, wastewater treatment and disposal, and stormwater management and conveyance.

The Servicing Study represents an investment in the infrastructure and will help support sustainable and cost-effective growth in the Reservoir ASP study area. It should be noted however, that this document is considered a high-level study and is not intended to replace a detailed Servicing Study or Master Drainage Plan. The servicing calculations contained herein are not intended to be used for detailed off-site levy or other calculations generally based on those previously noted comprehensive infrastructure studies.

The Reservoir ASP area is comprised of approximately 18,860 ha of land within Vulcan County (the County. The plan area surrounds three reservoirs within the County: Lake McGregor Reservoir, Travers Ridge Reservoir, and Little Bow Reservoir. The location of the study area presents a number of servicing challenges as well as opportunities.

Study Objectives

The purpose of developing a Servicing Review for Vulcan County is outlined below:

The objectives of the Reservoir ASP Servicing Review can be largely grouped as follows:

- To recommend systems that will provide water servicing for the study area. Provide a framework for future development of detailed water studies for design of water supply, treatment, and distribution infrastructure.
- To recommend systems that will provide wastewater servicing for the study area. Provide a framework for future development of detailed wastewater studies for design of wastewater conveyance, treatment, and disposal infrastructure.
- To review other measures to assist in servicing the study area including items such as wastewater effluent re-use and stormwater harvesting.
- Provide a framework for future development of detailed stormwater studies including Master Drainage Plans (MDPs) and Stormwater Management Reports (SWMRs) to design stormwater management and erosion control measures. This includes stormwater management facilities as well as best management practices to control stormwater runoff release rates, volume, and water quality.

The completed Reservoir ASP Servicing Review will provide a guiding document for future development of the study area that can be used in preparation of future more detailed studies such as Servicing Strategies, Subdivision Servicing Reports, Staged Master Drainage Plans, and Subdivision Stormwater Management Reports.

Water Servicing

Conclusions and recommendations for the overall water servicing system for the study area can be summarized as follows:

- The total average day demand, maximum day demand, and peak hour demand water demands were calculated to be 2,747 m^3/day, 5,494 m^3/day, and 10,989 m^3/day, respectively.
- The total reservoir storage capacity required was calculated to be 3,877 m^3.
- Further analysis is required to ensure a proposed distribution system proves to be adequate under average day demand, peak hour demand, and maximum day plus fire flow scenarios.
- A detailed review of capacities of existing town and village systems as well as water co-ops should be undertaken to determine the feasibility of an existing connection compared to a stand-alone system.
- Consideration of water consumption reduction measures should be made.

Wastewater Servicing

Conclusions and recommendations for the overall wastewater servicing system for the study area can be summarized as follows:

- The total average dry weather flow, peak dry weather flow, and peak wet weather flow were calculated to be 2,648 m^3/day, 9,759 m^3/day, and 123,325 m^3/day, respectively.
- Further analysis is required to ensure a proposed collection system proves to be adequate under peak wet weather flow conditions.
- A detailed review of capacities of existing town and village systems should be undertaken to determine the feasibility of an existing connection compared to a stand-alone system.
- Consideration of wastewater flow reduction measures should be made.

Stormwater Drainage

Conclusions and recommendations related to planning the future stormwater drainage system in the study area are as follows:

- The maximum allowable area release rate from proposed stormwater management facilities shall be limited to 1.16 L/s/ha.
- The total active storage volume required was calculated to be 1,975,988 m^3.
- Stormwater quality treatment of SWMFs shall be at minimum 85% removal of particles 75 microns and larger on an annual basis under the 1:100 year rainfall event.
- Erosion mitigation measures are to be incorporated by developers to ensure no adverse impacts are occurring to existing drainage channels and surrounding areas. Localized Stormwater Management Reports (SWMRs) are required to detail any localized erosion risks and provide mitigation options focussed on naturalized techniques.
- The use of source control Best Management Practices is encouraged to reduce the total runoff volume and enhance stormwater treatment.

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1.0 Introduction

1.1 Authorization

Vulcan County has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Review encompassing water, wastewater, and stormwater infrastructure to support the preparation of the Vulcan County Reservoir Area Structure Plan (ASP). The ultimate intent of this Servicing Review is to provide a high-level evaluation of the potential future water and wastewater servicing systems in the area as well as stormwater drainage systems. This includes the necessary parameters for the design, including recommendations for water supply and treatment, wastewater treatment and disposal, and stormwater management and conveyance.

The Servicing Study represents an investment in the infrastructure and will help support sustainable and cost-effective growth in the Reservoir ASP study area. It should be noted however, that this document is considered a high-level study and is not intended to replace a detailed Servicing Study or Master Drainage Plan. The servicing calculations contained herein are not intended to be used for detailed off-site levy or other calculations generally based on those previously noted comprehensive infrastructure studies.

1.2 Background

The Reservoir ASP area is comprised of approximately 18,860 ha of land within Vulcan County (the County. The plan area surrounds three reservoirs within the County: Lake McGregor Reservoir, Travers Ridge Reservoir, and Little Bow Reservoir. The location of the study area presents a number of servicing challenges as well as opportunities.

1.3 Purpose of Study

The purpose of developing a Servicing Review for Vulcan County is outlined below.

1.3.1 Water

- To recommend systems that will provide water servicing for the study area.
- To identify existing available and potential water sources.
- To outline recommended water distribution infrastructure requirements.
- To assess the use of stormwater to address a portion of the water supply needs of the area.
- Provide a framework for future development of detailed wastewater studies including Servicing Strategies to design water distribution, supply, and treatment infrastructure.

1.3.2 Wastewater

- To recommend systems that will provide wastewater servicing for the study area.
- To identify wastewater service providers, particularly with respect to treatment and disposal.
- To outline recommended wastewater collection infrastructure requirements.
- To assess potential reuse/recycling of wastewater effluent as a means of disposal.
- Provide a framework for future development of detailed wastewater studies including Servicing Strategies to design wastewater collection, treatment, and disposal infrastructure.

1.3.3 Stormwater Drainage

- To assess existing drainage conditions and determine design criteria for the stormwater drainage system including runoff rates and volumes.
- To develop high-level stormwater management strategies to manage increased runoff resulting from future growth.
- To maintain existing topography wherever possible with concern for potential erosion risks impacting the area.
- To ensure the planned stormwater management system meets regulatory authority requirements.
- Provide a framework for future development of detailed stormwater studies including Master Drainage Plans (MDPs) and Stormwater Management Reports (SWMRs) to design stormwater management and erosion control measures.

2.0 Plan Area

2.1 Location

The Reservoir ASP area is located within Vulcan County and surrounds three reservoirs within the County: Lake McGregor Reservoir, Travers Ridge Reservoir, and Little Bow Reservoir. It is primarily located east of Highway 842 and west of Highway 845 as well as well as north of Highway 522 and south of Highway 542. The Town of Vulcan and the Villages of Champion and Carmangay are located to the west, the village of Lomond is located to the east, and the village of Milo is located to the northeast. The extent of the study area is approximately 18,860 ha and is shown in Figure 2.1. Generally speaking, the study area drains towards the reservoirs and ultimately southeast toward the Old Man River. A topographical map is shown in Figure 2.2.

2.2 Existing Development

The predominant land use within the study area is currently Reservoir Vicinity. Other land uses within the study area include Rural Recreational and Urban Fringe. Figure 2.3 shows the existing land use for the study area. A summary of the existing land use scenario is outlined in Table 2.1.

Table 2.1: Summary of Existing Land Use

Land Use	Area
	ha
Reservoir Vicinity (RV)	10,541.00
Rural Recreational (RR)	844.03
Urban Fringe (UF)	525.79
Total	**11,910.82**

2.3 Future Development

Four primary land use areas have been identified for the study area including: Future Development Types 1, 2, and 3 as well as area with Redevelopment Potential. A majority of the ASP area is Crown-owned land as well as the reservoirs themselves. An approximate breakdown of the proposed land use is given in Table 2.2 as well as shown in Figure 2.4.

Table 2.2: Summary of Proposed Land Use

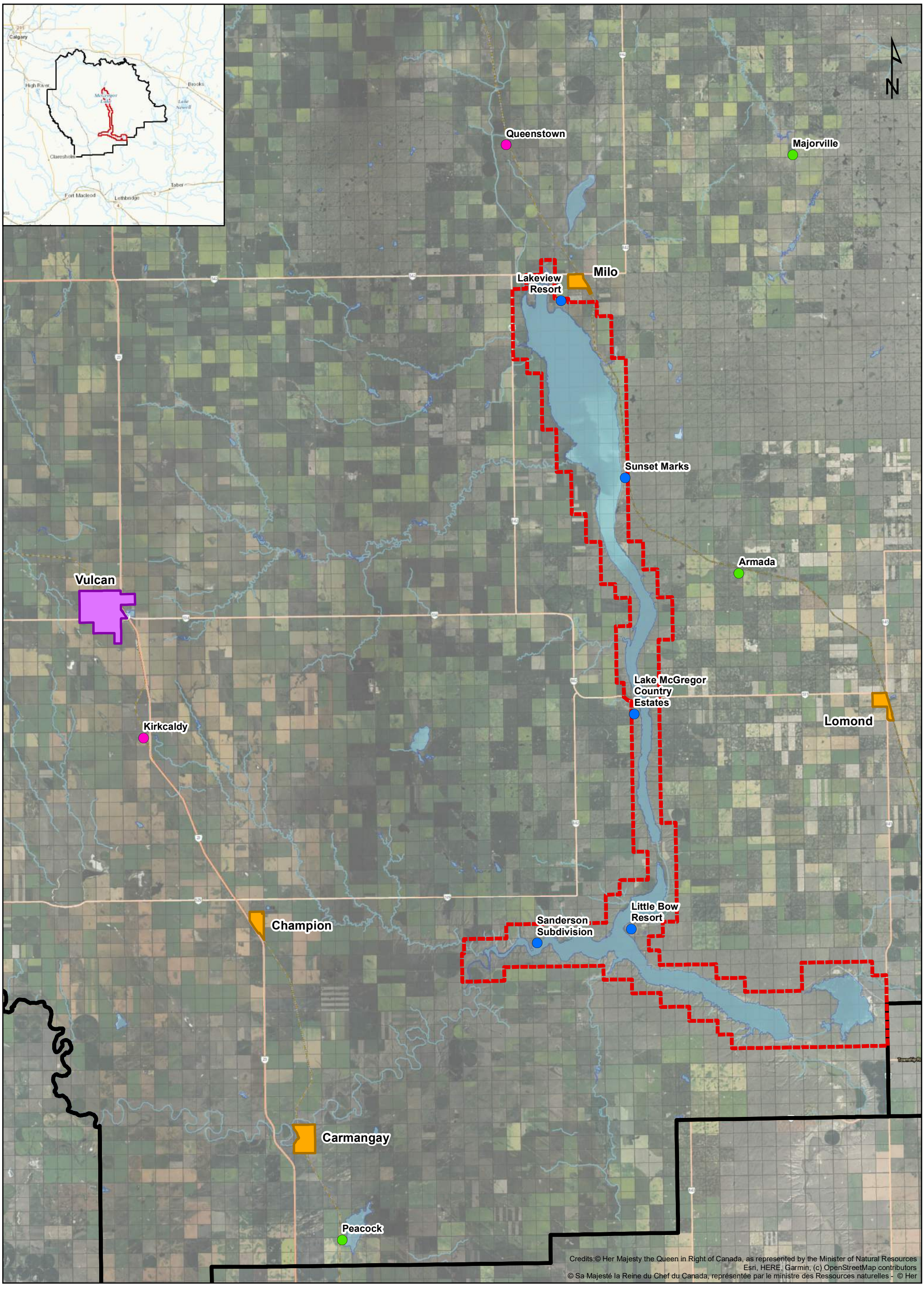
Land Use	Area
	ha
Future Development Type 1	657.62
Future Development Type 2	2,668.91
Future Development Type 3	1,133.12
Redevelopment Potential	234.72
Total	**4,694.36**

These development areas are located within seven nodes and policy areas, which are shown in Figure 2.5. A breakdown of the development areas outlined above within these nodes and policy areas as well as their proposed populations is provided in Table 2.3.

Table 2.3: Summary of Proposed Nodes and Policy Areas

Node / Policy Area	Area	Units	Population[1]
	ha		
North McGregor Node	487.65	362.0	941
North McGregor Policy Area	1,021.83	1003.0	2,608
South McGregor Node	609.05	643.0	1,672
South McGregor Policy Area	635.36	92.0	239
East Travers Node	651.54	242.0	629
East Travers Policy Area	167.94	166.0	432
West Travers Policy Area	1,120.98	38.0	99
Total	**4,694.36**	**2,546**	**6,620**

[1] Population calculation is based on an average density of 2.6 people/unit.



Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure2.1_Study_Area.mxd
Date: 3/26/2020

0 20,000 40,000 80,000 120,000 160,000 Metres

1:200,000 CANA83-3TM114

Legend

- Hamlet
- Locality
- Subdivison
- Water Course
- Water Body
- Village Boundary
- Town Boundary
- County Boundary
- ASP Boundary

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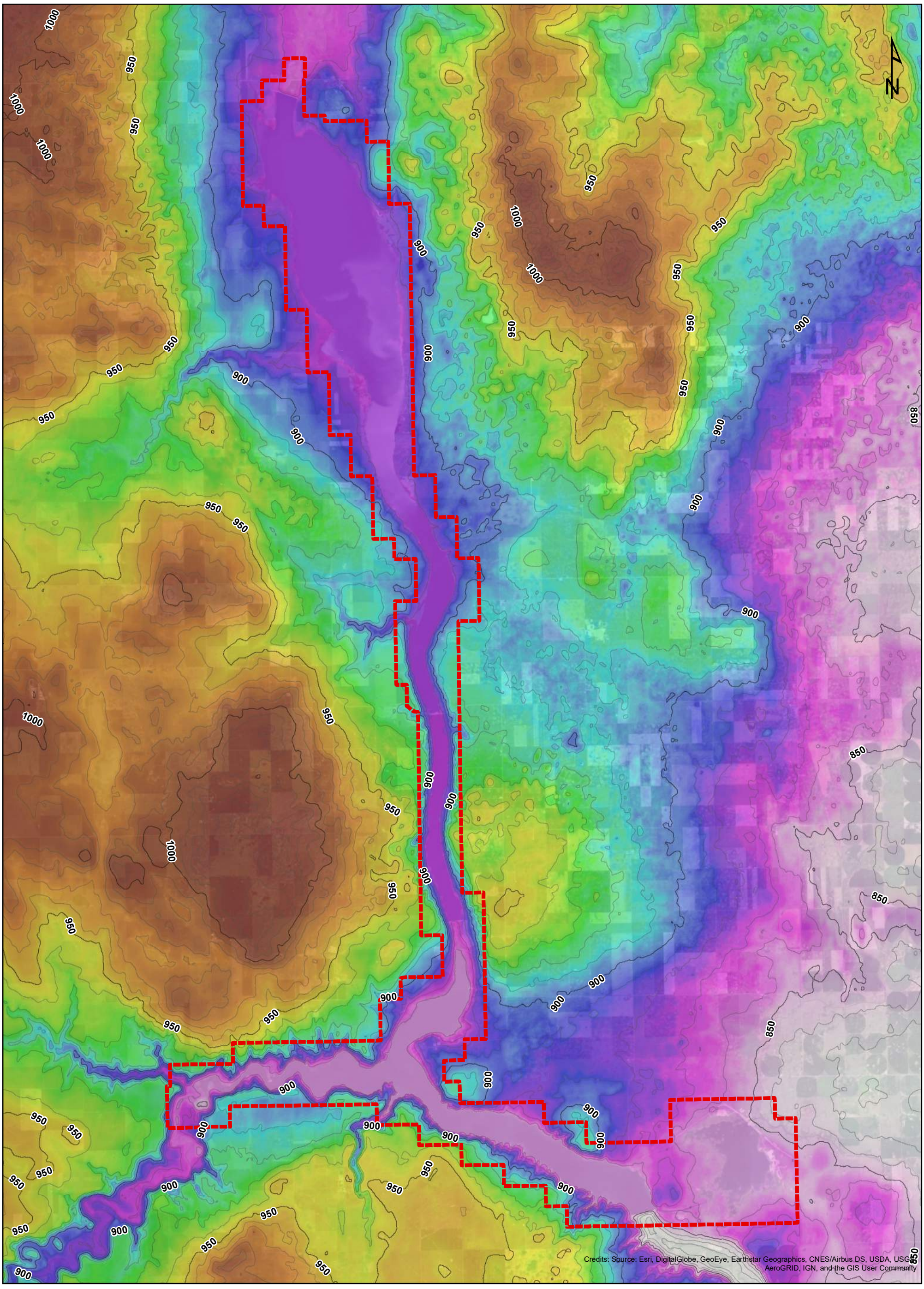
Vulcan County

FIGURE 2.1
STUDY AREA
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN



Date: 3/26/2020 Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure2.2_Topography.mxd

0 800 1,600 3,200 4,800 6,400 Metres

1:135,000 CANA83-3TM114

Legend

- Major Contour - 50m
- Minor Contour - 10m
- ASP Boundary

Ground Elevation

High : 1045

Low : 814

FIGURE 2.2
TOPOGRAPHY
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN

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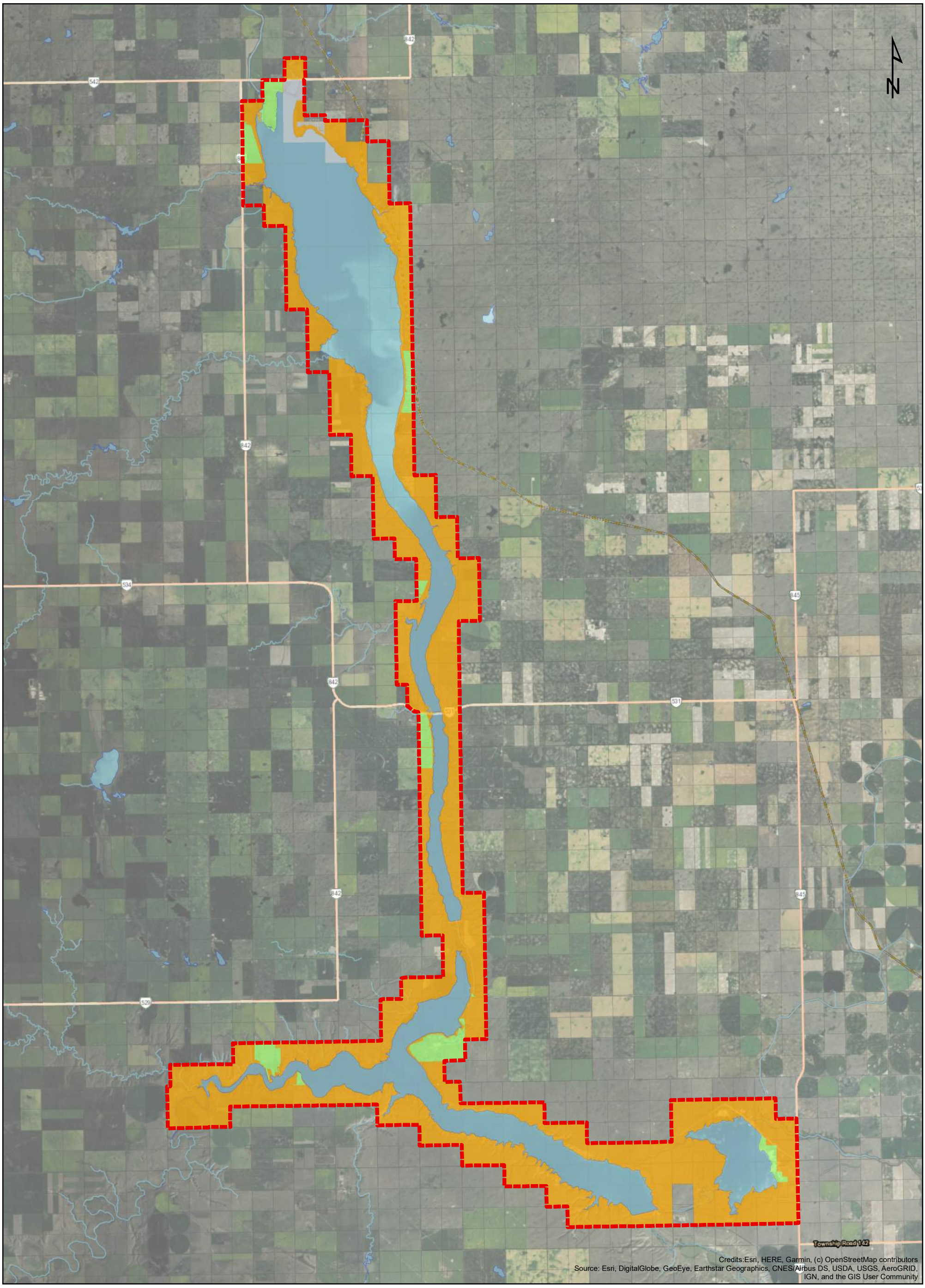
Vulcan COUNTY



Date: 3/26/2020 Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure2.3_Ex_Land_Use.mxd

Metres
0 800 1,600 3,200 4,800 6,400

1:135,000 CANA83-3TM114

Legend

Water Course
Water Body

Land Use District

Reservoir Vicinity (RV)
Rural Recreational (RR)
Urban Fringe (UF)
ASP Boundary

FIGURE 2.3
EXISTING LAND USE
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN

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Vulcan COUNTY

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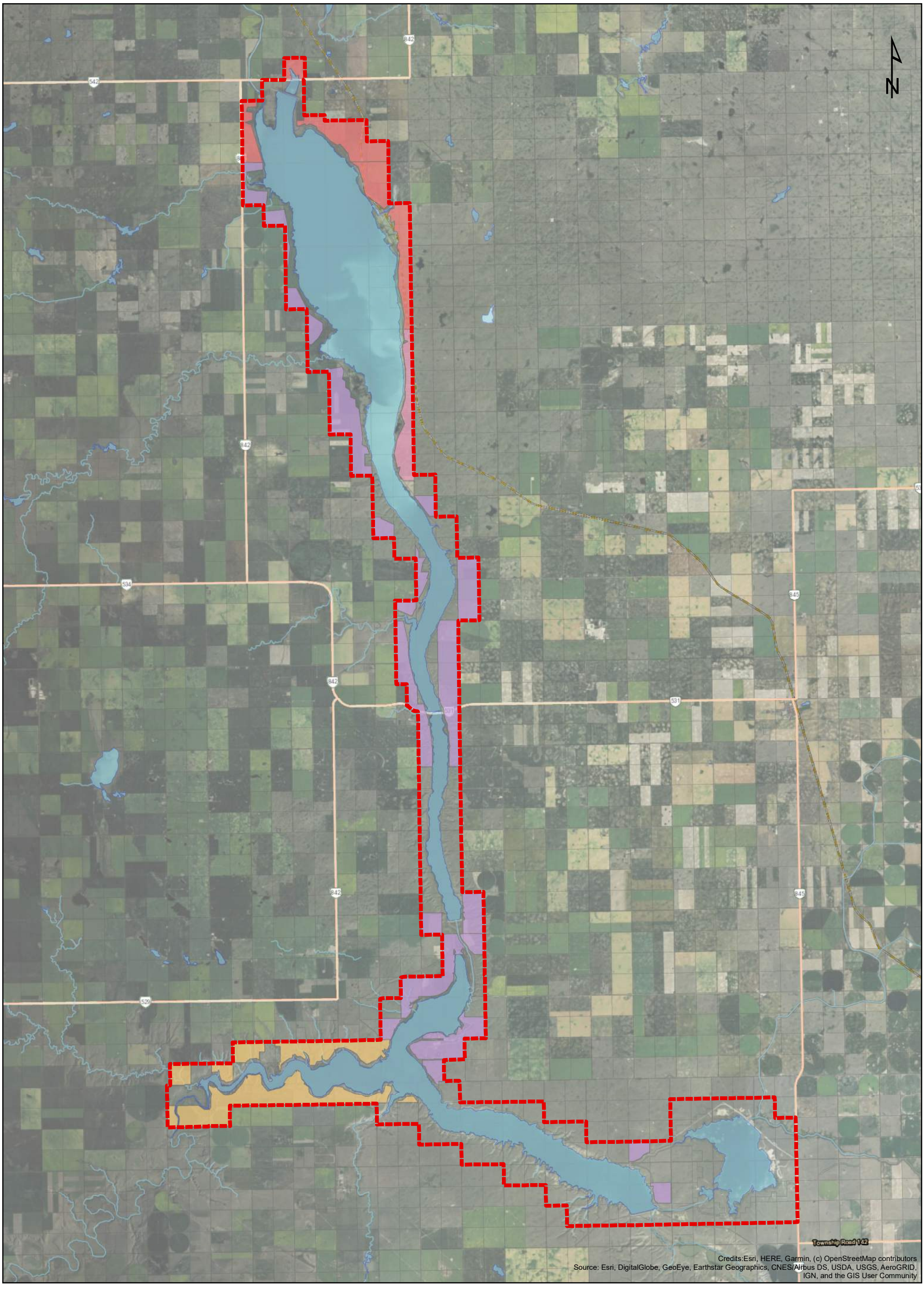

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Date: 3/30/2020 Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure2.4_Pr_Land_Use.mxd

0 800 1,600 3,200 4,800 6,400 Metres

1:135,000 CANA83-3TM114

Legend

- Water Course
- Water Body
- Future Development Type 1
- Future Development Type 2
- Future Development Type 3
- Redevelopment Potential
- ASP Boundary

FIGURE 2.4
PROPOSED LAND USE
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN

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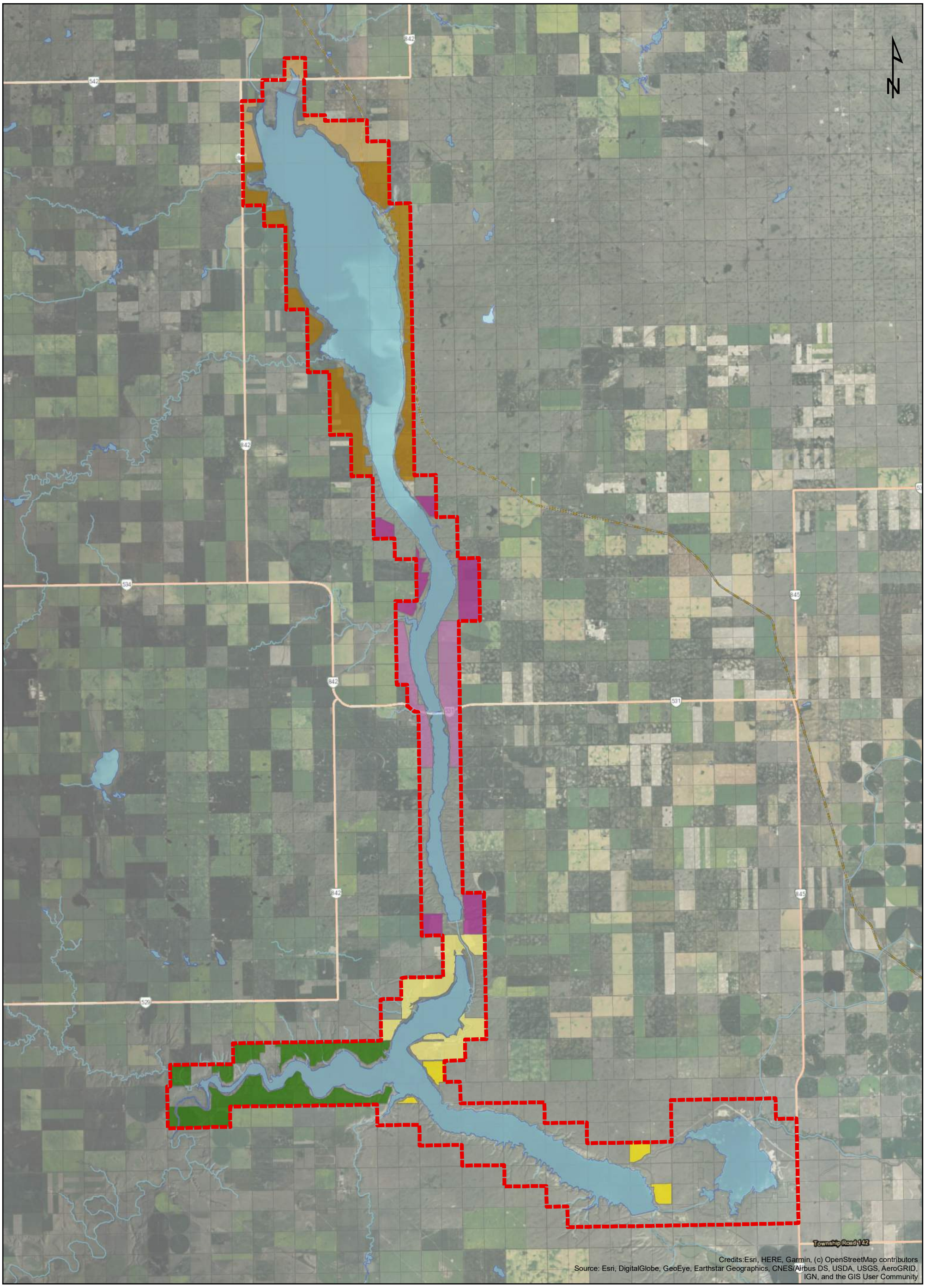

Credits:Esri, HERE, Garmin, (c) OpenStreetMap contributors
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Date: 3/27/2020 Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure2.5_Pr_Policy_Area.mxd

0 8001,600 3,200 4,800 6,400 Metres

1:135,000 CANA83-3TM114

Legend

- Water Course
- Water Body
- East Travers Node
- East Travers Policy Area
- North McGregor Node
- North McGregor Policy Area
- South McGregor Node
- South McGregor Policy Area
- West Travers Policy Area
- ASP Boundary

FIGURE 2.5
DEVELOPMENT POLICY AREAS
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN

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3.0 Water

3.1 Existing Infrastructure

3.1.1 Existing Water Sources

Existing developed water sources within or within close proximity to the study area were reviewed. Potential sources included surface water diversions as well as groundwater diversions. Information relating to existing licensed water diversions was obtained from Alberta Environment and Parks (AEP). Licenses within the entire South Saskatchewan River Basin (SSRB) were also reviewed.

Since 2006, the SSRB has been closed to new water license applications with a few exceptions such as First Nations, Water Conservation Objectives, and water storage projects. Consequently, the moratorium resulted in the establishment of the first market-based system to transfer (trade) water licenses in Canada. The transfer program is administered by the Government of Alberta through the enacted provisions of the Water Act. According to the water allocation transfer under a license provision, a willing seller and willing buyer can trade (re-distribute) the existing water allocation licenses.

Licensed Surface Water Diversions

For the purpose of the study, surface water diversions licensed by AEP were reviewed. A total of 165 surface water diversions were identified within the study area and around the study area. The licensed diversions within the study area and close proximity are summarized in Appendix A. Overall, the total volume of licensed surface water diversions within the SSRB is roughly 5.71 billion cubic meters per year.

Licensed Groundwater Diversions

Similarly, groundwater diversions licensed by AEP were also reviewed. A total of 50 groundwater diversions were identified within the study area and around the study area. It is noted that small local wells are also present within the ASP area, generally serving a single lot or farm. The licensed diversions within the study area and close proximity are summarized in Appendix A. Overall, the total volume of licensed groundwater diversions within the SSRB is roughly 98.9 million cubic meters per year.

Summary of Groundwater Diversions

The development areas within the ASP boundary will require a potable water volume of 2,747 m^3/day as discussed in the following sections. This is equivalent to 1,002,704 m^3/year of potable water volume required to make development viable.

Table 3.1 summarizes the annual volumes for surface water and groundwater diversions in the surrounding area.

Table 3.1: Summary of Annual Volumes

Location	Source		Total Annual Volume
	Surface Annual Volume	Groundwater Annual Volume	
	m³/year	m³/year	m³/year
Within and Around Study Area	3,287,767	210,002	3,497,769
Within SSRB	5,713,316,932	98,928,540	5,812,254,472

A summary of all the licenses available in the South Saskatchewan River Basin (SSRB) in comparison with study area water demands is included in Table 3.2 for reference.

Table 3.2: Comparison of SSRB Licences and Study Area Water Demands

Active Licenses		Total Annual Volume	Water Demand
Surface Annual Volume	Groundwater Annual Volume		
m³/year	m³/year	m³/year	m³/year
5,713,316,932	98,928,540	5,812,254,472	1,002,704
Percentage of Total Licenses			0.02%

Based on the said water demands required for the area, it is apparent that these values constitute a fraction of all active surface and groundwater licenses available within the entire South Saskatchewan River Basin as presented in Table 3.2. As a result, it can be stated that the required water licenses to service proposed developments should not be an issue, provided willing sellers are found.

3.1.2 Existing Water Infrastructure

Water distribution infrastructure in the study area does not currently exist. Outside of the study area, formal water distribution systems are available in surrounding towns and villages including the Town of Vulcan, Village of Lomond, Village of Milo, Village of Carmangay, and the Village of Champion.

There are also a number of water servicing cooperatives surrounding the study area, including Lomond North Water Users Co-Op Association, Milo Water Co-Op Ltd., Mine Road Water Co-Op, McGregor Water Users Co-Op, Plainfield Water Co-Op Ltd., and Vulcan East Water Co-Op Ltd.. These existing networks are shown in Figure 3.1.

3.2 Review of Existing Capacities

A detailed review of existing system capacities is recommended to determine if connections to one or a combination of these systems is possible.

3.3 Design Criteria

The water design criteria for the study area were derived from the typical municipal servicing standards in the Province of Alberta, City of Lethbridge Standards, and Alberta Environment and Parks' Standards and Guidelines.

The detailed analysis of a proposed water distribution network is considered outside of the scope of this project and should be completed as part of a detailed Servicing Study. To further analyze a proposed water distribution system, it is recommended to use Bentley's WaterCAD CONNECT Edition or a similar computer model. WaterCAD is a powerful analysis tool that hydrodynamically routes flows through the physical distribution system. In this manner, pressure results are obtained, and available fire flow at any location in the water distribution system can be estimated. The network should be assessed under average day demand, peak hour demand, and maximum day demand plus fire flow to analyze the performance of a proposed system.

3.3.1 Water Consumption Rates

The City of Lethbridge's Standards stipulate a residential water consumption rate of 415 L/capita/day. It is recommended that the County incorporate water conservation and water re-use measures to reduce this per capita consumption rate.

3.3.2 Peaking Factors

The following factors are recommended to establish Maximum Day Demand (MDD) and Peak Hour Demand (PHD), in accordance with AEP requirements:

- Maximum Day Demand – 2.0 x Average Day Demand
- Peak Hour Demand – 4.0 x Average Day Demand

3.3.3 Reservoir Storage Requirements

Reservoir storage volumes were calculated per AEP standards.

Alberta Environment and Parks (Standards and Guidelines for Municipal Waterworks, Wastewater and Stormwater Drainage Systems)

$$S = A + B + \text{(the greater of C or D)}$$

Where,

S=Total storage requirement, m^3
A=Fire storage, m^3
B=Equalization storage (25% of Maximum Day Demand), m^3
C=Emergency storage (minimum of 15% of Average Day Demand), m^3
D=Disinfection contact time storage to meet CT requirements, m^3

3.3.4 Fire Flow Protection Requirements

Based on the Fire Underwriters Survey's Water Supply for Public Fire Protection, A Guide to Recommended Practice, Table 3.3 outlines proposed fire flow rates, durations, and storage volumes for various development types.

Table 3.3: Fire Flow Requirements

Land Use Type	Fire Flow Required	Duration	Fire Storage Required
	L/s	hours	m^3
Country Residential	50	1.5	270
Single Family Dwellings	76-100	2	550-720
Multi-Family Residential / Institutional	114-227	2-2.5	820 - 2,043
Light Commercial / Schools	150-166	2	1,080 - 1,200
Heavy Commercial / Light Industrial	250	3.5	3,150
High Risk Industrial / Airport	300	3.5	3,780

Due to the nature of the proposed residential area, a fire flow of 100 L/s for the duration of 2 hours has been adopted for this study.

It should be also noted the fire flow requirements can typically be reduced by up to 50% for facilities equipped with sprinkler systems as per the Fire Underwriters Survey recommendations.

3.3.5 Distribution Pressure Requirements

The future water system was assessed using the following criteria based on a variety of standards, including those stipulated by AEP:

- Normal pressure range in the system under Average Day Demand of 350 kPa to 550 kPa.
- Minimum residual pressure in the system under Peak Hour Demand of 300 kPa.
- Minimum residual pressure in the system under Maximum Day Demand plus Fire Flow of 140 kPa.

3.3.6 Maximum Velocity Requirements

Main line flow velocities should not exceed 3.0 m/s and be preferably below 2.0 m/s if possible, during peak flow conditions and maximum day plus fire flow conditions.

3.4 Proposed Water Distribution System

3.4.1 Water System Demands

Following the determination of the water system design criteria to be used throughout the Servicing Review, the required water demands were derived for each node and policy area. A summary of the proposed water demands is provided in Table 3.4.

Table 3.4: Total Water Demands

Proposed Development Area	Total Water Demands					
	ADD		MDD = 2 x ADD		PHD = 4 x ADD	
	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
North McGregor Node	4.52	391	9.04	781	18.08	1,562
North McGregor Policy Area	12.53	1,082	25.05	2,164	50.10	4,329
South McGregor Node	8.03	694	16.06	1,388	32.12	2,775
South McGregor Policy Area	1.15	99	2.30	199	4.60	397
East Travers Node	3.02	261	6.04	522	12.09	1,044
East Travers Policy Area	2.07	179	4.15	358	8.29	716
West Travers Policy Area	0.47	41	0.95	82	1.90	164
Total	**31.8**	**2,747**	**63.6**	**5,494**	**127.2**	**10,989**

A detailed breakdown of the calculated water demands for each service area are shown in Table 3.5.

3.4.2 Reservoir Storage

Regardless of whether future development requires a water treatment plant to support a stand-alone system or water is supplied by a potable system, the study area requires a reservoir with sufficient water storage. The volume of water storage required in the study area was determined using the formula provided by AEP as mentioned in Section 3.3.3. Tables 3.6 summarizes the storage requirements.

Table 3.6: Reservoir Storage Requirements

Fire Storage[1]	ADD	MDD	Storage[2]
m^2	m^3	m^3	m^3
720	2,747	5,494	3,877

[1] Fire storage required determined based on 100 L/s for 2 hours.
[2] AEP storage volume required determined based on the following formula: Fire Storage + 25% of MDD + 15% of ADD.

Shown above, the storage requirement calculated is 3,877 m^3. It should be noted that this storage volume could be divided between a number of reservoirs instead, depending on supply sources and development connections as well as development phasing.

3.4.3 Water Pipe Network

Given the fact that the proposed development will be residential, a minimum watermain size of 200 mm is to be applied. Generally speaking, the standard grid layout consists of 300 mm watermains spaced out every 1,600 m (one standard section length) with 250 mm watermains dissecting a development in between at one quarter section length. This looped network provides added resiliency to the system in the case of a watermain break or failure.

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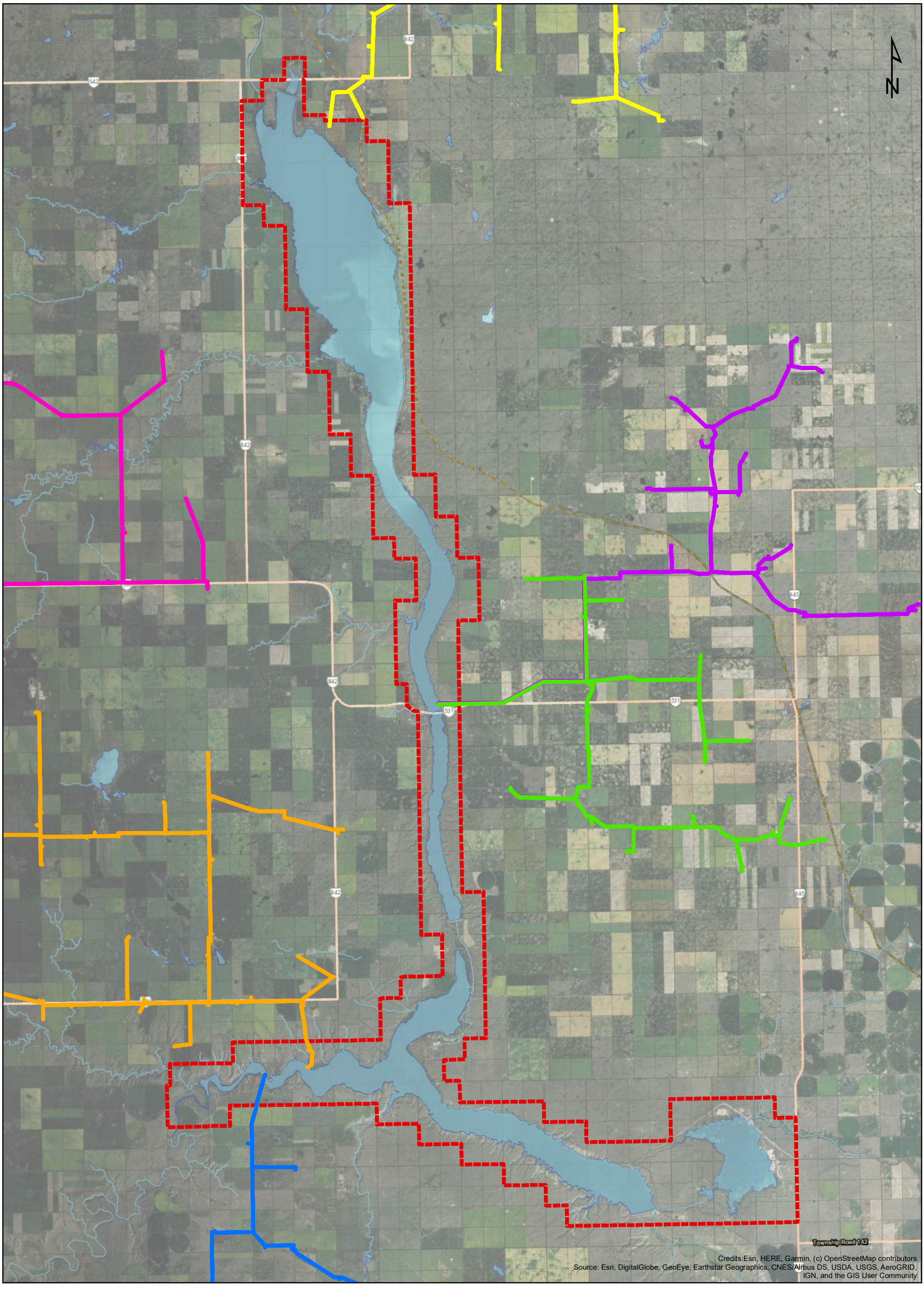
Table 3.5: Estimated Study Area Water Demands

Service Area	Developable Area	Residential Population	Water Consumption	Average Day Demand		MDD (2 x ADD)		PHD (4.0 x ADD)	
	ha	capita	L/p/d	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
North McGregor Node	487.65	941	415	4.52	391	9.04	781	18.08	1,562
North McGregor Policy Area	1,021.83	2,608	415	12.53	1,082	25.05	2,164	50.10	4,329
South McGregor Node	609.05	1,672	415	8.03	694	16.06	1,388	32.12	2,775
South McGregor Policy Area	635.36	239	415	1.15	99	2.30	199	4.60	397
East Travers Node	651.54	629	415	3.02	261	6.04	522	12.09	1,044
East Travers Policy Area	167.94	432	415	2.07	179	4.15	358	8.29	716
West Travers Policy Area	1,120.98	99	415	0.47	41	0.95	82	1.90	164
Total	**4,694.36**	**6,620**		**31.80**	**2,747**	**63.6**	**5,494**	**127.2**	**10,989**



Date: 3/28/2020 Document: Q:\Projects\27456_Vulcan_County_ASP\251_Figures\Figure3.1_Ex_Water_Network.mxd

0 800 1,600 3,200 4,800 6,400 Metres

1:135,000 CANA83-3TM114

Legend

Water Co-Op Network

- Lomond North
- Milo
- Mine Road
- McGregor
- Plainfield
- Vulcan East
- Water Course
- Water Body
- ASP Boundary

FIGURE 3.1
EXISTING WATER CO-OP NETWORKS
VULCAN COUNTY
RESERVOIR AREA STRUCTURE PLAN

ISL

Vulcan COUNTY

Integrated Expertise. Locally Delivered.

4.0 Wastewater

4.1 Existing Infrastructure

Wastewater treatment/disposal and collection infrastructure in the study area does not currently exist. Wastewater servicing is currently provided via private sewage treatment systems (PSTS).

Outside of the study area, formal wastewater treatment and disposal systems are available in surrounding towns and villages including the Town of Vulcan, Village of Lomond, Village of Milo, Village of Carmangay, and the Village of Champion.

4.2 Review of Existing Capacities

A detailed review of existing system capacities is recommended to determine if connections to one or a combination of these systems is possible.

4.3 Design Criteria

The wastewater design criteria for the study area were derived from the typical municipal servicing standards in the Province of Alberta, City of Lethbridge Standards, and Alberta Environment and Parks' Standards and Guidelines.

4.3.1 Dry Weather Flow Conditions

The City of Lethbridge's Standards stipulate a residential wastewater generation rate of 400 L/capita/day. It is recommended that the County incorporate water conservation and water re-use measures to reduce this per capita consumption rate.

4.3.2 Peaking Factor for Residential Areas

Peaking factors derived based on Harmon's formula for residential areas:

$$PF = 1 + \frac{14}{4 + P^{\frac{1}{2}}}$$

- Where, P is the contributing design population in thousands.
- It is noted that PF must be at least 2.5.

4.3.3 Allowable Velocities for Forcemains

Forcemains should be sized to maintain a minimum velocity of 1.0 m/s; however, should not exceed a velocity of 2.0 m/s, with the preferred velocity being 1.5 m/s.

4.3.4 Wet Weather Flow Conditions (Inflow-Infiltration)

A constant inflow-infiltration allowance of 0.28 L/s/ha as per the Alberta Environment and Parks' guidelines was applied to the development area to simulate wet weather response.

4.4 Proposed Wastewater Collection System

4.4.1 Wastewater System Flows

Following the determination of the wastewater system design criteria to be used throughout the Servicing Review, an estimation of the anticipated sanitary flows was derived for each node and policy area. A summary of the proposed water demands is provided in Table 4.2.

Table 4.2: Total Wastewater Flows

Proposed Development Area	Total Wastewater Flows					
	ADWF[1]		PDWF[2]		PWWF[3]	
	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
North McGregor Node	4.36	376	16.63	1,437	153.17	13,234
North McGregor Policy Area	12.07	1,043	42.18	3,644	328.29	28,364
South McGregor Node	7.74	669	28.21	2,437	198.75	17,172
South McGregor Policy Area	1.11	96	4.56	394	182.46	15,765
East Travers Node	2.91	252	11.42	987	193.85	16,749
East Travers Policy Area	2.00	173	8.01	692	55.03	4,755
West Travers Policy Area	0.46	40	1.94	168	315.82	27,287
Total	30.65	2,648	112.9	9,759	1,427.37	123,325

[1] ADWF = Average Dry Weather Flow
[2] PDWF = Peak Dry Weather Flow
[3] PWWF = Peak Wet Weather Flow

A detailed breakdown of the calculated wastewater flows for each service area are shown in Table 4.3.

4.4.2 Wastewater Collection System Sizing

Pipe sizes are to be the smallest possible determined based on the required minimum design slope to provide a self-cleansing full-pipe velocity, under the derived peak wet weather flows, based on the roughness coefficient (n) of 0.013 as per Table IV-C3 of the City of Calgary's Design Guidelines for Subdivision Servicing as presented in Table 4.4. These guidelines are more conservative than Alberta Environment and Parks' Guidelines.

Table 4.4: Minimum Design Slopes for Sewers

Nominal Pipe Size	Minimum Design Slope		Full Pipe Velocity	Full Pipe Capacity
mm	%	m/m	m/s	L/s
250	0.40	0.0040	0.77	37.6
300	0.32	0.0032	0.77	54.7
375	0.24	0.0024	0.78	85.9
450	0.18	0.0018	0.76	121.0
525	0.16	0.0016	0.79	172.0
600	0.12	0.0012	0.75	212.7
675	0.10	0.0010	0.74	265.8
750	0.10	0.0010	0.80	352.0
900	0.10	0.0010	0.90	572.5
1050	0.10	0.0010	1.00	863.5
1200	0.10	0.0010	1.09	1,232.9

If flatter slopes are preferred or required at the detailed design stages, this can be reviewed, though it would have negative repercussions. If this was acceptable, the determined pipe sizes would need to be increased to meet the specified design flows as presented in Table 4.3.

4.5 Other Measures to Assist in Servicing

In conjunction with the servicing systems noted above, several other measures may be employed to assist with servicing. These measures assist in such areas as reduction of water demand requirements for new water sources and reduction of total volume of wastewater for disposal. Measures include the following:

- Stormwater Re-Use
- Treated Wastewater Effluent Re-Use
- Use of Snowfluent for Wastewater Effluent Disposal
- Treatment Wetlands for Wastewater Effluent Disposal
- Groundwater Recharge for Wastewater Effluent Disposal

None of these measures would change the feasibility of water or wastewater connections to existing systems or stand-alone systems. However, these measures assist in reducing system requirements, and hence, costs.

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Table 4.3: Estimated Study Area Wastewater Flows

Service Area	Developable Area	Residential Population	DWF Generation Rate	Average DWF Total		Peaking Factor	PDWF		I-I Rate	I-I Flow		Peak WWF	
	ha	capita	L/p/d	L/s	m^3/d		L/s	m^3/d	L/s	L/s	m^3/d	L/s	m^3/d
North McGregor Node	487.65	941	400	4.36	376	3.8	16.63	1,437	0.28	136.54	11,797	153.17	13,234
North McGregor Policy Area	1,021.83	2,608	400	12.07	1,043	3.5	42.18	3,644	0.28	286.11	24,720	328.29	28,364
South McGregor Node	609.05	1,672	400	7.74	669	3.6	28.21	2,437	0.28	170.53	14,734	198.75	17,172
South McGregor Policy Area	635.36	239	400	1.11	96	4.1	4.56	394	0.28	177.90	15,371	182.46	15,765
East Travers Node	651.54	629	400	2.91	252	3.9	11.42	987	0.28	182.43	15,762	193.85	16,749
East Travers Policy Area	167.94	432	400	2.00	173	4.0	8.01	692	0.28	47.02	4,063	55.03	4,755
West Travers Policy Area	1,120.98	99	400	0.46	40	4.2	1.94	168	0.28	313.87	27,119	315.82	27,287
Total	**4,694.36**	**6,620**	**400**	**30.65**	**2,648**	**3.1**	**112.95**	**9,759**	**0.28**	**1,314.42**	**113,566.0**	**1,427.37**	**123,325**

5.0 Stormwater

5.1 Analysis Methodology

5.1.1 Design Criteria

The design criteria used to assess the study area was taken from a variety of sources including design guidelines provided by the City of Lethbridge as well as past work undertaken by ISL for numerous municipalities in the Province of Alberta.

There are several hydraulic design criteria necessary to conceptualize a future stormwater management system for the study area. As part of this study, the following criteria were utilized to evaluate the stormwater conditions of the study area:

- Ponds were sized using a 1:100 year design storm with a maximum active storage depth of 1.5 m from the pond bottom or normal water level (NWL) to the high water level (HWL).

Overland drainage systems and stormwater management facilities (SWMFs) are typically assessed under 1:100 year storm events. For the purposes of this report, the 1:100 year, 24-hour Chicago rainfall distributions derived using the City of Lethbridge's IDF curve was used. The nature of the Chicago distribution is such that it includes high intensity intervals following a period of increasing rainfall intensity to provide a solid, conservative assessment of the stormwater drainage system.

5.1.2 Computer Models

To further analyze the stormwater drainage system, a hydrologic/hydraulic computer model is necessary. The XPSWMM computer model is recommended to perform this analysis. XPSWMM is a dynamic model capable of unsteady flow simulation that is more accurate than most models; thus it is capable of delivering more realistic conveyance results. XPSWMM features an enhanced graphical user interface making for easy review of models created and allowing for customized graphical output.

In order to assess the existing stormwater system under current and future conditions, existing culvert information would need to be obtained via survey. This would include accurate location, material, condition, diameter, and invert data. No LiDAR data was provided for the area, thus at this stage the topographic data available from Natural Resources Canada (Government of Canada) was used. To provide an adequate assessment of the stormwater drainage system moving forward, it is recommended LiDAR data be obtained for the area. The hydraulic design criteria, runoff parameters, catchment areas, and imperviousness can be combined to develop a full stormwater drainage system model once this information is obtained.

It should be noted that the use of synthetic rainfall events has limitations in the overall effectiveness of considering longer periods of rainfall where antecedent moisture conditions may result in increased runoff potential.

5.2 Existing Drainage System

5.2.1 Existing Drainage Patterns

The study area lies within the Old Man River watershed, which is part of the overall South Saskatchewan River Basin. The area primarily drains toward the reservoirs and ultimately southeast to the Old Man River. The topography of the study area is shown in Figure 2.2.

5.2.2 Existing Drainage Infrastructure

Within the study area, it is likely that minimal drainage infrastructure exists, and the stormwater system consists primarily of ditch drainage elements connected by culverts across roadway crossings. Culvert locations, inverts, and diameters are currently unknown. This information is required to produce a detailed Master Drainage Plan (MDP). A survey of the stormwater infrastructure in the area is recommended to proceed with this detailed study.

5.3 Proposed Drainage System

5.3.1 Pre-Development Runoff Conditions

As there is not an existing MDP for the area, a pre-development runoff rate was based on previous studies completed in the area. A pre-development runoff rate of 1.16 L/s/ha was used as this release rate has been determined as part of a Lethbridge area project previously completed by ISL in 2009 and used for The Village of Champion Infrastructure Study and the Town of Picture Butte Infrastructure Assessment. Details pertaining to this analysis are presented in Appendix B.

5.3.2 Proposed Drainage Patterns

Proposed changes to the existing drainage pattern would require a more detailed study. It is recommended that the existing topography be maintained wherever possible to preserve the current drainage conditions. Impacts of rerouting drainage on the water courses and water bodies in the area should be considered.

5.3.3 Preliminary Proposed Stormwater Management Facilities

For the current stage of the study, stormwater management facilities (SWMF) in the form of dry ponds have been sized. The required pond size for each catchment area was determined based on a 100 year, 24-hour rainfall using the unit area release rate of 1.16 L/s/ha as described above. Preliminary pond sizing is outlined in Table 5.1 utilizing a residential runoff coefficient of 0.40 as outlined in the City of Lethbridge's Standards.

Table 5.1: SWMF Required Storage Volume

Proposed Development Area	Developable Area	Active Storage Volume	Pond Surface Area	Percentage of Development Area
	ha	m^3	ha	
North McGregor Node	487.65	204,293	14.06	2.9%
North McGregor Policy Area	1,021.83	431,697	29.45	2.9%
South McGregor Node	609.05	255,678	17.54	2.9%
South McGregor Policy Area	635.36	266,798	18.26	2.9%
East Travers Node	651.54	27,3703	18.76	2.9%
East Travers Policy Area	167.94	69,673	4.90	2.9%
West Travers Policy Area	1,120.98	474,146	32.31	2.9%
Total	**4,694.36**	**1,975,988**	**135.28**	**2.9%**

It should be noted that these storage volumes may be divided among the parcels within the development areas depending on development layout as well as upstream or downstream connections and have been provided as a reference rather than a design requirement. As such, preliminary SWMF volumes and surface areas for residential development are provided in Table 5.2.

Table 5.2: Preliminary SWMF Cost Estimates

Residential Development Area	Active Storage Volume	Pond Surface Area
ha	m^3	ha
1	402	0.05
5	2,034	0.19
10	4,080	0.34
50	20,549	1.53
100	41,377	2.97

It should be noted that these surface areas are based on SWMFs sized as dry ponds. If wet ponds with a permanent pool depth of 2.0 m were to be employed, this would increase the pond depth and surface area required; therefore, increasing the cost by approximately 30%.

5.3.4 Design Guidelines for Future Stormwater Management Facilities

A set of design guidelines are required to govern the future stormwater management facilities in the study area. Numerous documents were reviewed to determine the recommended guidelines. These documents included the Stormwater Management Guidelines for the Province of Alberta (Alberta Environment and Parks, 1999), the Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems (Alberta Environment and Parks, 2006) and Design Standards Stormwater Management & Design Manual (City of Lethbridge, 2016).

Recommended design guidelines for the stormwater management system include the following:

- **Stormwater Discharge Rates:**
  - Post-development stormwater discharge velocities do not exceed the existing levels from all upstream stormwater management facilities.
  - Maximum allowable area release rate of 1.16 L/s/ha from all stormwater management facilities.
- **Stormwater Quality Controls:**
  - Minimum removal of 85% of particles 75 microns and larger on an annual basis as per Alberta Environment standards.
- **Stormwater Management Facility Design Guidelines:**
  - <u>Conventional Stormwater Management Facilities:</u>
    - Storage volume based on the greater of 1:100 year design storm or 1:100 year continuous simulation.
    - Continuous simulation is required for any stormwater management concept involving infiltration or evaporation methodologies.
    - Maximum storage depth of 1.5 m (dry) or 2.0 m (wet).
    - Permanent pool depth of 2.0 m at minimum; 3.0 m at maximum (wet).
    - Minimum pond area of 2.0 ha at NWL.
    - Maximum interior side slopes of 5:1 to 7:1 (H:V) within permanent pool, 5:1 between NWL and HWL and 4:1 to 5:1 above HWL.
    - Minimum effective length to width ratio of 4:1 to 5:1.
    - Minimum pond bottom slope of 2% (dry).
    - The HWL must be a minimum depth of 0.45 m below building floor elevations.
    - Overflow/overland escape route provided.
    - Low flow bypass provided if possible, to reduce frequency of pond inundation.
    - Quality control provided generally by the pond, but a forebay is strongly recommended. An oil/grit separator may be included for additional water quality control, normally upstream of the pond. If a dry pond is utilized, an oil/grit separator at the pond inlet would be required.
    - Measures to mitigate erosion downstream of the pond must also be incorporated.
  - <u>Stormwater Management Facilities as Constructed Wetlands:</u>
    - Storage volume based on the greater of 1:100 year design storm and 1:00 year continuous simulation.
    - Continuous simulation is required to provide the long term statistical HWL and NWL anticipated by the facility.
    - Maximum storage depth of 1.0 m. This peak depth is to be achieved infrequently to ensure long-term survival of wetland ecology.
    - Permanent pool depth of 1.0 m at minimum; 2.0 m at maximum (varying pool depth required).
    - Minimum pond area of 2.0 ha at Normal Water Level (NWL).
    - Maximum interior side slopes of 5:1 to 7:1 (H:V) within permanent pool, 5:1 between NWL and HWL and 4:1 to 5:1 above HWL.
    - Minimum effective length to width ratio of 4:1 to 5:1.
    - The HWL must be a minimum depth of 0.45 m below building floor elevations
    - Overflow/overland escape route provided.

- Low flow bypass provided if possible, to reduce frequency of pond inundation.
- Quality control provided generally by the pond, but a forebay is strongly recommended. An oil/grit separator may be included for additional water quality control, normally upstream of the pond. If a dry pond is utilized, an oil/grit separator at the pond inlet would be required.
- Water permanency zones within the wetland identified based on the wetland elevation and modelled hydrologic regime. The hydroperiodicity within each zone is critical for maintaining wetland vegetation and thereby wetland function.
- Wetland vegetation to be selected based on the appropriate ecological successional stage, hydrologic regime, the surrounding land use, individual species traits, wildlife habitat potential, provincial conservation status and origin (i.e., native).
- All vegetation zones staked-out prior to planting, with planting occurring as soon as possible after the wetland cells have been constructed and under frost-free conditions.
- Measures to mitigate erosion downstream of the pond must also be incorporated.

5.3.5 Design Guidelines for Future Conveyance System

For this study area, a stormwater conveyance system providing the overall framework for the ultimate drainage system will need to be developed after further analysis. This system will consider proposed stormwater management facility sites and provide surface conveyance linking the ponds to each other and ultimately downstream drainage courses.

A set of guidelines are required to govern the future stormwater conveyance system in the study area. Numerous documents were reviewed to determine the recommended guidelines. These documents included the Stormwater Management Guidelines for the Province of Alberta (Alberta Environment and Parks, 1999), the Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems (Alberta Environment and Parks, 2006) and Design Standards Stormwater Management & Design Manual (City of Lethbridge, 2016).

- **Minor (Piped) Drainage System:**
  - Sized for 1:5 year flows using the XPSWMM model under future conditions with potential upsizing as required to reduce surface ponding at critical locations.
  - Sizing based on the City of Lethbridge's IDF curve.
  - Minimum size of roadway culverts is 600 mm (wall thickness of 1.6 mm or as required by the loading criteria).
- **Major (Surface) Drainage System:**
  - Sized for 1:100 year flows with a ditch bottom width of 1m, depth of 1m, and 3:1 (H:V) side slopes.
  - Sized based on the City of Lethbridge's IDF curve.
  - Surface ponding levels for 1:100 year confined below constructed buildings.
  - Roadway surface ponding generally less than 0.3m (absolutely less than 0.5m outside of stormwater management facilities) with at least one lane in either direction free of water on arterial roads. Ponding on other roads, such as collector roads, to be minimized wherever possible.
  - Emergency escape routes for events larger than 1:100 year. With flow paths detailed due to the large slopes and existing channelization of the topography.

- Surface flows conforming to AEP's allowable depth-velocity relationships as per Section 3.4.9 of the Stormwater Management Guidelines for the Province of Alberta outlined below.

Table 5.3: Permissible Depth and Velocity of Overland Flow

Water Velocity	Permissible Depth
m/s	m
0.5	0.80
1.0	0.32
2.0	0.21
3.0	0.09

It should be noted that culverts are considered part of the major drainage system.

5.3.6 Erosion Control Best Management Practices

To maintain existing topography and minimize environmental impacts wherever possible, the preferred option for stormwater management is to utilize and maintain existing flow paths in the area; therefore, erosion must be considered. Regarding this, focus should be placed on naturalized approaches as these flow paths are within close proximity of the reservoirs. Potential options to mitigate negative impacts are outlined below. Note that the information found in this section has been taken from the Guidelines for Erosion and Sediment Control (City of Calgary, 2011).

All developments are required to submit a detailed Erosion and Sediment Control (ESC) report detailing the downstream erosion impacts caused by the proposed stormwater discharge and detail how these impacts are being mitigated.

Vegetative Check Dams:

Vegetative check dams act as low-lying barriers within a drainage ditch or channel to decrease the flow velocity as well as improve water quality. These control measures are generally used for a combination of erosion and sediment control. The dams sit perpendicular to the direction of flow and only allow a certain amount of water to pass through at a time while also retaining sediment. It should be noted that there are limitations involved with vegetative check dams including a maximum feasible slope for implementation of approximately 8%; however, this erosion mitigation measure serves both this purpose as well as achieves the improved water quality objective.

Erosion Control Blankets:

Erosion control blankets are the most appropriate erosion mitigation measure when run-off-quantity and velocities are the driving force behind the erosion risk. They offer a typical erosion reduction of 95-99%. Two of these types of erosion control measures include the following:

- Straw Blankets:
  - Ideal for short-term erosion control.
- Turf Reinforcement Mats:
  - Synthetic material.
  - Recommended for additional shear resistance.
  - Promotes longevity of a channel.
  - Ideal for more long-term erosion control.

It should be noted that a substantial length of erosion control blankets may be required over long slopes. Slope steepness may also create issues with feasibility of installation and considerations for the environmental implications should also be made. Soil characteristics may affect the overall performance of erosion control measures and would also need to be accounted for.

5.3.7 Source Control Best Management Practices

Source control practices are becoming of increasing value in terms of stormwater management. A primary focus of these practices is sustainability in the form of pollution prevention strategies. These strategies involve the reduction of runoff volume and rate of flow as well as reduction of overall environmental impact in terms of water quality.

Several low impact development (LID) considerations may be integrated into the future stormwater system to ensure these guidelines are met. Potential source control options are summarized in Table 5.4, below.

Table 5.4: Source Control Practice Table

Source Control Practice	Description	Driving Forces
Evaporation Facilities	Large stormwater management facilities could be designed to promote evaporation. These could either be wet or dry ponds with designs governed by continuous simulation to ensure that adequate volumes can be evaporated on an annual basis. To work properly, outlet rates must be virtually non-existent with at most an overflow provided for wet years.	• Relatively simple facilities to design • Eliminates up to 100% of runoff volume • Stormwater pollutants retained in the pond • Highly applicable to residential, commercial or industrial areas

Source Control Practice	Description	Driving Forces
Stormwater Re-use/ Rainwater Harvesting	Stormwater could be captured in stormwater management facilities and used for non-potable uses. Guidelines for household non-potable water usage are currently under development by Alberta Environment and Parks. This would need to be assessed at the time of development as to whether suitable guidelines exist at that stage. Stormwater could also be used for irrigation. The larger the discharge area, the larger the volume reduction as evaporation could be considered over the net irrigated area, thus further enhancing the benefit of this stormwater volume reduction method.	• Irrigation water could be readily used with minimal, if any, treatment • Potentially significant use of stormwater runoff • Stormwater pollutants retained by storage ponds • Highly applicable to both residential and commercial areas
Bioretention Areas	Stormwater is diverted into holding areas that allow for infiltration. Significant vegetation is planted in the area to provide additional quality treatment. Evaporation also contributes to volume reduction.	• Could work well upstream in subdivisions • Provides high amount of volume / rate control • Provides a high amount of stormwater pollutant control by retaining pollutants within the bioretention area • Highly applicable to both residential and low-intensity commercial areas
Bioswales /Vegetated Swales	Stormwater is diverted into surface drainage swales that are vegetated. The net effect is similar to a combination of a grassed swale and an infiltration trench. Significant vegetation is planted to provide additional quality treatment. Ditch blocks are often installed to promote pollutant settling. Subdrains are often installed in soils with infiltration rates below 12.5 mm/hr.	• Provides high amount of volume / rate control • Provides high amount of stormwater pollutant control by retaining pollutants in the swales • Highly applicable to both residential, light commercial, and industrial areas
Adsorbent Landscapes	Stormwater runoff is reduced by promoting infiltration into the soil as runoff flows overland. This is often accomplished by designing for significant greenspace. Increased depth of topsoil and reduced soil compaction are also provided. This promoted infiltration can allow the soil to work like a sponge to absorb stormwater. However, the local geology may not be conducive to absorbent landscapes. A geotechnical report is required if this source control is to be implemented.	• Provides high amount of volume / rate control • Highly applicable for low-intensity commercial areas • Somewhat applicable for residential areas • Minimal maintenance required
Permeable Pavement	Stormwater runoff is reduced by promoting infiltration into pavement by providing a permeable surface. Stormwater is then either infiltrated into the underlying soil or diverted to a storage tank for later use. However, the local geology may not be conducive to permeable pavement. A geotechnical report is required if this source control is to be implemented.	• Works well for parking lots in commercial and industrial areas and residential back lanes • Provides high amount of volume / rate control • Reduces the size of stormwater management facilities downstream • Can be used as on-lot stormwater control for commercial and residential areas

Source Control Practice	Description	Driving Forces
Green Roofs	Stormwater runoff is reduced by using vegetated roofs. Stormwater is absorbed into soil and is then either evaporated naturally or collected by a subdrain system.	• Works well for roofs of larger buildings (normally commercial and industrial) • Provides high amount of volume / rate control, particularly for small events • Can be used as on-lot stormwater control for commercial / industrial areas

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6.0 Conclusions and Recommendations

The objectives of the Reservoir ASP Servicing Review can be largely grouped as follows:

- To recommend systems that will provide water servicing for the study area. Provide a framework for future development of detailed water studies for design of water supply, treatment, and distribution infrastructure.
- To recommend systems that will provide wastewater servicing for the study area. Provide a framework for future development of detailed wastewater studies for design of wastewater conveyance, treatment, and disposal infrastructure.
- To review other measures to assist in servicing the study area including items such as wastewater effluent re-use and stormwater harvesting.
- Provide a framework for future development of detailed stormwater studies including Master Drainage Plans (MDPs) and Stormwater Management Reports (SWMRs) to design stormwater management and erosion control measures. This includes stormwater management facilities as well as best management practices to control stormwater runoff release rates, volume, and water quality.

The completed Reservoir ASP Servicing Review will provide a guiding document for future development of the study area that can be used in preparation of future more detailed studies such as Servicing Strategies, Subdivision Servicing Reports, Staged Master Drainage Plans, and Subdivision Stormwater Management Reports.

6.1 Water Servicing

Conclusions and recommendations for the overall water servicing system for the study area can be summarized as follows:

- The total average day demand, maximum day demand, and peak hour demand water demands were calculated to be 2,747 m^3/day, 5,494 m^3/day, and 10,989 m^3/day, respectively.
- The total reservoir storage capacity required was calculated to be 3,877 m^3.
- Further analysis is required to ensure a proposed distribution system proves to be adequate under average day demand, peak hour demand, and maximum day plus fire flow scenarios.
- A detailed review of capacities of existing town and village systems as well as water co-ops should be undertaken to determine the feasibility of an existing connection compared to a stand-alone system.
- Consideration of water consumption reduction measures should be made.

6.2 Wastewater Servicing

Conclusions and recommendations for the overall wastewater servicing system for the study area can be summarized as follows:

- The total average dry weather flow, peak dry weather flow, and peak wet weather flow were calculated to be 2,648 m^3/day, 9,759 m^3/day, and 123,325 m^3/day, respectively.
- Further analysis is required to ensure a proposed collection system proves to be adequate under peak wet weather flow conditions.

- A detailed review of capacities of existing town and village systems should be undertaken to determine the feasibility of an existing connection compared to a stand-alone system.
- Consideration of wastewater flow reduction measures should be made.

6.3 Stormwater Drainage

Conclusions and recommendations related to planning the future stormwater drainage system in the study area are as follows:

- The maximum allowable area release rate from proposed stormwater management facilities shall be limited to 1.16 L/s/ha.
- The total active storage volume required was calculated to be 1,975,988 m^3.
- Stormwater quality treatment of SWMFs shall be at minimum 85% removal of particles 75 microns and larger on an annual basis under the 1:100 year rainfall event.
- Erosion mitigation measures are to be incorporated by developers to ensure no adverse impacts are occurring to existing drainage channels and surrounding areas. Localized Stormwater Management Reports (SWMRs) are required to detail any localized erosion risks and provide mitigation options focussed on naturalized techniques.
- The use of source control Best Management Practices is encouraged to reduce the total runoff volume and enhance stormwater treatment, including the following:
  - Stormwater re-use for irrigation and/or other non-potable water usage.
  - The use of evaporation facilities if volume control targets imposed.
  - Installation of low impact development (LID) features, such as bioswales and bioretention areas.
  - Incorporation of absorbent landscaping design at the time of subdivision design, within the context of steep slopes present in the area, slope stability is to be preserved.
  - All developments are required to submit a detailed Erosion and Sediment Control (ESC) report detailing the downstream erosion impacts caused by the proposed stormwater discharge and detail how these impacts are being mitigated.

7.0 References

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APPENDIX A

Surface Water and Groundwater Licenced Diversions

Licenced Surface Water Diversions						
Approval ID	Priority	Licence	Point of Diversion	Purpose	Source	Annual Volume m^3/year
24782	1993-07-30-005	Schmeelke, William	NE-13-015-23-4	Agricultural	Tributary to Long Coulee	2,460
26154	1991-04-23-004	Rebalkin, Cyril	NE-22-017-23-4	Agricultural	Tributary to Snake Creek	6,160
27202	1990-01-29-008	Hartung, Elden	NW-19-016-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,160
27356	1989-10-25-003	Maier, Don	SW-32-021-25-4	Municipal	Bow River	3,700
27555	1989-07-26-007	Gooch Farms Ltd	NW-34-018-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	1,240
27957	1988-12-21-004	Chambers, R. & L.	SW-32-021-25-4	Municipal	Bow River	3,700
28113	1988-11-25-001	Bjornson, Jerry	SE-01-015-23-4	Agricultural	Tributary to Long Coulee	4,930
28185	1988-09-30-004	Kennedy, Robert	SE-20-014-22-4	Agricultural	Tributary to Little Bow River	6,170
28221	1988-08-22-001	Mine Road Water Co-Op	SW-01-015-22-4	Commercial	Little Bow River	293,560
28363	1988-05-26-017	Richard A. & David C Hegland And Hegland, David	SW-15-015-21-4	Agricultural	Tributary to Little Bow River	4,930
28687	1987-07-24-001	Marsh Farms Ltd.	SW-32-021-25-4	Irrigation	Bow River	219,560
28840	1987-03-09-001	Champion East Water Co-Op Ltd.	NW-04-014-23-4	Municipal	Little Bow River	8,630
28940	1999-02-28-003	Mcgregor Water Users Co-Op Ltd	SW-32-021-25-4	Municipal	Bow River	141,910
29694	1985-04-16-028	West, Douglas	SW-17-017-20-4	Agricultural	Tributary to Badger Lake	4,930
29816	1985-02-08-009	Marks, Douglas	SE-31-017-20-4	Irrigation	Tributary to McGregor Lake (042-13-W5 83-B-12)	64,140
30002	1984-07-16-007	Wyatt, Frank	SW-18-019-23-4	Agricultural	Tributary to East Arrowwood Creek	2,460
30732	1983-05-09-002	Alton R & Hazel I Beagle	NE-17-017-20-4	Agricultural	Tributary to Badger Lake	3,700
30736	1983-05-09-001	Willard, Ward	NW-35-018-24-4	Agricultural	Tributary to East Arrowwood Creek	9,860
31025	1957-08-22-001	Vooys, Gilbert	SW-27-018-20-4	Agricultural	Tributary to Bow River	30,840
31298	1936-11-02-002	Deitz, David	SW-26-018-21-4	Agricultural	Tributary to Bow River	3,700
31539	1980-05-05-001	Ducks Unlimited Canada, Edmonton	SE-16-017-23-4	Habitat Enhancement	Snake Creek	27,140
31653	1979-12-20-008	Healy, Robert	NE-09-018-22-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	19,730
32369	1978-10-25-004	Somerville, Lee	SW-35-016-24-4	Habitat Enhancement	Tributary to Snake Creek	17,270
32545	1978-09-08-004	Northcott, Janetta	SW-35-019-21-4	Agricultural	Tributary to Indian Lake	4,930
33402	1976-11-01-001	Mitchell, Donald	SE-10-017-24-4	Agricultural	Tributary to Snake Creek	6,160
33693	1976-03-10-006	Davey Farms Ltd	SW-25-014-23-4	Agricultural	Tributary to Little Bow River	2,460
33777	1976-01-20-002	Healy, H.	NW-08-018-22-4	Irrigation	Tributary to McGregor Lake (042-13-W5 83-B-12)	62,910
33953	1975-07-30-004	Francis, William	NE-14-019-22-4	Agricultural	Tributary to Unnamed Lake	4,930
34408	1974-08-22-002	Brown, James	NW-24-015-23-4	Agricultural	Tributary to Long Coulee	3,700
34438	1981-12-29-001	Southern Alberta Bible Camp	SW-09-015-21-4	Commercial	Tributary to Little Bow River	4,930
34571	1974-05-31-001	Arrow Ridge Farms	SE-12-020-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,700
34605	1974-05-06-002	Lebsack, Brian	SE-12-016-23-4	Agricultural	Tributary to Snake Creek	23,430
34946	1986-07-15-002	Hartung, David	SW-11-015-22-4	Agricultural	Tributary to Little Bow River	2,460
35433	1973-03-16-001	Monner, Lawrence	SW-14-019-21-4	Agricultural	Tributary to Unnamed Lake	6,160
35442	1973-02-16-001	Deitz, John	SE-15-019-21-4	Agricultural	Tributary to Unnamed Lake	1,240
36477	1972-01-21-001	Schlaht, Hector	NW-25-016-20-4	Agricultural	Tributary to Badger Lake	12,330
36880	1970-10-05-001	Mcmorris Ranches Ltd	SW-34-019-22-4	Agricultural	Tributary to McGregor Lake (015 to 018-21-W4 82-I-07)	6,160
36893	1970-10-13-001	Darnall, Marilyn	SE-13-017-23-4	Agricultural	Tributary to Snake Creek	13,570
36911	1970-08-14-001	Hartung, Donald	SW-10-015-22-4	Agricultural	Tributary to Little Bow River	2,460
36936	1970-06-08-001	Walker, Alvin	NE-26-016-20-4	Agricultural	Tributary to Badger Lake	2,460
37251	1969-04-16-001	Hermann, Everett	SE-22-018-22-4	Irrigation	Tributary to McGregor Lake (042-13-W5 83-B-12)	37,000
37633	1968-01-10-002	Warkentin, David	NE-07-017-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,700
37780	1966-12-01-001	Ivers, Lewis	NW-21-019-22-4	Agricultural	Tributary to Unnamed Lake	3,700
37928	1965-12-03-001	Magnuson, Harold & Norma	NW-14-017-20-4	Agricultural	Tributary to Unnamed Lake	2,460
37929	1965-12-17-001	BIG 4 LEASE ASSOCATION And MAGNUSON, MELVIN	NE-05-018-20-4	Agricultural	Tributary to Badger Lake	7,400
38075	1965-03-16-001	Baldwin, Margaret	SW-03-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	14,800
38105	1964-12-30-002	Gerhan, Emil	NW-24-016-20-4	Agricultural	Tributary to Unnamed Lake	4,930
38362	1964-01-08-002	Nelson, Kenneth	NW-09-018-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	7,400
38363	1964-01-10-003	Nelson, Kenneth	SE-10-018-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	2,460
38423	1963-10-24-002	Healy, H. Keith	NE-09-018-22-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,160

Licenced Surface Water Diversions						
Approval ID	Priority	Licence	Point of Diversion	Purpose	Source	Annual Volume m^3/year
38430	1963-10-10-003	Bertrand, Ross	NE-23-018-21-4	Agricultural	Tributary to Bow River	12,330
38546	1963-07-03-009	Shield, Benjamin	NE-28-018-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	12,330
38572	1963-06-25-004	Monner, Michael	NE-26-019-21-4	Agricultural	Tributary to Indian Lake	2,460
39057	1962-05-30-003	Mcmullen, William	SE-11-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,160
39136	1962-03-05-005	Wyatt, Merle & Neeltje	NW-19-019-23-4	Agricultural	Tributary to East Arrowwood Creek	2,460
39137	1962-03-05-004	Deitz, David	SE-24-018-21-4	Agricultural	Tributary to Bow River	7,400
39138	1962-03-15-002	Nelson, Kenneth	NW-16-018-20-4	Agricultural	Tributary to Bow River	14,800
39142	1962-03-08-003	Nelson, Kenneth	SW-15-018-20-4	Agricultural	Tributary to Bow River	7,400
39393	1963-09-13-001	Vulcan County	SE-17-018-22-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	616,740
39425	1961-04-13-002	Pasolli, Margaret	SW-08-016-23-4	Agricultural	Tributary to Long Coulee	2,460
39485	1961-01-10-001	Schlaht, Steven	NE-25-016-20-4	Agricultural	Tributary to Unnamed Lake	4,930
39534	1960-10-04-001	Ruggles, Tom	NE-10-015-21-4	Agricultural	Tributary to Little Bow River	7,400
39611	1960-06-22-001	Stokes, Bertram	SW-12-016-20-4	Agricultural	Tributary to Unnamed Lake	6,160
39684	1959-12-02-001	Magnuson, Harold & Norma	NE-16-017-20-4	Agricultural	Tributary to Unnamed Lake	4,930
39697	1959-11-19-001	Magnuson, Meluni	NE-22-017-20-4	Irrigation	Tributary to Unnamed Lake	18,500
39895	1958-12-31-002	Village Of Milo	SW-32-021-25-4	Municipal	Bow River	49,340
40049	1957-12-23-002	Umscheid, Jessie	SW-11-019-21-4	Agricultural	Tributary to Indian Lake	7,400
40098	1957-09-17-003	Marks, Douglas	NE-29-017-20-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,160
40133	1957-07-09-002	Big 4 Lease Assocation	SW-05-018-20-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,160
40378	1954-11-09-001	Healy, Lorne	SW-04-018-22-4	Agricultural	Tributary to Snake Creek	3,700
40731	1950-10-02-001	Marshall, Norman	NW-09-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	9,860
40737	1950-09-23-002	Maisey, Albert	NW-10-016-24-4	Management of Fish	Tributary to Long Coulee	20,970
40818	1950-08-12-006	Vulcan County	NW-17-017-23-4	Water Management	Snake Creek	185,020
41261	1947-07-05-003	Shield, Benjamin	SE-02-019-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	1,240
41412	1946-07-17-001	Ully, Edward	NE-17-018-22-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	9,860
41645	1945-07-30-002	Sunny Glen Farms Ltd	SE-14-017-23-4	Irrigation	Snake Creek	111,020
41934	1943-06-19-001	Peterson, William	SE-15-018-24-4	Agricultural	Tributary to Snake Creek	1,240
42164	1943-05-03-001	Cockwill, Robert	NW-04-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	2,460
42278	1942-06-30-002	Silbernagel, Peter & Norma	NW-33-017-22-4	Agricultural	Tributary to Snake Creek	4,930
42279	1942-06-30-001	J F Murray Ranches Ltd	SW-12-014-21-4	Agricultural	Tributary to Little Bow River	6,160
42330	1942-02-02-001	Wyatt, Dale	SE-18-019-23-4	Agricultural	Tributary to East Arrowwood Creek	3,700
42337	1942-01-26-001	ROBERT & GERALD STOKES And STOKES, GERALD	NE-26-017-20-4	Agricultural	Tributary to Badger Lake	8,630
42359	1941-11-28-001	Walker, Alvin	SW-25-016-20-4	Agricultural	Tributary to Badger Lake	3,700
42397	1980-12-23-004	Ducks Unlimited Canada, Edmonton	SE-19-017-22-4	Habitat Enhancement	Snake Creek	65,380
42503	1941-07-17-001	Rushfeldt, V.	NE-31-018-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	46,870
42577	1940-07-19-002	Walker, Alvin	NE-23-016-20-4	Agricultural	Tributary to Little Bow River	6,160
42640	1940-01-15-002	W & J Honess Farms Ltd.	SW-21-015-20-4	Agricultural	Tributary to Lost Lake	6,160
42671	1940-08-21-002	West, Douglas	NE-02-017-20-4	Agricultural	Tributary to Badger Lake	1,240
42675	1939-12-06-001	West, Albert	SW-02-017-20-4	Agricultural	Tributary to Badger Lake	3,700
42676	1939-12-01-002	Anderson, Wayne	SW-01-017-24-4	Agricultural	Tributary to Snake Creek	7,400
42738	1939-10-16-006	Stokes, Joseph	NE-34-017-20-4	Irrigation	Tributary to Badger Lake	11,100
42760	1939-10-04-003	Big 4 Lease Assocation	NW-21-017-20-4	Agricultural	Tributary to Badger Lake	3,700
42779	1939-09-27-002	Magnuson, Harold & Norma	SW-21-017-20-4	Agricultural	Tributary to Badger Lake	3,700
42814	1941-07-14-002	Hill, Robert	SE-15-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	6,170
42833	1941-01-29-001	Hendricks, Alvin & Marvina	NW-35-017-20-4	Agricultural	Tributary to Badger Lake	4,930
42834	1939-09-29-002	Johnson, Alexander	NW-32-017-20-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	2,460
42836	1939-08-25-003	Stokes, Robert	SE-33-017-20-4	Agricultural	Tributary to Badger Lake	12,330
42878	1939-06-28-001	Craine, Dorothy	SW-27-017-20-4	Agricultural	Tributary to Badger Lake	8,630
42943	1939-05-08-001	Steeves, Donald	SW-18-015-20-4	Agricultural	Tributary to Little Bow River	12,330
43013	1938-12-09-001	Brotherwood, John	NE-35-017-20-4	Agricultural	Tributary to Badger Lake	3,700

Licenced Surface Water Diversions						
Approval ID	Priority	Licence	Point of Diversion	Purpose	Source	Annual Volume m^3/year
43063	1938-09-24-001	White, Terrance & Shirley	NW-10-017-23-4	Agricultural	Tributary to Snake Creek	4,930
43067	1938-09-21-001	Strum, Charles	SW-33-019-23-4	Agricultural	Tributary to East Arrowwood Creek	7,400
43162	1939-06-03-004	West, Albert	SW-14-017-20-4	Agricultural	Tributary to Badger Lake	6,160
43181	1938-06-25-001	Wyatt, Dale	NE-18-019-23-4	Agricultural	Tributary to East Arrowwood Creek	2,460
43230	1938-09-19-004	Cockwill Et Al, Helen	SE-27-019-23-4	Agricultural	Tributary to East Arrowwood Creek	4,930
43333	1938-01-24-001	Steiner, William & Carol	NE-03-020-24-4	Agricultural	Tributary to West Arrowwood Creek	4,930
43353	1938-01-18-001	Lomond Grazing Association	NE-10-018-20-4	Agricultural	Tributary to Badger Lake	4,930
43381	1937-11-08-001	Cockwill, John & Sharon	SE-03-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	2,460
43420	1939-04-11-001	Sealock, Kenneth & Marie	NW-31-017-20-4	Irrigation	Tributary to McGregor Lake (042-13-W5 83-B-12)	38,230
43421	1938-01-21-001	W & J Honess Farms Ltd.	NE-21-015-20-4	Agricultural	Tributary to Lost Lake	2,460
43422	1937-10-29-001	Beagle, Hazel & Alton	NE-17-017-20-4	Agricultural	Tributary to Badger Lake	6,160
43441	1937-10-27-003	Birkenes, Victor & Judy	NE-15-017-20-4	Agricultural	Tributary to Badger Lake	17,270
43467	1937-10-08-005	Magnuson, Melvin	SE-28-017-20-4	Agricultural	Tributary to Badger Lake	2,460
43468	1937-10-18-002	Hendricks, Alvin & Marvina	SW-28-017-20-4	Agricultural	Tributary to Badger Lake	2,460
43469	1940-08-21-001	West, Herbert	NW-01-017-20-4	Agricultural	Tributary to Badger Lake	3,700
43474	1937-10-12-001	Craine, Dorothy	NW-20-017-20-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	11,100
43486	1937-09-20-002	Birkenes, Victor & Judy	NW-27-017-20-4	Agricultural	Tributary to Badger Lake	7,400
43494	1992-12-30-001	Kardos, Ruby	SW-32-018-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,690
43566	1937-08-30-002	Magnuson, Harold & Norma	SE-21-017-20-4	Agricultural	Tributary to Badger Lake	11,100
43597	1937-08-25-004	Magnuson, Harold & Norma	NE-16-017-20-4	Agricultural	Tributary to Badger Lake	2,460
43599	1937-08-23-004	Walker, Alvin	NW-26-016-20-4	Agricultural	Tributary to Badger Lake	3,700
43609	1937-08-13-001	2 Bar Ranches Ltd.	SW-17-020-23-4	Agricultural	Tributary to Arrowwood Creek	3,700
43673	1937-08-17-001	Triple E Farms Ltd	SW-05-017-23-4	Agricultural	Tributary to Snake Creek	9,860
43698	1937-07-05-003	Hendricks, Alvin & Marvina	SW-32-017-20-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	4,930
43773	1958-12-02-001	Allon, Marian	SW-10-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,700
43903	1939-02-13-001	Armstrong, Earl	NE-10-016-20-4	Agricultural	Tributary to Little Bow River	37,000
43905	1938-03-23-002	Markert, Albert	SE-34-017-24-4	Agricultural	Tributary to Snake Creek	3,700
43906	1937-01-21-001	Mcmorris Ranches Ltd	SW-12-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	1,240
43907	1937-03-09-001	Deimert, Lenore	SE-15-017-24-4	Agricultural	Tributary to Snake Creek	3,700
43951	1936-11-20-002	Nelson, Kenneth	SE-08-018-20-4	Agricultural	Tributary to Badger Lake	2,460
43982	1936-11-05-002	Cockwill, Grace	NW-03-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,700
43984	1936-11-02-001	Deitz, David	SW-26-018-21-4	Agricultural	Tributary to Bow River	2,460
43993	1936-12-30-002	Doane, Orlo	NE-26-018-24-4	Agricultural	East Arrowwood Creek	2,460
44029	1936-10-08-001	Oldfield, Edith	SW-25-018-24-4	Agricultural	Tributary to Snake Creek	1,240
44050	1936-09-18-001	Howell, Kate	NW-22-018-21-4	Agricultural	Tributary to Indian Lake	3,700
44063	1936-09-30-001	Pioneer Farms Ltd	SE-11-019-21-4	Agricultural	Tributary to Indian Lake	2,460
44064	1936-10-02-001	Mcmorris Ranches Ltd	NE-01-019-23-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	3,700
44105	1937-06-28-004	P. Nelson & Sons Farms Ltd.	NW-25-019-22-4	Agricultural	Tributary to Indian Lake	11,100
44205	1936-02-24-001	Maronda, Marvin	NW-31-015-20-4	Agricultural	Tributary to Little Bow River	1,240
44222	1936-03-28-002	Nelson, Kenneth	NW-11-018-21-4	Agricultural	Tributary to McGregor Lake (042-13-W5 83-B-12)	17,270
44224	1936-03-28-001	Big 4 Lease Assocation	NW-03-018-20-4	Agricultural	Tributary to Badger Lake	9,860
44411	1935-08-26-005	Sunny Glen Farms Ltd	NE-11-017-23-4	Irrigation	Tributary to Snake Creek	70,310
44828	1925-07-02-001	Jones, Carl	NE-21-020-22-4	Agricultural	Tributary to Bow River	1,230
79046	1999-12-15-001	Bertram, Al	SW-34-016-24-4	Agricultural	Snake Creek	5,553
151667	1992-04-22-008	Plainfield Water Users Ltd	SW-32-021-25-4	Municipal	Bow River	59,200
173326	2001-08-28-002	Marks, Ronald	SW-36-018-22-4	Agricultural	McGregor Lake (042-13-W5 83-B-12)	4,689
212893	2003-06-03-001	Marks, Ronald	NE-04-019-22-4	Agricultural	McGregor Lake (015 to 018-21-W4 82-I-07)	1,001
238601	1979-04-10-002	Webber, Allen	NW-06-018-22-4	Other Purpose Specified by the Director	Tributary to Snake Creek	0
242402	2006-01-10-003	Allan & Kaye Giles	NW-11-018-24-4	Agricultural	Tributary to Snake Creek	4,163
249395	1991-06-18-010	Tiegen Farms Ltd.	SE-20-018-21-4	Agricultural	McGregor Lake (015 to 018-21-W4 82-I-07)	1,752

Licenced Surface Water Diversions						
Approval ID	Priority	Licence	Point of Diversion	Purpose	Source	Annual Volume m^3/year
251710	2001-12-31-106	Hartung, Elden, Debora & Tillie	NE-20-016-21-4	Agricultural	McGregor Lake (015 to 018-21-W4 82-I-07)	9,026
267437	1978-10-20-001	Hutterian Brethren Church Of Shadow Ranch	NW-36-014-22-4	Municipal	Little Bow River	11,111
267451	1978-10-20-001	Hutterian Brethren Church Of Shadow Ranch	NW-36-014-22-4	Agricultural	Little Bow River	50,000
267454	1978-10-20-001	Hutterian Brethren Church Of Shadow Ranch	NW-36-014-22-4	Other Purpose Specified by the Director	Little Bow River	50,000
316951	1978-10-20-001	Hutterian Brethren Church Of Shadow Ranch	NW-36-014-22-4	Municipal	Little Bow River	12,222
341322	1976-06-24-003	Hutterian Brethren Church Of Carmangay	SW-13-014-23-4	Agricultural	Little Bow River	83,333
341326	1976-06-24-003	Hutterian Brethren Church Of Carmangay	SW-13-014-23-4	Other Purpose Specified by the Director	Little Bow River	7,778
341327	1976-06-24-003	Hutterian Brethren Church Of Carmangay	SW-13-014-23-4	Municipal	Little Bow River	11,111
347211	1976-06-24-003	Alberta Environment And Parks	SW-13-014-23-4	Government Holdback	Little Bow River	23,704
347213	1976-06-24-003	Alberta Environment And Parks	SW-13-014-23-4	Government Holdback	Little Bow River	9,259
347214	1976-06-24-003	Alberta Environment And Parks	SW-13-014-23-4	Government Holdback	Little Bow River	864
347215	1976-06-24-003	Alberta Environment And Parks	SW-19-014-22-4	Government Holdback	Little Bow River	1,235
408491	1977-01-24-011	Alberta Environment And Parks	SW-32-014-22-4	Government Holdback	Little Bow River	26,988
408492	1997-09-23-039	Alberta Environment And Parks	SW-32-014-22-4	Government Holdback	Little Bow River	48,519
					Total	3,287,767

Licenced Groundwater Diversions						
Approval ID	Priority	Licence	Point of Diversion	Purpose	Source	Annual Volume m^3/year
23789	1997-01-06-002	Ward, Ross	01-16-020-23-4	Agricultural	Unnamed Aquifer	2,470
23810	1996-09-03-006	Mcmorris Ranches Ltd	08-12-019-23-4	Agricultural	Unnamed Aquifer	620
23810	1996-09-03-005	Mcmorris Ranches Ltd	06-01-019-23-4	Agricultural	Unnamed Aquifer	990
23811	1996-09-03-004	Mcmorris Ranches Ltd	04-34-019-22-4	Agricultural	Unnamed Aquifer	490
23812	1996-09-03-002	Mcmorris, Brenda	13-27-019-22-4	Agricultural	Unnamed Aquifer	0
23812	1996-09-03-001	Mcmorris, Brenda	13-27-019-22-4	Agricultural	Unnamed Aquifer	7,150
23813	1996-08-26-007	Premium Farms Ltd	04-03-018-24-4	Agricultural	Unnamed Aquifer	3,820
23813	1996-08-26-006	Premium Farms Ltd	04-03-018-24-4	Agricultural	Unnamed Aquifer	3,820
23813	1996-08-26-004	Premium Farms Ltd	04-03-018-24-4	Agricultural	Unnamed Aquifer	3,950
23813	1996-08-26-003	Premium Farms Ltd	10-34-017-24-4	Agricultural	Unnamed Aquifer	7,650
23813	1996-08-26-002	Premium Farms Ltd	10-34-017-24-4	Agricultural	Unnamed Aquifer	7,770
24033	1995-02-28-025	Steiner, William & Carol	06-13-019-24-4	Agricultural	Unnamed Aquifer	1,230
24034	1995-02-28-024	Steiner, William & Carol	16-03-020-24-4	Agricultural	Unnamed Aquifer	1,230
24034	1995-02-28-023	Steiner, William & Carol	04-11-020-24-4	Agricultural	Unnamed Aquifer	3,820
24034	1995-02-28-022	Steiner, William & Carol	06-03-020-24-4	Agricultural	Unnamed Aquifer	1,850
24034	1995-02-28-021	Steiner, William & Carol	01-11-020-24-4	Agricultural	Unnamed Aquifer	6,410
24034	1995-02-28-020	Steiner, William & Carol	01-11-020-24-4	Agricultural	Unnamed Aquifer	6,660
24034	1995-02-28-019	Steiner, William & Carol	01-11-020-24-4	Agricultural	Unnamed Aquifer	6,290
24042	1996-03-12-001	Hill, Duane	11-15-019-24-4	Agricultural	Unnamed Aquifer	740
24043	1995-03-21-004	Hill, Duane	11-15-019-24-4	Agricultural	Unnamed Aquifer	990
24043	1995-03-21-003	Hill, Duane	11-15-019-24-4	Agricultural	Unnamed Aquifer	1,480
24077	1995-03-14-005	Fitzpatrick, Robert	13-13-020-21-4	Agricultural	Unnamed Aquifer	1,850
24078	1995-03-14-004	Fitzpatrick, Robert	13-09-020-21-4	Agricultural	Unnamed Aquifer	1,970
24078	1995-03-14-003	Fitzpatrick, Robert	13-09-020-21-4	Agricultural	Unnamed Aquifer	2,470
24671	1993-12-13-019	Mialta Hutterian Brethren	15-26-017-23-4	Municipal	Unnamed Aquifer	3,700
24672	1993-12-13-018	Mialta Hutterian Brethren	11-26-017-23-4	Municipal	Unnamed Aquifer	4,930
24921	1993-03-29-003	Larkins, Alvin & Jeanette	09-26-016-22-4	Agricultural	Unnamed Aquifer	620
24921	1993-03-29-002	Larkins, Alvin & Jeanette	09-26-016-22-4	Agricultural	Unnamed Aquifer	620
28597	1989-11-08-002	Dorchak, Wallace & Karen	08-26-017-24-4	Agricultural	Unnamed Aquifer	4,930
28598	1989-11-08-001	Dorchak, Wallace & Karen	02-26-017-24-4	Agricultural	Unnamed Aquifer	2,470
28644	1963-10-19-001	Roe, Orville	13-22-016-23-4	Municipal	Unnamed Aquifer	12,330
31746	1968-12-31-017	Ward, George	01-16-020-23-4	Agricultural	Unnamed Aquifer	4,930
31746	1968-12-31-016	Ward, George	01-16-020-23-4	Agricultural	Unnamed Aquifer	8,630
31746	1968-12-31-015	Ward, George	01-16-020-23-4	Agricultural	Unnamed Aquifer	2,470
31751	1942-11-30-002	2 Bar Ranches Ltd.	13-17-020-23-4	Agricultural	Unnamed Aquifer	7,400
31752	1911-07-31-001	2 Bar Ranches Ltd.	16-18-020-23-4	Agricultural	Unnamed Aquifer	9,870
32168	1965-07-31-002	L. & V. Smith	08-36-014-23-4	Agricultural	Unnamed Aquifer	7,400
32329	1918-12-31-003	Arrow Ridge Farms	15-12-020-23-4	Agricultural	Unnamed Aquifer	19,740
32466	1955-12-23-001	Roe, Orville	16-16-016-23-4	Agricultural	Unnamed Aquifer	4,930
184565	2004-10-06-001	Wyatt, Wade	SW-08-019-23-4	Agricultural	Unnamed Aquifer	3,070
204802	2002-10-09-009	Myrlee Farm Ltd	NW-06-020-22-4	Agricultural	Unnamed Aquifer	1,023
248178	1111-01-01-001	Hutterian Brethren Of Skylight	SE-23-016-23-4	Agricultural	Unnamed Aquifer	0
248178	2008-05-16-002	Hutterian Brethren Of Skylight	01-23-016-23-4	Agricultural	Unnamed Aquifer	17,431
248178	2008-05-16-001	Hutterian Brethren Of Skylight	08-23-016-23-4	Agricultural	Unnamed Aquifer	6,826
248186	1111-01-01-001	Hutterian Brethren Of Skylight	SE-23-016-23-4	Municipal	Unnamed Aquifer	0
248186	2008-05-16-003	Hutterian Brethren Of Skylight	01-23-016-23-4	Municipal	Unnamed Aquifer	3,982
366689	2015-09-25-001	Aqua Properties Ltd.	NW-02-015-22-4	Recreation	Unnamed Aquifer	2,912
428803	2018-11-14-001	Gogravel Inc.	NW-13-020-24-4	Commercial	Unnamed Aquifer	3,768
430241	2019-11-01-001	Jim Randle Holdings Inc.	NE-22-019-23-4	Agricultural	Unnamed Aquifer	300
					Total	210,002

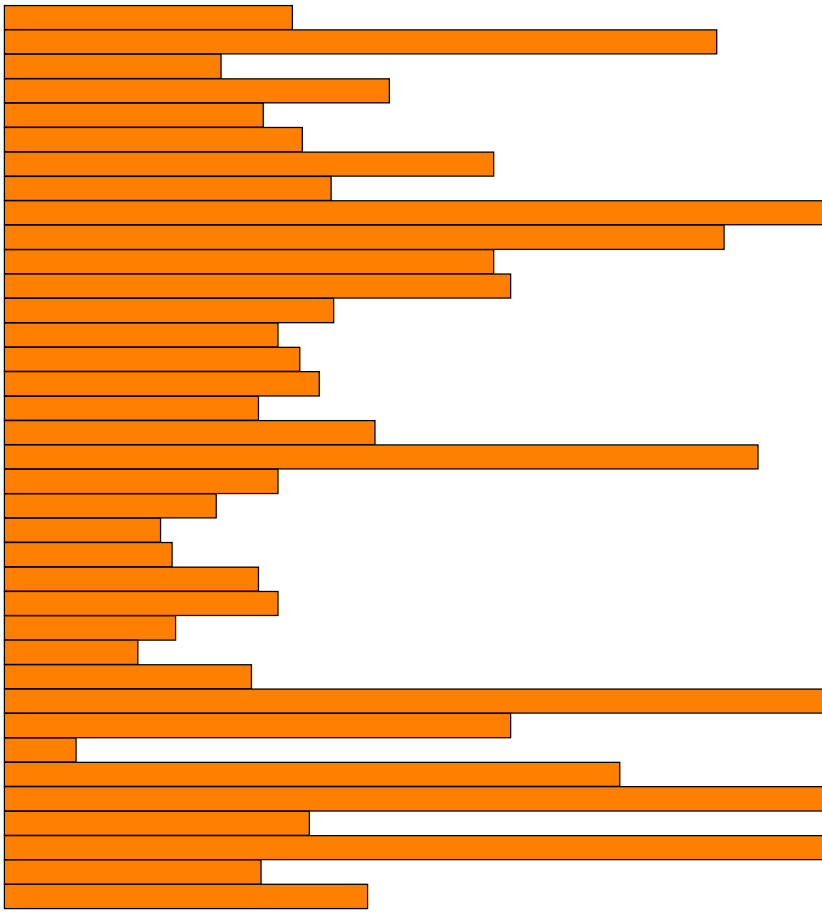
APPENDIX B
Hydrostat Output Files

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

This data is an ANNUAL MAXIMUM series.

DATA ENTERED

Water Year	PEAK DISCHARGE Q cms
1972	11.90
1973	29.40
1974	8.95
1975	15.90
1976	10.70
1977	12.30
1978	20.20
1979	13.50
1980	51.30
1981	29.70
1982	20.20
1983	20.90
1984	13.60
1985	11.30
1986	12.20
1987	13.00
1988	10.50
1989	15.30
1990	31.10
1991	11.30
1992	8.75
1993	6.46
1994	6.94
1995	10.50
1996	11.30
1997	7.08
1998	5.52
1999	10.20
2000	39.60
2001	20.90
2002	2.97
2003	25.40
2004	66.50
2005	12.60
2006	56.60
2007	10.60
2008	15.00



End of Data Series ==========
This series contains 37 years of data.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

DATA AS CONTAINED IN: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HY

UNSORTED				SORTED			
Q (cms)	Rank	Plotting Position	Plotted Period (yrs)	Q (cms)	Rank	Plotting Position	Plotted Period (yrs)
11.90	0	.0000	0.000	25.80	1	.0263	38.000
29.40	0	.0000	0.000	22.90	2	.0526	19.000
8.95	0	.0000	0.000	10.90	3	.0789	12.667
15.90	0	.0000	0.000	10.70	4	.1053	9.500
10.70	4	.1053	9.500	9.90	5	.1316	7.600
12.30	4	.1053	9.500	9.20	6	.1579	6.333
20.20	4	.1053	9.500	8.88	7	.1842	5.429
13.50	4	.1053	9.500	8.60	8	.2105	4.750
51.30	4	.1053	9.500	8.03	9	.2368	4.222
29.70	4	.1053	9.500	6.60	10	.2632	3.800
20.20	4	.1053	9.500	6.04	11	.2895	3.455
20.90	4	.1053	9.500	4.99	12	.3158	3.167
13.60	4	.1053	9.500	4.99	13	.3421	2.923
11.30	4	.1053	9.500	4.22	14	.3684	2.714
12.20	4	.1053	9.500	4.22	15	.3947	2.533
13.00	4	.1053	9.500	3.94	16	.4211	2.375
10.50	4	.1053	9.500	3.86	17	.4474	2.235
15.30	4	.1053	9.500	3.59	18	.4737	2.111
31.10	4	.1053	9.500	3.57	19	.5000	2.000
11.30	4	.1053	9.500	3.55	20	.5263	1.900
8.75	4	.1053	9.500	3.44	21	.5526	1.810
6.46	4	.1053	9.500	2.94	22	.5789	1.727
6.94	4	.1053	9.500	2.78	23	.6053	1.652
10.50	4	.1053	9.500	2.69	24	.6316	1.583
11.30	4	.1053	9.500	2.67	25	.6579	1.520
7.08	4	.1053	9.500	2.67	26	.6842	1.462
5.52	4	.1053	9.500	2.63	27	.7105	1.407
10.20	4	.1053	9.500	2.61	28	.7368	1.357
39.60	4	.1053	9.500	2.59	29	.7632	1.310
20.90	4	.1053	9.500	2.55	30	.7895	1.267
2.97	4	.1053	9.500	2.49	31	.8158	1.226
25.40	4	.1053	9.500	2.46	32	.8421	1.188
66.50	4	.1053	9.500	2.45	33	.8684	1.152
12.60	4	.1053	9.500	2.31	34	.8947	1.118
56.60	4	.1053	9.500	2.25	35	.9211	1.086
10.60	4	.1053	9.500	1.55	36	.9474	1.056
15.00	4	.1053	9.500	1.16	37	.9737	1.027

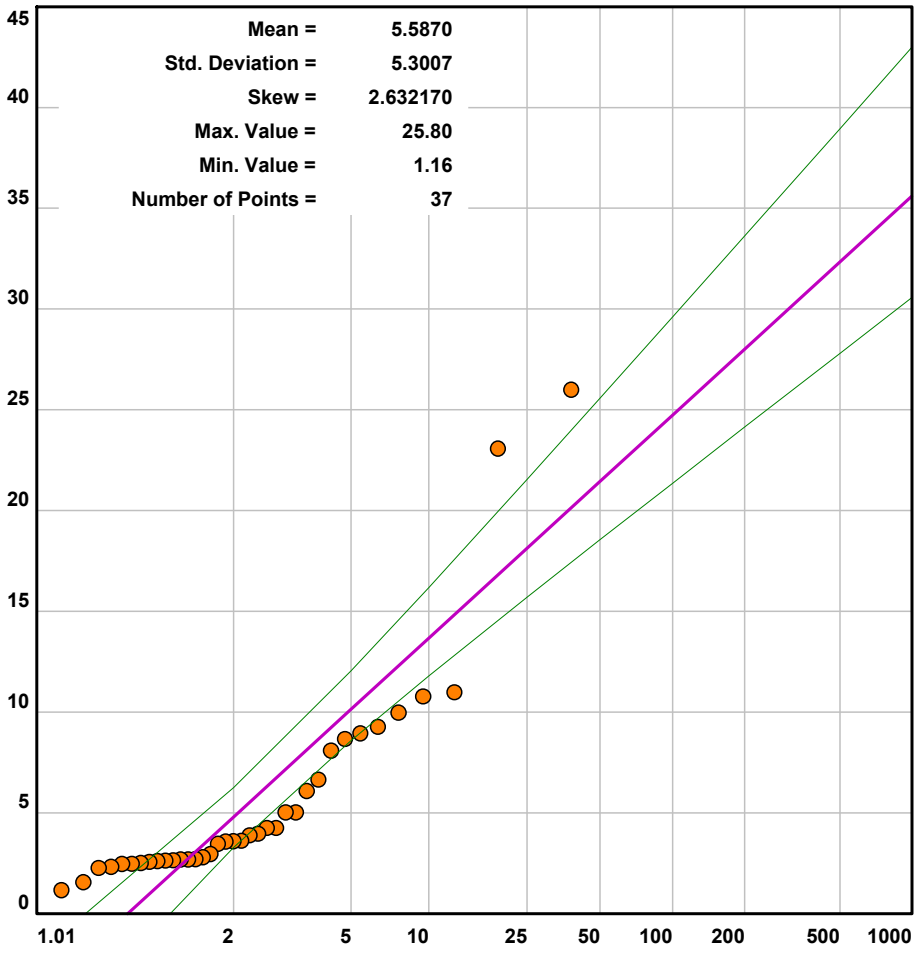
Note that the UNSORTED listing will give the same rank to identical values occuring in the input data file. The SORTED listing shows all ranks.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

EXTREME VALUE TYPE I (GUMBEL) DISTRIBUTION

PEAK DISCHARGE (cms)

Tr (yrs)	Q cms
1.01	-4.09
2	4.77
5	10.07
10	13.57
25	18.00
50	21.29
100	24.55
200	27.80
500	32.09
1000	35.33



FAILED
Chi-Square Test

PotHole Creek Peak Yealry DIscharge 1972-2008

RETURN PERIOD (yrs)

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean =	5.5870	Maximum Input Value =	25.80
Std. Deviation =	5.3007	Minimum Input Value =	1.16
Skew =	2.63217000	Number of Points =	37

EXTREME VALUE TYPE I (GUMBEL) DISTRIBUTION

RETURN PERIOD (yrs)	Q (cms)	FREQUENCY FACTOR	Q 90% CONFIDENCE LIMITS Lower (cms)	Upper (cms)
1.01	-4.09	-1.8257	-6.90	-2.03
2	4.77	-0.1544	3.27	6.21
5	10.07	0.8448	8.52	11.96
10	13.57	1.5064	11.71	16.06
25	18.00	2.3423	15.59	21.38
50	21.29	2.9624	18.42	25.39
100	24.55	3.5779	21.20	29.38
200	27.80	4.1912	23.96	33.38
500	32.09	5.0003	27.59	38.66
1,000	35.33	5.6118	30.33	42.66

NOTE: Negative values are shown for verification purposes only. Obviously, negative values will not occur. Frequently the lower return periods will have negative values resulting from the statistical fit.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean =	5.5870	Maximum Input Value =	25.80
Std. Deviation =	5.3007	Minimum Input Value =	1.16
Skew =	2.63217000	Number of Points =	37

EXTREME VALUE TYPE I (GUMBEL) DISTRIBUTION
CHI-SQUARE TEST FOR GOODNESS-OF-FIT

	CLASS LIMITS		NUMBER OF VALUES		
CLASS	Lower (cms)	Upper (cms)	Expected "Ei"	Observed "Oi"	$\frac{(Oi-Ei)^2}{Ei}$
1	0.00	-1.20	3.0833	0	3.0833
2	-1.20	0.33	3.0833	0	3.0833
3	0.33	1.53	3.0833	1	1.4077
4	1.53	2.62	3.0833	9	11.3536
5	2.62	3.68	3.0833	10	15.5158
6	3.68	4.77	3.0833	4	0.2725
7	4.77	5.94	3.0833	2	0.3806
8	5.94	7.27	3.0833	2	0.3806
9	7.27	8.88	3.0833	2	0.3806
10	8.88	11.01	3.0833	5	1.1914
11	11.01	14.47	3.0833	0	3.0833
12	14.47	Infinity	3.0833	2	0.3806
				COMPUTED CHI-SQUARE =	40.5135
				CHI-SQUARE FROM TABLE =	14.7000

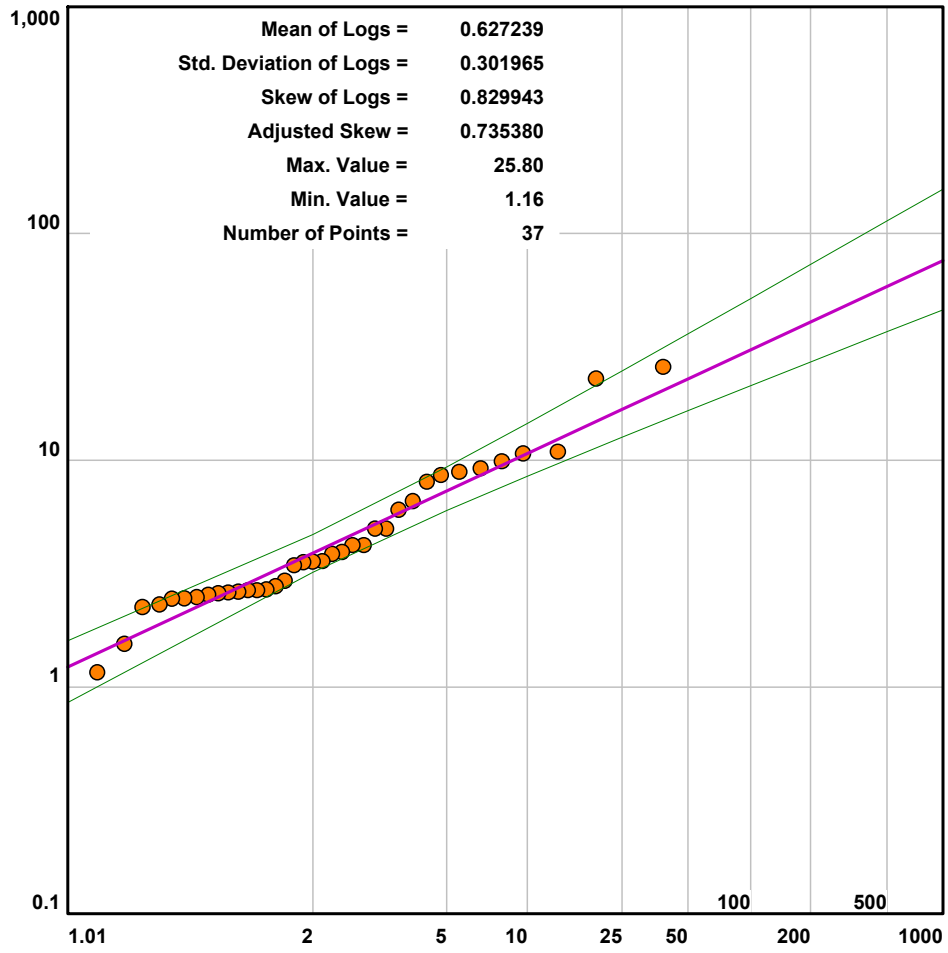
CONCLUDE: Based on Chi-Square (Goodness-of-Fit) results,
the EXTREME VALUE TYPE I (GUMBEL) DISTRIBUTION does NOT apply to the input data.
Note that Chi-Square results are dependent upon the number of class intervals used.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

LOG-PEARSON TYPE III DISTRIBUTION

PEAK DISCHARGE (cms)

Tr (yrs)	Q cms
1.01	1.23
2	3.90
5	7.32
10	10.72
25	16.75
50	22.85
100	30.69
200	40.74
500	58.38
1000	75.99



FAILED
Chi-Square Test

PotHole Creek Peak Yealry DIscharge 1972-2008

RETURN PERIOD (yrs)

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean of Logs =	0.627239	Maximum Input Value =	25.80
Std. Deviation of Logs =	0.301965	Minimum Input Value =	1.16
Skew of Logs =	0.829943	Number of Points =	37
Adjusted Skew =	0.735380	Generalized Map Skew =	0.6

LOG-PEARSON TYPE III DISTRIBUTION

RETURN PERIOD (yrs)	Q (cms)	FREQUENCY FACTOR	Q 90% CONFIDENCE LIMITS Lower (cms)	Upper (cms)
1.01	1.23	-1.7825	0.85	1.60
2	3.90	-0.1215	3.20	4.71
5	7.32	0.7864	6.00	9.33
10	10.72	1.3342	8.50	14.52
25	16.75	1.9760	12.62	24.74
50	22.85	2.4231	16.53	36.04
100	30.69	2.8474	21.30	51.62
200	40.74	3.2545	27.14	72.96
500	58.38	3.7721	36.87	113.46
1,000	75.99	4.1512	46.12	156.89

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean of Logs =	0.627239	Maximum Input Value =	25.80
Std. Deviation of Logs =	0.301965	Minimum Input Value =	1.16
Skew of Logs =	0.829943	Number of Points =	37
Adjusted Skew =	0.735380	Generalized Map Skew =	0.6

LOG-PEARSON TYPE III DISTRIBUTION
CHI-SQUARE TEST FOR GOODNESS-OF-FIT

	CLASS LIMITS		NUMBER OF VALUES		
CLASS	Lower (cms)	Upper (cms)	Expected "Ei"	Observed "Oi"	$\frac{(Oi-Ei)^2}{Ei}$
1	0.00	1.77	3.0833	2	0.3806
2	1.77	2.17	3.0833	0	3.0833
3	2.17	2.56	3.0833	6	2.7590
4	2.56	2.95	3.0833	8	7.8401
5	2.95	3.39	3.0833	0	3.0833
6	3.39	3.90	3.0833	5	1.1914
7	3.90	4.51	3.0833	3	0.0023
8	4.51	5.32	3.0833	2	0.3806
9	5.32	6.45	3.0833	1	1.4077
10	6.45	8.31	3.0833	2	0.3806
11	8.31	12.01	3.0833	6	2.7590
12	12.01	Infinity	3.0833	2	0.3806
			COMPUTED CHI-SQUARE =		23.6487
			CHI-SQUARE FROM TABLE =		13.4000

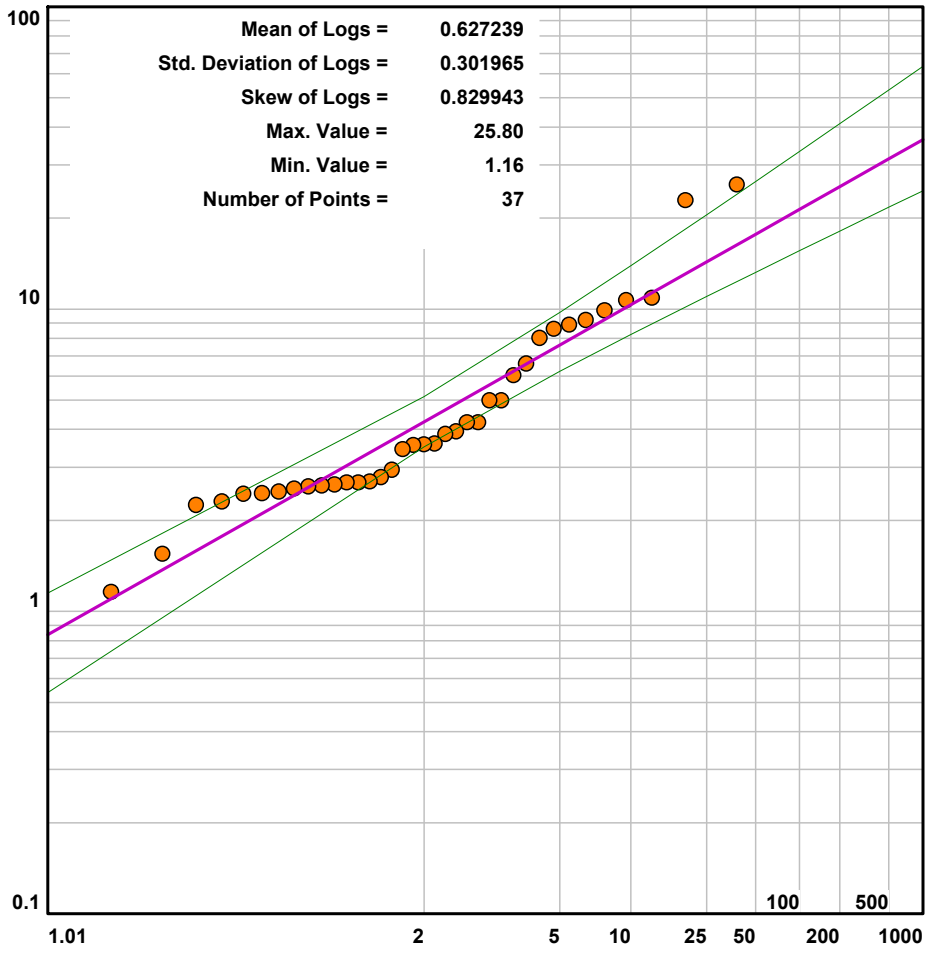
CONCLUDE: Based on Chi-Square (Goodness-of-Fit) results,
the LOG-PEARSON TYPE III DISTRIBUTION does NOT apply to the input data.
Note that Chi-Square results are dependent upon the number of class intervals used.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

LOG-NORMAL DISTRIBUTION

PEAK DISCHARGE (cms)

Tr (yrs)	Q cms
1.01	0.84
2	4.24
5	7.61
10	10.33
25	14.32
50	17.68
100	21.37
200	25.42
500	31.37
1000	36.35



FAILED
Chi-Square Test

PotHole Creek Peak Yealry DIscharge 1972-2008

RETURN PERIOD (yrs)

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean of Logs =	0.627239	Maximum Input Value =	25.80
Std. Deviation of Logs =	0.301965	Minimum Input Value =	1.16
Skew of Logs =	0.829943	Number of Points =	37

LOG-NORMAL DISTRIBUTION

RETURN PERIOD (yrs)	Q (cms)	FREQUENCY FACTOR	Q 90% CONFIDENCE LIMITS Lower (cms)	Upper (cms)
1.01	0.84	-2.3305	0.54	1.15
2	4.24	0.0000	3.50	5.13
5	7.61	0.8415	6.22	9.75
10	10.33	1.2817	8.23	13.91
25	14.32	1.7511	11.00	20.50
50	17.68	2.0542	13.23	26.42
100	21.37	2.3268	15.60	33.23
200	25.42	2.5762	18.12	41.02
500	31.37	2.8785	21.70	53.00
1,000	36.35	3.0905	24.62	63.46

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean of Logs =	0.627239	Maximum Input Value =	25.80
Std. Deviation of Logs =	0.301965	Minimum Input Value =	1.16
Skew of Logs =	0.829943	Number of Points =	37

LOG-NORMAL DISTRIBUTION
CHI-SQUARE TEST FOR GOODNESS-OF-FIT

	CLASS LIMITS		NUMBER OF VALUES		
CLASS	Lower (cms)	Upper (cms)	Expected "Ei"	Observed "Oi"	$\frac{(Oi-Ei)^2}{Ei}$
1	0.00	1.62	3.0833	2	0.3806
2	1.62	2.16	3.0833	0	3.0833
3	2.16	2.65	3.0833	9	11.3536
4	2.65	3.14	3.0833	5	1.1914
5	3.14	3.66	3.0833	4	0.2725
6	3.66	4.24	3.0833	4	0.2725
7	4.24	4.91	3.0833	0	3.0833
8	4.91	5.72	3.0833	2	0.3806
9	5.72	6.77	3.0833	2	0.3806
10	6.77	8.31	3.0833	1	1.4077
11	8.31	11.09	3.0833	6	2.7590
12	11.09	Infinity	3.0833	2	0.3806
				COMPUTED CHI-SQUARE =	24.9460
				CHI-SQUARE FROM TABLE =	14.7000

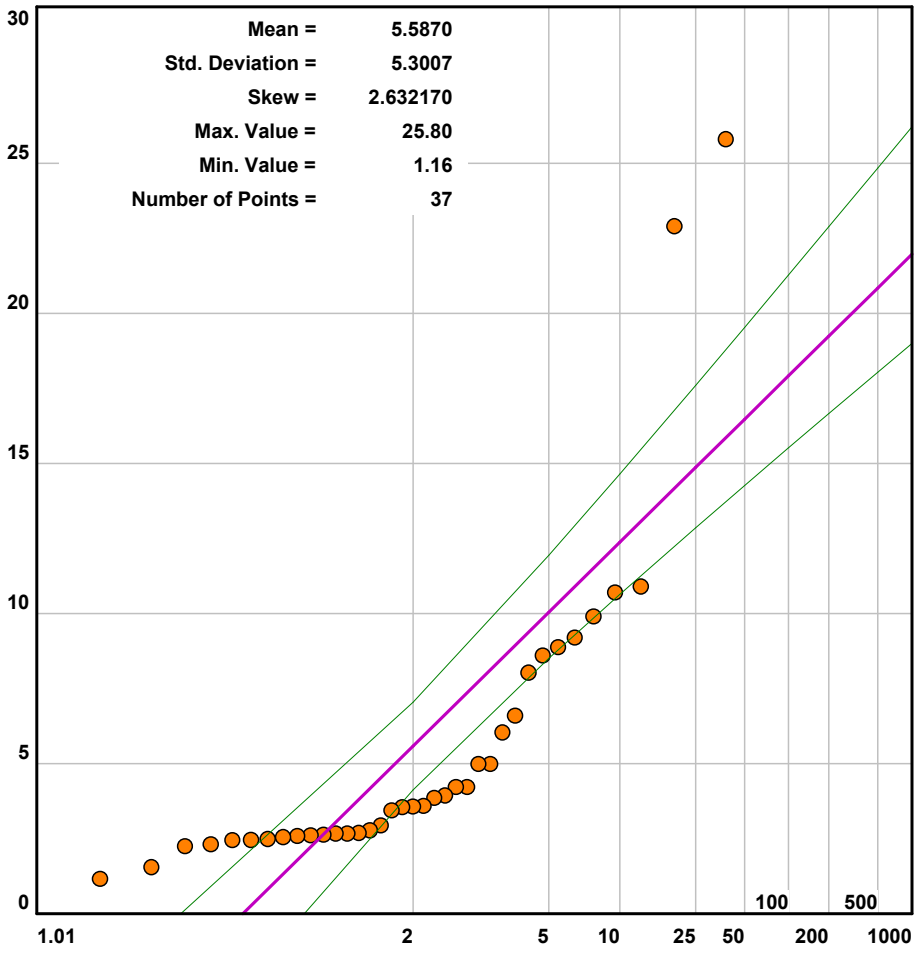
CONCLUDE: Based on Chi-Square (Goodness-of-Fit) results,
the LOG-NORMAL DISTRIBUTION does NOT apply to the input data.
Note that Chi-Square results are dependent upon the number of class intervals used.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

NORMAL DISTRIBUTION

PEAK DISCHARGE (cms)

Tr (yrs)	Q cms
1.01	-6.77
2	5.59
5	10.05
10	12.38
25	14.87
50	16.48
100	17.92
200	19.24
500	20.85
1000	21.97



FAILED
Chi-Square Test

PotHole Creek Peak Yealry DIscharge 1972-2008

RETURN PERIOD (yrs)

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean =	5.5870	Maximum Input Value =	25.80
Std. Deviation =	5.3007	Minimum Input Value =	1.16
Skew =	2.63217000	Number of Points =	37

NORMAL DISTRIBUTION

RETURN PERIOD (yrs)	Q (cms)	FREQUENCY FACTOR	Q 90% CONFIDENCE LIMITS Lower (cms)	Upper (cms)
1.01	-6.77	-2.3305	-10.13	-4.36
2	5.59	0.0000	4.13	7.05
5	10.05	0.8415	8.51	11.94
10	12.38	1.2817	10.64	14.65
25	14.87	1.7511	12.86	17.60
50	16.48	2.0542	14.27	19.54
100	17.92	2.3268	15.52	21.28
200	19.24	2.5762	16.66	22.89
500	20.85	2.8785	18.04	24.84
1,000	21.97	3.0905	19.00	26.22

NOTE: Negative values are shown for verification purposes only. Obviously, negative values will not occur. Frequently the lower return periods will have negative values resulting from the statistical fit.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean =	5.5870	Maximum Input Value =	25.80
Std. Deviation =	5.3007	Minimum Input Value =	1.16
Skew =	2.63217000	Number of Points =	37

NORMAL DISTRIBUTION
CHI-SQUARE TEST FOR GOODNESS-OF-FIT

	CLASS LIMITS		NUMBER OF VALUES		
CLASS	Lower (cms)	Upper (cms)	Expected "Ei"	Observed "Oi"	$\frac{(Oi-Ei)^2}{Ei}$
1	0.00	-1.75	3.0833	0	3.0833
2	-1.75	0.46	3.0833	0	3.0833
3	0.46	2.01	3.0833	2	0.3806
4	2.01	3.31	3.0833	14	38.6509
5	3.31	4.47	3.0833	8	7.8401
6	4.47	5.59	3.0833	2	0.3806
7	5.59	6.70	3.0833	2	0.3806
8	6.70	7.87	3.0833	0	3.0833
9	7.87	9.16	3.0833	3	0.0023
10	9.16	10.71	3.0833	3	0.0023
11	10.71	12.92	3.0833	1	1.4077
12	12.92	Infinity	3.0833	2	0.3806
				COMPUTED CHI-SQUARE =	58.6757
				CHI-SQUARE FROM TABLE =	14.7000

CONCLUDE: Based on Chi-Square (Goodness-of-Fit) results,
the NORMAL DISTRIBUTION does NOT apply to the input data.
Note that Chi-Square results are dependent upon the number of class intervals used.

Project: PotHole Creek Peak Yealry DIscharge 1972-2008
User: ISL
Date: 9 February 2009, Monday
Time: 1:18 pm
Input: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19
Output: N:\12000\12674 - LETHBRIDGE HOLIDAY INN\01_DESIGN\01C_MUNI\WATER SURVEY OF CANADA\POTHOLE CREEK HYDRO STAT 19

Mean =	5.5870	Maximum Input Value =	25.80
Std. Deviation =	5.3007	Minimum Input Value =	1.16
Skew =	2.63217000	Number of Points =	37
Mean of Logs =	0.627239	Generalized Map Skew =	0.6
Std. Deviation of Logs =	0.301965		
Skew of Logs =	0.829943		
Adjusted Skew =	0.735380		

COMPARISON OF STATISTICAL DISTRIBUTIONS

Number of Chi-Square class intervals used = 12

DISTRIBUTION	CHI-SQUARE COMPUTED	CHI-SQUARE TABULATED	
EXTREME VALUE TYPE I (GUMBEL)	40.514	14.700	FAILED
LOG-PEARSON TYPE III	23.649	13.400	FAILED
LOG-NORMAL	24.946	14.700	FAILED
NORMAL	58.676	14.700	FAILED

BASED ON A 10-PERCENT SIGNIFICANCE LEVEL, THE
LOG-NORMAL
DISTRIBUTION RESULTS IN THE BEST FIT OF THE DATA.
HOWEVER, NOTE THAT ALL DISTRIBUTIONS FAILED THE CHI-SQUARE GOODNESS-OF-FIT TEST.

Appendix D

Travers Ridge RV Park Area Structure Plan

AQUA PROPERTIES LTD.

TRAVERS RIDGE RV PARK
Area Structure Plan

VULCAN COUNTY

VULCAN, ALBERTA

BYLAW 2014-002

APPROVED APRIL 2, 2014

AQUA PROPERTIES LTD.

TRAVERS RIDGE RV PARK
AREA STRUCTURE PLAN

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1.	Introduction	Page 1
2.	The Plan Area	Page 4
3.	Plan Objectives	Page 6
4.	Plan Policies	Page 9
5.	Implementation	Page 16
6.	Figures	Page 17

AQUA PROPERTIES LTD.

TRAVERS RIDGE RV PARK
AREA STRUCTURE PLAN

LIST OF FIGURES

Figure 1	Regional Area Map
Figure 2	Rural Recreational – Land Use District Map
Figure 3	Preliminary Lotting Plan
Figure 4	Pre-development Land Drainage
Figure 5	Post-development Land Drainage
Figure 6	Sewage Piping Detail
Figure 7	Concept Plan

AQUA PROPERTIES LTD.

TRAVERS RIDGE RV PARK
AREA STRUCTURE PLAN

1.0 Introduction

1.1 Background

The Travers Ridge RV Park Area Structure Plan has been prepared pursuant to Section 633 (1) of the Municipal Government Act and is in accordance with the requirements of the "Guidelines for the Preparation of an Area Structure Plan" as adopted by an official bylaw of Vulcan County.

The Plan is intended to act as a guide to subdivision and development within the Plan area, which was prepared by Aqua Properties Ltd. to reflect what it considers the best use for the land under consideration as a seasonal and/or full-time recreational based development.

1.2 Interpretation

a) "Council" means the Council of Vulcan County.
b) "Plan" means the Travers Ridge RV Park Area Structure Plan, as amended from time to time.
c) "Plan Area" means the land included in the Travers Ridge RV Park Area Structure Plan.
d) "Subdivision Approving Authority" means the Council of Vulcan County.
e) "Municipal Reserve" (MR) means land dedicated to Vulcan County pursuant to the Municipal Government Act, Section 666(1).
f) "Applicant" means Aqua Properties Ltd.
g) "Landowner" means Robert (Bob) and Margaret (Maggie) Rettie with respect to LSD 12 and LSD 13, NW 2, Twn. 15, Rg. 22 W4.

h) "RV Development" means Recreational Vehicle bare land condominium development.

1.3 Legislative Framework

1.3.1 The Municipal Government Act

The Municipal Government Act as amended to this date sets out the requirements for an Area Structure Plan in Section 633 (2) and in the corresponding subdivision and Development Regulation being Alberta Reg. 43/2002, Section 14(e) as follows:

"An Area Structure Plan

a) must describe:

i) the sequence of development proposed for the area;
ii) the land uses proposed for the area, either generally or with respect to specific parts of the area;
iii) the density of population proposed for the area either generally or with respect to specific parts of the area; and
iv) the general location of major transportation routes and public utilities.

And

b) may contain any other matter the Council considers necessary".

1.3.2 The Municipal Development Plan

The Municipal Development Plan, adopted by Council Bylaw 2012-003, is a statutory planning document affecting land use within the Vulcan County.

Specific policies designed to achieve the objectives contained in the Municipal Development Plan are as outlined in this Area Structure Plan and the Land Use Bylaw.

2.0 The Plan Area

2.1 Regional Location

The Plan Area is located entirely within the Vulcan County, approximately twenty (20) km southeast of Vulcan (adjacent to west boundary of Little Bow Provincial Park). See Regional Area Map, Figure 1.

2.2 Definition of the Plan Area

2.2.1 Boundary of the Plan Area consists of two parcels – NW Section 2, Township 15, Range 22, W4, comprised of 20.65 hectares; and SW Section 11, Township 15, Range 22, W4, comprised of 5.8 hectares, for a total Plan Area of 28.07 hectares.

2.2.2 Figure 2, Land Use District Map, indicates that the proposed lands are situated within Rural Recreational lands.

2.3 General Physical Description

2.3.1 Topography and Drainage

The majority of the Plan Area (approximately 75%) is situated on the land that is gently sloping to Travers Reservoir. The south boundary is a steep slope to the reservoir lands. There is a winding pathway down to the Reservoir edge. Refer to Figure 5 for Pre-development Drainage and Figure 5 for Post-development Drainage.

The total change in elevation of the Plan Area is approximately ten (10) meters from north to the south. The land continues to slope downward a further twenty-five (25) meters towards the Travers Reservoir.

2.3.2 Natural Areas

The majority of the land was seeded to grass seven years ago by the previous owner. The south end of the land has two coulees sloping towards the reservoir which consists of natural grasses. The east boundary of the property consists of natural grass which slopes towards Little Bow Provincial Park. The land bordering the west consists of a coulee that slopes towards the Travers Reservoir. The access road to Little Bow Provincial Park borders onto the north end of the property.

2.3.3 Existing Development

There is no development on the property.

2.3.4 Livestock/Farming Operations

There currently is no grain farming or livestock grazing occurring on either of the parcels. There are no confined livestock feeding operations within the vicinity of the property.

3.0 Plan Objectives

3.1 Goals and Objectives of the Plan

3.1.1 To create a RV Park bare land condominium development, achieving the highest design, aesthetic and environmental standards in conformance with the existing provincial, regional and municipal policy documents.

3.1.2 To act as a guide under which Vulcan County can review and evaluate specific development proposals.

3.1.3 To provide a framework for subsequent subdivision and development proposals in the County.

3.1.4 To establish policies which will direct proposed land use, open space, population density, location of transportation routes, location and methods of utility servicing, phasing of development and other such matters as Council deems necessary.

3.2 Principals of Development

The major objectives of this development are as follows:

3.2.1 To ensure all development is in accordance with the current statutory policy and municipal standards.

3.2.2 To provide for land uses that respect the character of the landscape and which reflect the rural surroundings.

3.2.3 To provide high quality design and development standards for all proposed development, including architectural controls and restrictive covenants.

3.2.4 To provide Municipal Reserve parcels that serve the needs of the neighbourhood and that take advantage of the natural features of the area. There is also the possibility of dedicating money in lieu of land for the Municipal Reserve.

3.2.5 To ensure accessible green spaces to the Travers Ridge RV Park Condominium Association members that respect the quality of the landscape.

3.2.6 To develop safe and efficient road and utility systems that respects the natural qualities of the landscape.

3.2.7 To encourage safe and efficient movement of traffic within and adjacent to the proposed development by adhering to the long-term goals of Alberta Transportation and Utilities.

3.2.8 To ensure that all development is controlled by fair and equitable policies which respect the character of the neighbouring developments.

3.2.9 To respect the area's natural resources and to actively mitigate against their destruction or overuse.

3.2.10 To improve upon and preserve the aesthetic qualities of the area.

4.0 Specifics of Development

4.1 Only one RV unit will be permitted per lot, which must be RV or park models only.

4.2 No residences or permanent dwellings will be permitted, except for one (1) manager's or caretaker's security residence.

4.3 Development will be seasonal only (May to October).

4.4 Architectural controls passed at subdivision state will determine:

- Setbacks (below)
- order of development, i.e. sheds prior to buildings
- permitted and discretionary uses

4.5 The setbacks for Recreational Vehicles/Park Models, the Manager's/Caretaker's Security Residence, or accessory buildings will be a minimum of 7.6 metres from the front and back property line setbacks and 1.5 metres from side property lines.

4.6 Lots will be individually titled.

4.7 There will be a maintenance/storage area on the north end of the property.

4.8 There will be a permanent dwelling for a on-site manager during the season.

4.9 There will be no public access to the dock area (it will be gated at the main access with lot owners being supplied a security fob for entrance).

4.10 Future plans may include the potential development of a club house and outdoor pool.

4.10 Future plans may include the potential development of a club house and outdoor pool.

5.0 Plan Policies

5.1 The Plan

This section discusses the implementation of the Area Structure Plan objectives and principals of development identified in Section 3.0 as they specifically apply to Travers Ridge.

Goal:

5.1.1 To comprehensively plan an RV Park that reflects the highest standards of design, aesthetic and environmental standards in conformance with the existing provincial, regional and municipal policy documents.

The Travers Ridge RV Park Concept Plan (Figure 7) provides the Vulcan County with a planned development consisting of one hundred and six (106) new RV lots and open space land uses that respect the character of the surrounding landscape and complement neighbouring residential acreages and developments. The Plan Area will be developed in three (3) Phases (see Figure 3):

Phase I – 42 lots
Phase II – 43 lots
Phase III – 21 lots

5.2 RV Park Bare Land Condominium Land Use Component

Principle:

To provide for RV Park and recreational uses in a manner that is sensitive to the character of the landscape and the needs of the greater community.

Policies:

5.2.1 All RV Park development shall conform to the provisions of the Municipal Development Plan, the Travers Ridge RV Park Area Structure Plan and its architectural controls.

5.2.2 All RV Park development shall be in conformity with the provisions of the Municipal Government Act, the Subdivision and Development regulations.

5.2.3 The one hundred and six (106) RV Park lots within the Plan Area shall range in size from 483.1 m2 to 1348.3 m2, more or less.

5.2.4 The design of the Plan Area takes into account all adjacent land uses to the extent possible at the time of application and will not negatively impact on any approved adjacent land uses.

5.2.5 The internal subdivision road will be a twenty (20) meter road right-of-way, with eight (8) meter top surface of gravel, and sealed.

5.2.6 A Travers Ridge RV Park Condominium Association will be assembled, comprised of homeowners from the development.

5.2.7 The ownership, operation and maintenance of all infrastructure will eventually be taken over by the Travers Ridge RV Park Condominium Association.

5.2.8 Each member of the Travers Ridge RV Park Condominium Association will be charged an annual levy to cover the costs incurred in servicing and maintaining the entire development.

5.3 Reserves

Approximately six (6) hectares of land will be dedicated as green space with walkway to Reservoir lands, which will be available for joint use of all Travers Ridge RV Park Condominium Association members.

Principle:

To ensure that the recreational land needs of the Travers Ridge RV Park Condominium Association members are met through the provision of accessible green space areas. There will be access across the Reservoir lands to Travers Reservoir, to allow swimming and boating.

Policies Regarding Reserves:

5.3.0 Capacity does not exist with the area to accommodate the provision for a school.

5.3.1 Green spaces comprised of a total of six (6) hectares of land, will be located north of the lots and also on the southern fringe of the development.

a) Walkways will be built for access of Travers Ridge RV Park Condominium Association members to the central green space.

b) A walkway to access the Reservoir will be constructed for use by Travers Ridge RV Park Condominium Association members.

5.4 Transportation

Principle:

To develop an efficient and safe internal roadway in accordance with the standards of Vulcan County.

Policies Regarding Transportation:

5.4.0 Long-term access to the Plan Area shall be from a service road:

a) An internal roadway will be accessed from the existing County road to Little Bow Provincial Park road, which is paved.

5.4.1 Approvals from Alberta Transportation – This is a County road, which will require County approval.

5.4.2 Access to all RV Park lots shall be from the internal road only.

5.5 Phasing

Development will be completed in three phases, with Phase I comprised of forty-two (42) lots, Phase II comprised of forty-three (43) lots, and Phase III comprised of twenty-one (21) lots.

Principle:

To phase development in an efficient manner based upon market conditions.

Policies:

5.5.0 Phase I – forty-two (42) lots, ranging in size from 483.1 m2 to 1348.3 m2

5.5.1 Phase II – forty-three (43) lots, ranging in size from 483.1 m2 to 1348.3 m2

5.5.2 Phase III - twenty-one (21) lots, ranging in size from 483.1 m2 to 1348.3 m2.

5.6 Utility Servicing

Principle:

To provide a high level of services which will not detrimentally affect adjacent communities.

The Plan Area will have high-quality development standards in all areas including water and sewage systems, roadways, landscaping and architectural guidelines/restrictive covenants, aimed at creating a quality residential development. All utilities and services will be developed in keeping with municipal and provincial standards, as follows:

Policies:

5.6.0 Water Supply, Storage and Distribution

5.6.0.1 Travers Ridge will be serviced by a community water system comprised of 4 drilled wells.

5.6.0.2 The water will be treated on-site according to Alberta Environmental standards.

5.6.0.3 Land comprised of .2 hectares will house the communal water plant has been provided in the Area Structure Plan.

This utility land will be owned by Aqua Properties Ltd. and an agreement will be entered into with Travers Ridge RV Park Condominium Association members with respect to the maintenance and operation of the water facility.

5.6.0.4 The communal water plant will be operated and maintained by the developer initially. The ownership, operation and maintenance will eventually be taken over by the Travers Ridge RV Park Condominium Association.

5.6.0.5 All capital costs associated with facilities to service new lots will be the responsibility of the Developer.

5.7 Sanitary System

5.7.0.1 Travers Ridge will be serviced by a low pressure communal sewage system which will be provided to all lots (see Figure 6).

5.7.0.2 Grinder pumps will be the means of delivering the semi-treated sewage from each RV unit, Park Model trailer and Manager's/Caretaker's residence and will be included in the cost of each lot. The sanitary system will meet with the approval of the Alberta Labour, Plumbing and Inspection Branch and will also meet any requirements of Alberta Environment, Alberta Municipal Affairs, the Safety Codes Act and Vulcan County.

5.7.0.3 Sewage will be collected through a low pressure sewage system designed by E1 Company, and transferred to a lagoon located on six (6) hectares, on the northwest corner of the property (see Figure 6).

5.7.0.4 Sewage will be treated by a standard lagoon(see Figure 6).

5.7.0.5 All capital costs associated with the provision of sanitary system facilities will be the responsibility of the homeowner and ownership of the sewage lagoon and collection piping will be by the Travers Ridge RV Park Condominium Association.

5.8 Storm Drainage System

5.8.1 A system of surface drainage integrated with the road system shall form the basis for run-off control within the development area. The open space overland flows will be directed to natural

discharge water features within the site and ultimately to the natural drainage areas adjoining the property. The routes, discharges rates and flow will not be altered by new construction other than the access road which will direct water towards existing drainage channels. Cross-flows will be contained within culverts as necessary to ensure positive drainage (see Figure 5). If necessary, retention ponds will be included in the design when detailed engineering is completed.

5.8.2 A Master Drainage Plan completed by a professional engineer will be provided as part of any subdivision application.

5.8.3 Approval has not yet been granted from Alberta Environment for the Drainage Plan, however, this approval is currently in progress.

5.9 Shallow Utilities

5.9.0.1 Installation of overhead and underground power services shall be completed to all new lots at the developer's expense and shall be in accordance with the franchised utility company design and installation standards.

5.10 Miscellaneous

5.10.0.1 During the construction of any buildings, a container for the collection of construction waste shall be maintained on the site under construction. This clause will be included as a restrictive covenant on all property titles.

5.10.0.2 Timely garbage pick-up and disposal from the development to an approved disposal site shall be the responsibility of each individual lot owner.

5.10.0.3 Utility rights-of-way shall be provided in accordance with provincial and municipal regulations.

5.11 Protective Services

5.11.1 Police Service

Police service to the Plan Area is provided for by the RCMP detachment at Vulcan.

5.11.2 Fire Service

Fire Department assessments are part of the Vulcan County's tax base of existing residences in this area.

5.11.3 Ambulance and Hospital

The hospital and ambulance services to this area are located in the town of Vulcan.

6.0 Implementation

6.1 Community Contact to Date

The plans and information contained in this document are currently being discussed on an ongoing basis with all neighbouring property owners within a one-half (0.5) mile radius of the Plan Area.

Figure 1

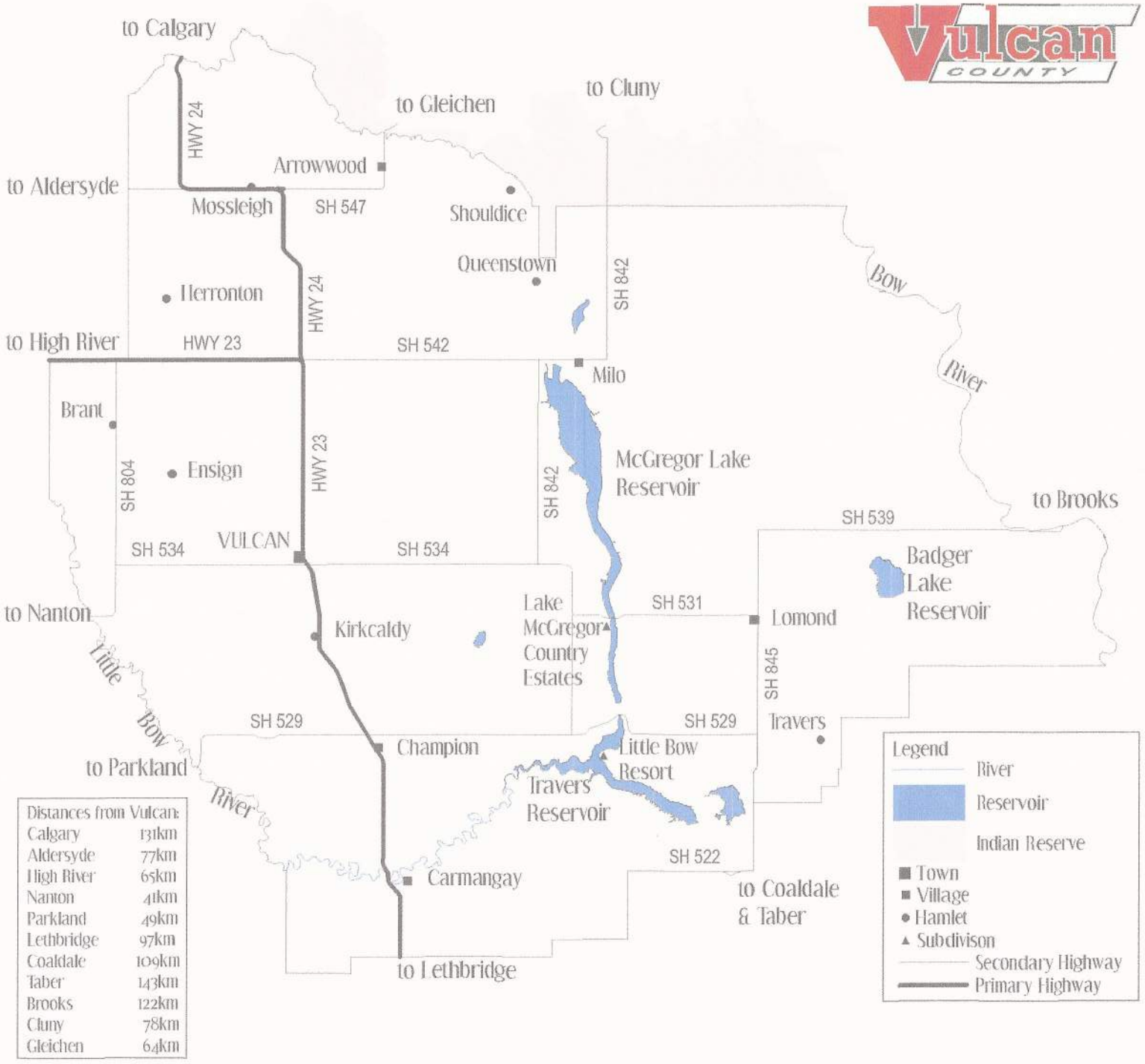
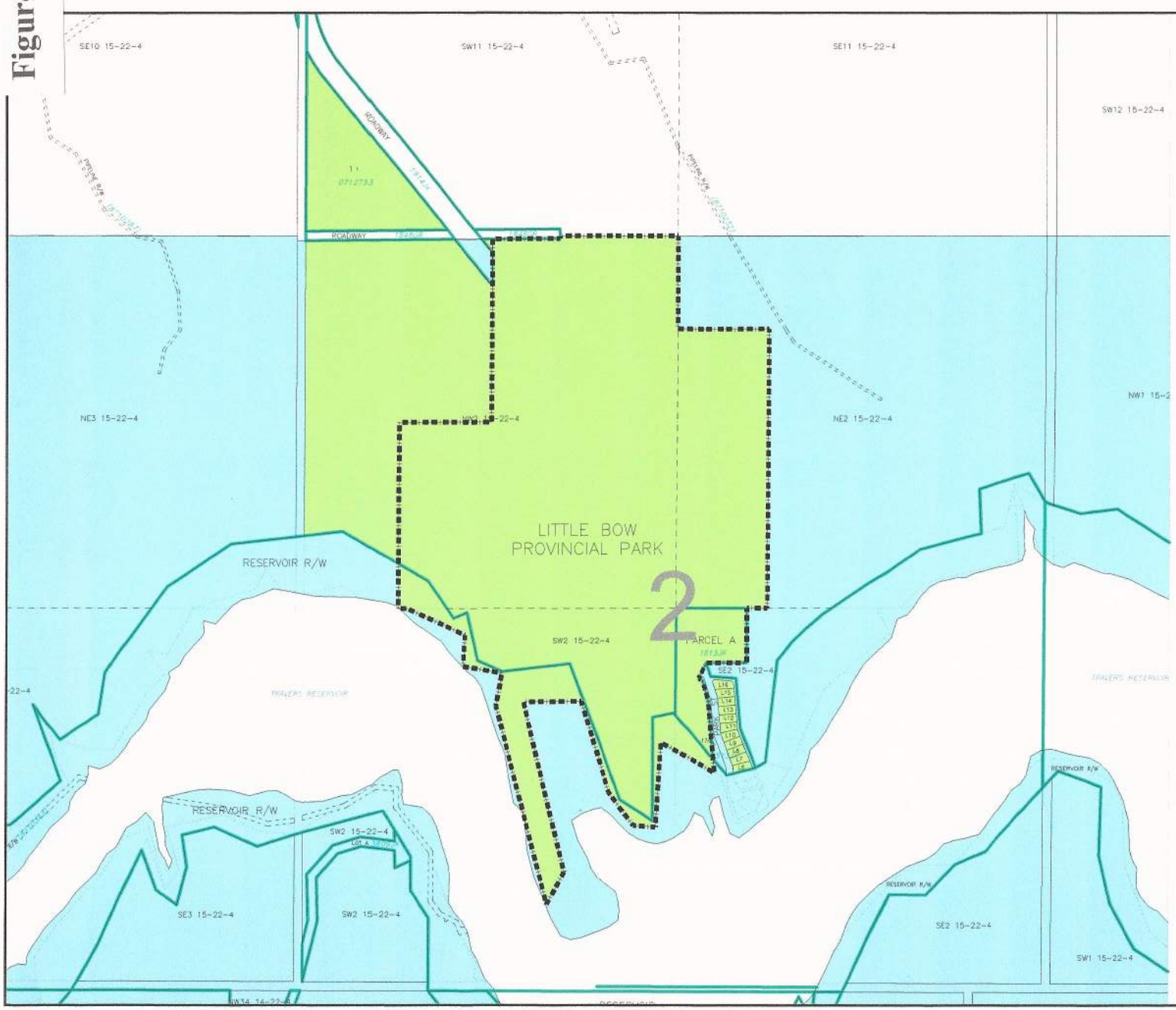

to Calgary
to Gleichen
to Cluny
HWY 24
Arrowwood
to Aldersyde
Mossleigh
SH 547
Shouldice
Queenstown
SH 842
Herronton
HWY 24
Bow
River
to High River
HWY 23
SH 542
Milo
Brant
SH 804
Ensign
HWY 23
McGregor Lake
Reservoir
SH 842
to Brooks
SH 539
SH 534
VULCAN
SH 534
Badger
Lake
Reservoir
to Nanton
Kirkcaldy
Lake
McGregor
Country
Estates
SH 531
Lomond
SH 845
Little
Bow
River
SH 529
SH 529
Travers
Champion
Little Bow
Resort
to Parkland
Travers
Reservoir
Carmangay
SH 522
to Coaldale
& Taber
to Lethbridge
Distances from Vulcan:
Calgary 131km
Aldersyde 77km
High River 65km
Nanton 41km
Parkland 49km
Lethbridge 97km
Coaldale 109km
Taber 143km
Brooks 122km
Cluny 78km
Gleichen 64km
Legend
River
Reservoir
Indian Reserve
Town
Village
Hamlet
Subdivison
Secondary Highway
Primary Highway

Figure 2



VULCAN COUNTY

LITTLE BOW
PROVINCIAL PARK
PORTION OF SEC 2
ALL IN 16-22-4

LAND USE DISTRICT MAP

Bylaw No: 2010-010 Date: July 21, 2010

LAND USE DISTRICTS

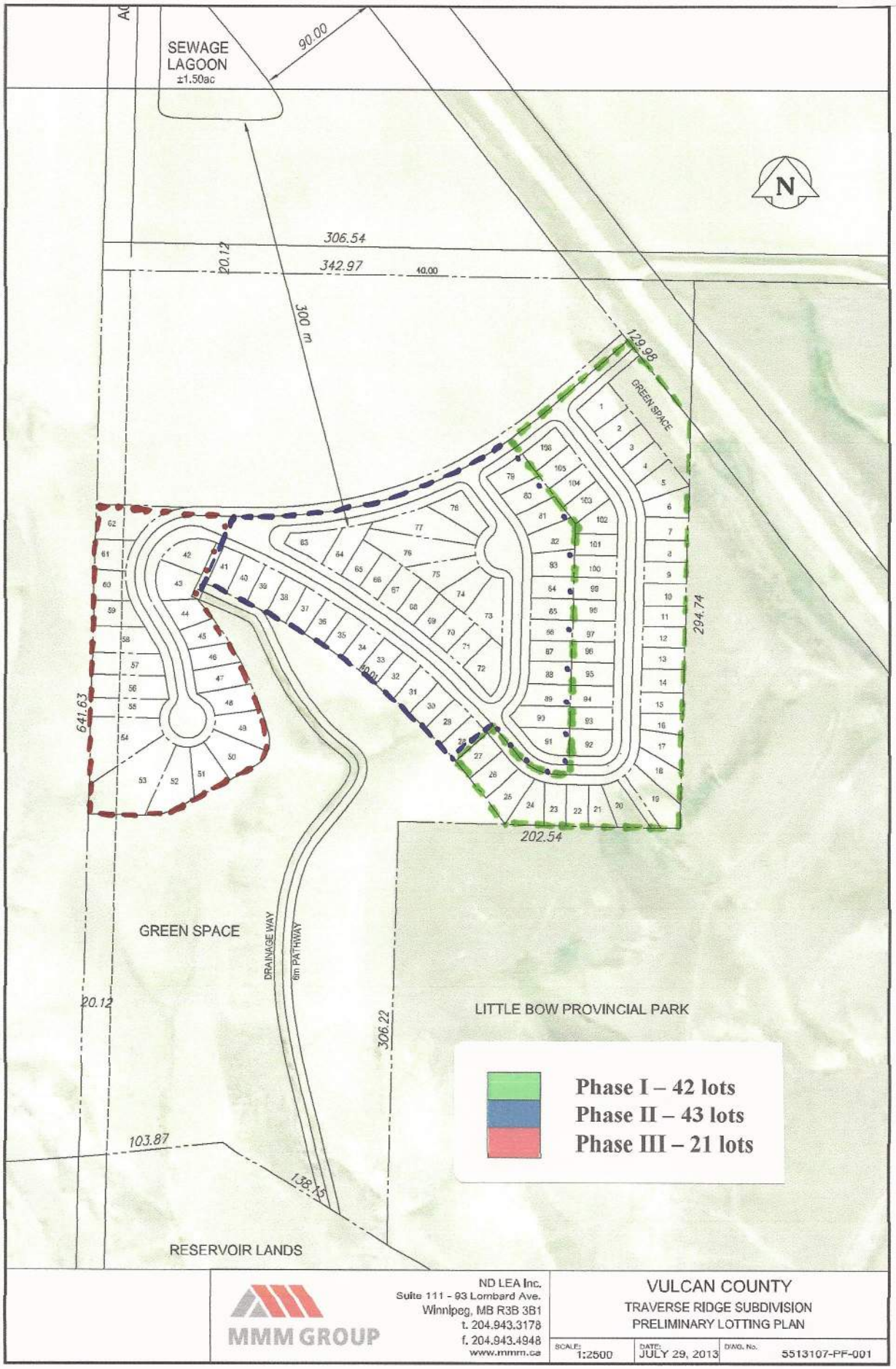
Rural General	RG
Small Holdings	SH
Single Lot Country Residential	SCR
Grouped Country Residential	GCR
Urban Fringe	UF
Hamlet Residential	HR
Hamlet Commercial	HC
Rural Industrial	RI
Rural Commercial	RC
Reservoir Vicinity	RV
Rural Recreational	RR
Public Service	PS
Direct Control	DC

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 22, 2010 N:\Vulcan-County\Vulcan-County-LUD\
Vulcan County Consolidated LUD Maps(Bylaw 2010-010).dwg

Map 16

Figure 3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129.98
GREEN SPACE
294.74
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GREEN SPACE
DRAINAGE WAY
6m PATHWAY
20.12
306.22
LITTLE BOW PROVINCIAL PARK
103.87
138.15
RESERVOIR LANDS
Phase I – 42 lots
Phase II – 43 lots
Phase III – 21 lots
MMM GROUP
ND LEA Inc.
Suite 111 - 93 Lombard Ave.
Winnipeg, MB R3B 3B1
t. 204.943.3178
f. 204.943.4948
www.mmm.ca
VULCAN COUNTY
TRAVERSE RIDGE SUBDIVISION
PRELIMINARY LOTTING PLAN
SCALE: 1:2500
DATE: JULY 29, 2013
DWG. No. 5513107-PF-001
Aug 29, 2013 - 2:06pm
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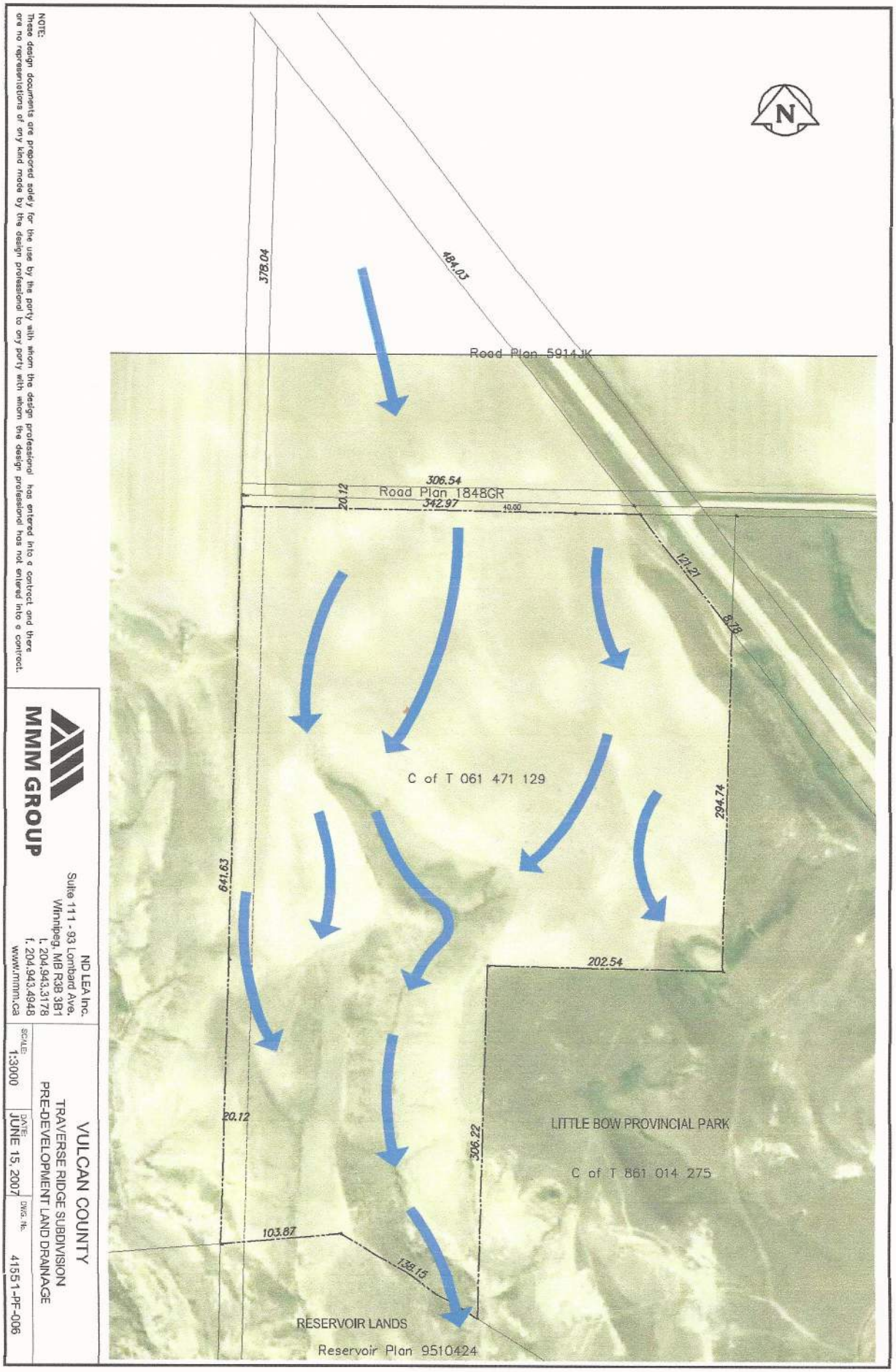
Figure 4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NOTE:
These design documents are prepared solely for the use by the party with whom the design professional has entered into a contract and there are no representations of any kind made by the design professional to any party with whom the design professional has not entered into a contract.
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Road Plan 1848GR
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RESERVOIR LANDS
Reservoir Plan 9510424
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VULCAN COUNTY
TRAVERSE RIDGE SUBDIVISION
PRE-DEVELOPMENT LAND DRAINAGE
SCALE: 1:3000
DATE: JUNE 15, 2007
DWG. No.: 41551-PF-006

Figure 5

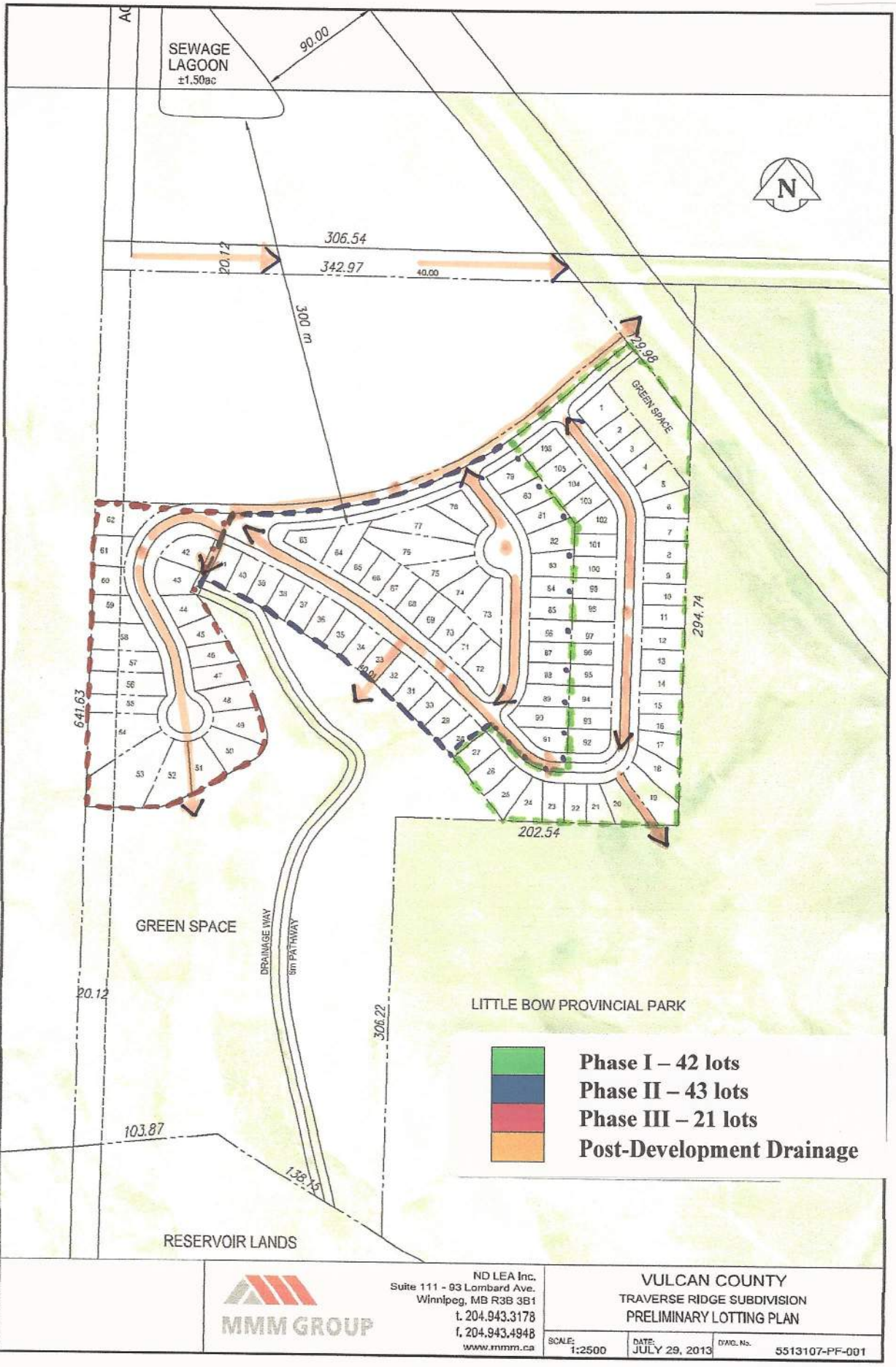
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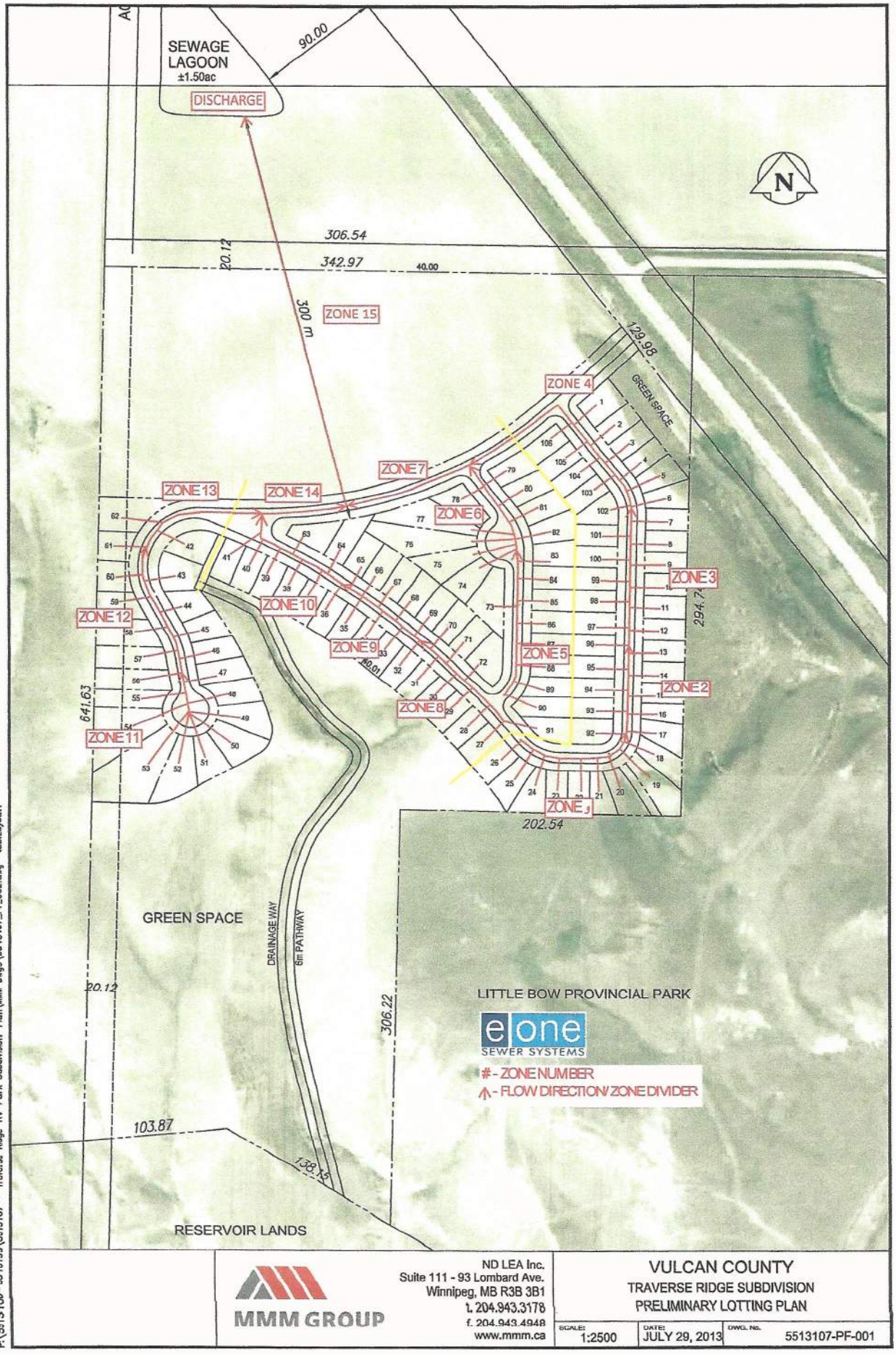
Figure 6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GREEN SPACE
DRAINAGE WAY
6m PATHWAY
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306.22
LITTLE BOW PROVINCIAL PARK
103.87
138.15
RESERVOIR LANDS
N
#- ZONE NUMBER
- FLOW DIRECTION/ ZONE DIVIDER
MMM GROUP
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DATE: JULY 29, 2013
DWG. No. 5513107-PF-001
Aug 29, 2013 - 2:06pm
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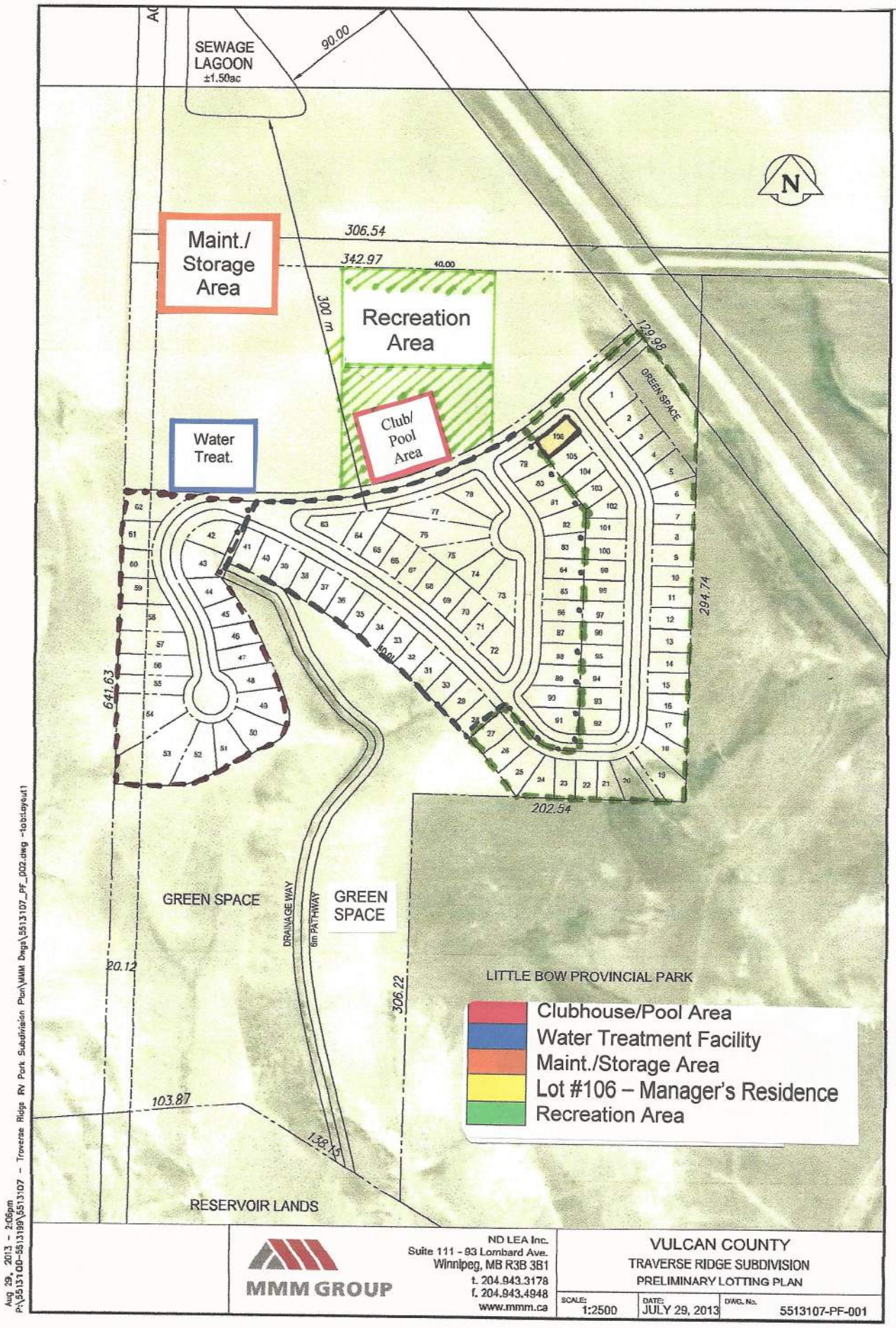
Figure 7


SEWAGE LAGOON ±1.50ac
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Maint./ Storage Area
306.54
342.97
40.00
300 m
Recreation Area
Club/ Pool Area
Water Treat.
129.98
GREEN SPACE
294.74
641.63
202.54
GREEN SPACE
DRAINAGE WAY
6m PATHWAY
GREEN SPACE
20.12
306.22
LITTLE BOW PROVINCIAL PARK
103.87
138.15
RESERVOIR LANDS
Clubhouse/Pool Area
Water Treatment Facility
Maint./Storage Area
Lot #106 – Manager's Residence
Recreation Area
MMM GROUP
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Suite 111 - 93 Lombard Ave.
Winnipeg, MB R3B 3B1
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f. 204.943.4948
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DATE: JULY 29, 2013
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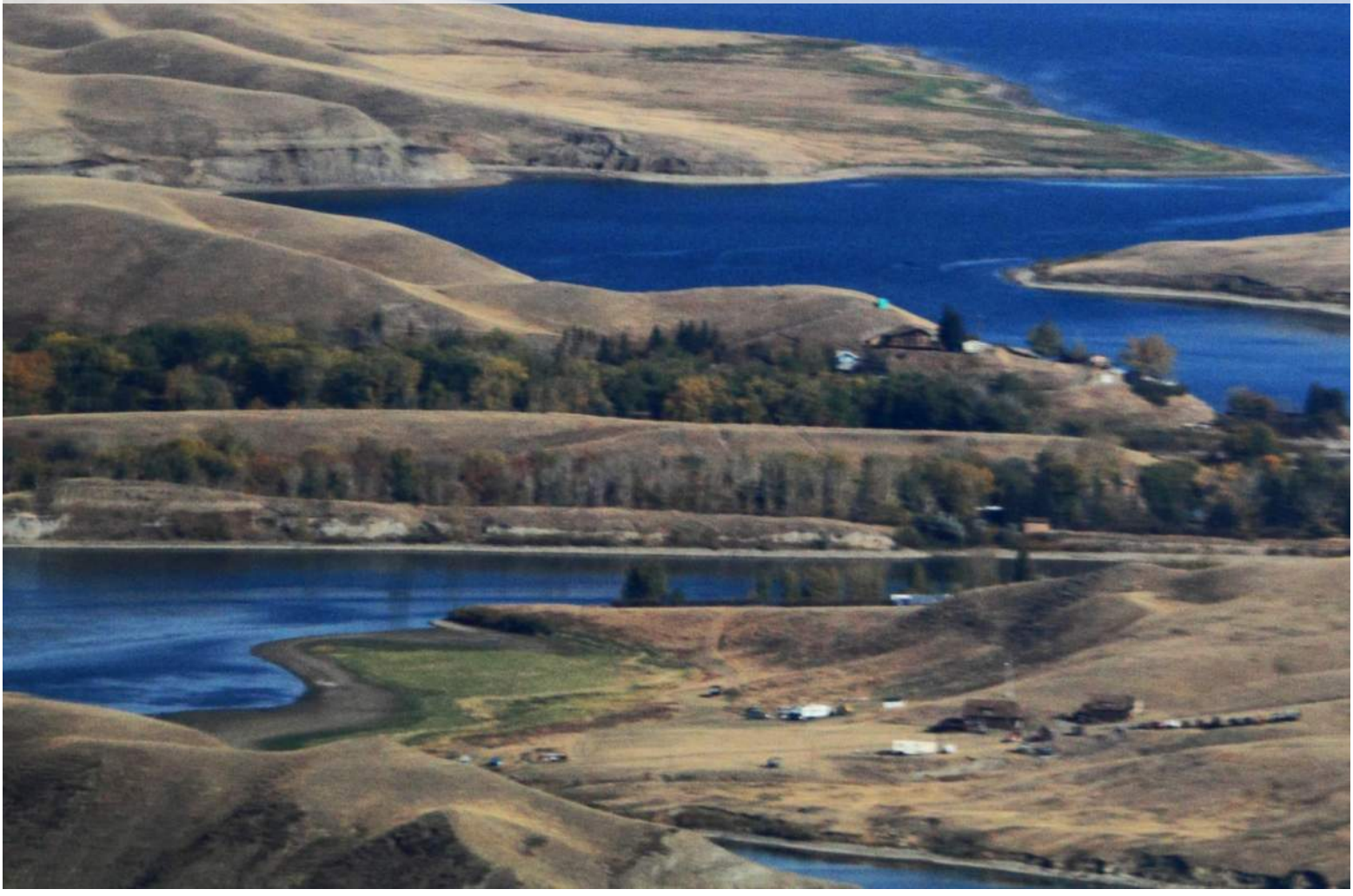
Appendix E

Crystal Blue Subdivision Application



AREA STRUCTURE PLAN FOR SUBDIVISION

CRYSTAL BLUE HARBOUR

PORTION OF NW ¼ 26-18-22-4 and SW ¼ 26-18-22-4

Vulcan County

Environmental
Agricultural
Structural
Civil
Municipal

PREPARED FOR:
Crystal Blue Developments
c/o Rick Wiens
4111 MacLeod Trail South
Calgary, AB T2G 2R7

PREPARED BY:
Hasegawa Engineering
A Division of 993997 Alberta Ltd.
1220 – 31st Street North
Lethbridge, AB T1H 5J8

HASEGAWA ENGINEERING

Consulting Professional Engineers

A Division of 993997 Alberta Ltd.

Environmental
Agricultural
Structural
Civil
Municipal

1220 31st Street North, Lethbridge, AB T1H 5J8
Bus: 328-2686 Fax: 328-2728 E-mail: office@hasegawa.ca

June 9, 2009

Our File #: 06-175

Crystal Blue Developments
c/o Rick Wiens
4111 MacLeod Trail South
Calgary, AB T2G 2R7

Re: Crystal Blue Harbour Area Structure Plan

Dear Sir:

Attached please find the Area Structure Plan submitted for the proposed Crystal Blue Harbour subdivision located in Vulcan County.

Please review this document and contact our office with any questions or comments.

Yours truly,

PROFESSIONAL ENGINEER MARK HASEGAWA ALBERTA

Mark Hasegawa, P.Eng.
HASEGAWA ENGINEERING
Consulting Professional Engineers
MAH/dd

PERMIT TO PRACTICE
HASEGAWA ENGINEERING
Signature
Date 6/9/09
PERMIT NUMBER: P 8170
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Attachment

cc: Vulcan County
ORRSC

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APPENDIX A: FIGURES

APPENDIX B: SURFACE RUNOFF AND HYDROLOGICAL ANALYSIS

APPENDIX C: COPY OF LAND TITLE

APPENDIX D: WATER ACCESS AND LICENCE

1.0 INTRODUCTION

1.1 Purpose

The purpose of the Crystal Blue Harbour Area Structure Plan (ASP) is to provide a conceptual land use plan and infrastructure servicing design to support the management of urban development of approximately 220 acres of land located on the northwest corner of McGregor Lake (refer to Figure 1).

The ASP provides a policy framework to guide the development of Crystal Blue Harbour and specifically addresses the following:

- Land use by type, size and location
- Transportation network
- Conceptual underground services plan
- General location of amenities
- Other development issues specific to the area

This ASP establishes the planning context for future planning and development decisions for the outline plan, subdivision plan, construction of urban services and development permits for future individual properties.

1.2 Location and Area

The lands subject to this ASP are situated near McGregor Lake, Alberta (NW ¼ 26-18-22-4 and SW ¼ 26-18-22-4). The proposed development is rectangular in shape and is located adjacent to the lake on the east with farmland on all other sides. The property is within the jurisdiction of Vulcan County and is currently used as pasture or farmland. The developers also own the land located directly south of the property, where the sewage treatment facility is proposed to be located.

The subject land is utilized for crop growth and there are no current structures located within the ASP boundaries. There are no known environmentally sensitive areas within the proposed area for development. However, there is an environmentally protected are located between the development and proposed sewage treatment facility. The site topography is shown on Figure 2. As can be seen by this information the site drains to the Lake.

The 220 acre parcel under consideration is currently native grassland and is zoned for agricultural use. A rezoning to low density country residential land use (1/4 acre minimum) is requested as part of this application. The proposed use of this land will fall within the criteria set forth for general residential use within the County. Developable hectares are defined as the lands which can be used for urban purposes, including residential lots, parks, storm ponds, roadways, etc.

1.3 Land Ownership

Current land ownership for the ASP area is summarized in Figure 1. Crystal Blue Developments Ltd. owns all developable hectares of land within the ASP (refer to attached land title). Land ownership of adjacent properties is also identified in Figure 1.

2.0 LAND USE CONCEPT

2.1 Development Objectives

The overall goal of the Crystal Blue Harbour Area Structure Plan is to establish a framework for creating an attractive and liveable residential area. The key objectives of this ASP are:

- Provide for a unique large sized lot residential area
- Promote an environmentally friendly development
- Meet or exceed County development criteria to provide for sustainable development
- Ensure the development adds value to the overall community for improved standard of living
- Respect the long-term agricultural intentions of adjacent landowners in Vulcan County
- Comply with Travers- McGregor Area Structure Plan

2.2 Land Use Concept Overview

The general land use concept is depicted on Figures 3 (Concept Plan). Figure 3 illustrates the proposed land use within the ASP boundary. Purpose of the land use concept in Figure 3 is to show the general relationship of proposed land uses. This map is intended to guide future growth and development within the boundaries of the ASP area. Therefore the location and size of the land uses shown on Figures 3 have been designed to meet Vulcan County planning criteria. In Figure 4 a potential lot layout schematic has been presented, but this layout is tentative and could be modified during the development process.

The Crystal Blue Harbour area, when complete, will be comprised primarily of single family homes on large lots. It has been concluded that local commercial, religious assembly and school sites, for example, are not warranted in this area, and will be accessed through the Village of Milo. Ancillary residential land uses will be limited to a large park development which serves the local area and provides for public access to the lake. Where possible, storm water storage facilities may be located adjacent to park areas

and designed for passive amenity purposes. A Home Owners Association will be established to own and maintain common land and facilities.

Vehicular circulation will be achieved through a limited hierarchy of roads. Major access to the site will occur from Highway 842 (refer to Figure 3). A buffer will be provided along the highway right-of-way through the use of a boulevard. All roads within the development will be paved.

Pedestrian access points will be provided in strategic locations to permit easy access to Crystal Blue Harbour and subdivision features.

The estimated distribution of land use within the proposed ASP is shown in Table 1 below. A statistical summary of housing and population projections for the ASP area is provided in Table 2. Crystal Blue Harbour will be a low density residential area with a minimum single family lot size of 11,000 square feet. The overall gross density for Crystal Blue Harbour is projected to be 2 units per gross developable acre. The total gross developable area is approximately 220.9 acres. The projected number of dwelling units is therefore expected to be approximately 432 initially and reach 450 units once the gas well onsite is removed. Total population will likely be in the order of 1296 – 1350 people. Many of these residents are anticipated to be seasonal.

Table 1: Land Use Predictions

	Acres	Percentage
Roads & Walkways	47.3	21%
Urban reserve	33.6	15%
Storm Ponds	11.7	5%
Single Family Residential Lots	128.3	58%
Gross Developable Area	**220.9**	

Table 2: Population Projections

	Dwelling Units	Persons per Unit	Total Population
Net Developable Area +/- 128.3 Acres	432	3	1296

2.3 Historical Land Uses

The land has been traditionally used for agricultural purposes. In addition, there is a gas well located on the property. The Energy and Utilities Board (EUB) has been contacted and the well owner has been contacted. The existence of this well restricts the development of permanent residential structures within 100 m of the well.

Currently land surrounding the gas well is classified as urban reserve. Once the well is removed, the developers intend to rezone some of this land to residential usage. A potential layout of these lots is shown in Figure 5.

3.0 SERVICING

3.1 Sanitary Sewer System

Due to the nature of this development, and the size of lots, a centralized sewage treatment facility will be essential. An estimation of peak and average sewage flow was developed to ensure adequate capacity. Based on a 3.0 per capita average it is estimated that average dry flow from the proposed development will be 540,000 l/d and the peak flow will be 2.05 million l/d (dry flow; refer to Table 3). A preliminary layout of the sewer and lift station is shown in Figure 5.

As shown in the attached figures a sewage treatment lagoon has been proposed as the wastewater treatment facility for the development. Preliminary design for the lagoon has been prepared based on the sewage generation rates described below. A preliminary layout of the lagoon is attached (refer to Figure 6). The lagoon will be sized and located to meet AENV standards. Water from the lagoon will be recycled for irrigation or land application purposes. All sewage facilities will be designed to protect the water quality of the lake.

Based on current site information, it appears that a lift station will be required to service the low lying areas of the development. As depicted in this layout, sewage will be sent to the treatment lagoon via a force main. The sewage main, pump station and lagoon will be designed to adequately service the needs of the future expansion of the land directly north of the development.

Table 3: Predicted Sewage Production

	Unit dry flow	Number of Lots	Total	Total Average Dry Flow		Wet Flow	Peak Factor	Peak Flow	Total Peak Flow
	l/d/cap		capita	l/d	l/min	l/d		l/d	l/d
Crystal Blue Harbour	400	450	1350	540,000	375.0	675000	3.8	2052000.0	2727000.0

3.2 Water System

A potable water source is an essential requirement for any development. Potable water will be obtained from the Village of Milo (refer to attachment). The village has an additional capacity to handle approximately 90 acre feet of water now and water rights are being acquired to expand that capacity. A water line will be designed to convey water from the village facility to the development. If needed, resources will be applied to the village treatment system to ensure adequate supply. To allow for future water needs an

agreement to purchase 650 acre feet of water rights from the River Bend Hutterian Brethren (License numbers 08125 and 19427; refer to attachment) has been executed. The transfer process with Alberta Environment has been initiated. The additional potable water usage (90-130 Acre feet) will be transferred to the Village of Milo.

The typical urban design standard of 700 l/d/cap gross usage has been used to predict water consumption. Based on this number and a 3.0 capita per home assumption, the total estimated gross water usage will be 220 acre feet per year. This calculation does not include water for irrigating common areas.

Fire flow will also be provided through the potable water system. The potable water line from Milo will be designed to meet fire flow requirements or a storage tank will be provided. Projected fire flow storage will be 270,000 liters with a projected peak flow requirement of 35 l/sec. Fire hydrants will be designed and provided as per the Milo Fire Association requirements.

A preliminary layout of the water production, treatment and distribution system is shown in Figure 8. The water line has been looped to allow for adequate fire supply and to reduce the potential for stagnant water.

Water conservation is also an important aspect of this development. As a result the following conservation methods will be required as part of the development.

1. Landscaping of common grounds, not including playgrounds or sports fields will be vegetated with native trees, shrubs and grasses, and will not be irrigated.
2. Landscaping of yards will require the minimization of turf and maximization of native vegetation not requiring irrigation.
3. High efficiency toilets and low flow shower heads will also be required.
4. Treated waste water will be utilized to irrigate common areas
5. Storm water collection reservoirs on each lot which will be used to collect storm water and used for individual lot irrigation

3.3 Gas

The Sunshine Gas Co-op will supply natural gas to the development. The existing line is nearby and has sufficient pressure for the subdivision. The developer will bring natural gas to each property line. Where possible, geothermal will be used to augment energy requirements at the development.

3.4 Electrical Power

Fortis will provide services to the proposed subdivision and underground services to each property line. The closest three-phase service is located just east of Milo or 1.6 miles from the development.

3.5 Telephone

Telus will provide services to the lots but each individual owner must apply for the service when building.

3.6 Solid Waste

Solid waste services will be provided by the home owners association.

4.0 TRANSPORTATION

Main access to the subdivision will be through Highway 842. Two access points to the highway are proposed. All other roads will have a 20 m right of way width and will be paved.

The roads in the proposed subdivision will meet Vulcan County design criteria. The roadway will be adequate in width to accommodate local traffic parking, subsurface drainage and pedestrian traffic.

4.1 Road Network

A primary collector and secondary collector will be used to access Highway 842 (refer to Figure 4). Based on the size of this development two access points will be able to accommodate traffic flow and emergency entrance / egress. Additional access points have been provided on the north and south end of the property to allow for future development (refer to Figure 5 for a conceptual layout).

4.2 Highway 842 Interface

The main access will be a divided road with median and boulevard while the secondary access will be a standard 20 m access road. In typical urban settings one trip per household during peak hours is used to design road access. However, due to the nature of the development typical standards may not apply.

The developer intends to work with County and Provincial authorities to potentially pave Highway 842 over the length of the development. The design of the highway intersections and highway improvements will require input from both the Province and County.

5.0 SITE DRAINAGE

The site contour information is shown in Figure B1 and B2. According to area topography information, the drainage on the site generally flows toward the west of the property to the lake. The site is also isolated from offsite drainage basins by highway

842 on the west and natural topography on the north and south. The limits of the drainage basin are illustrated in Figure B1. In addition, on lot drainage retention methods will be used in this development with either soak away pits or catch basins.

Additional design analysis was performed to determine the amount of runoff from the site, size drainage structures and retention ponds (refer to Appendix B). Based on this analysis the pond system was design to accomplish the following purposes:

1. Provide two wet ponds that are filled using lake water through the water license
2. Provide drainage ponds to retain a 100-year 24-hour storm event with a 1 l/sec/he discharge maximum
3. Provide adequate freeboard

Using these preliminary design criteria the pond design is as shown in Table 4.

Table 4: Retention Pond Design

	Pond A		**Pond B**	
	Wet Pond	**Storm retention**	**Pond B Wet Pond**	**Storm retention**
Total depth (m)	3.0	2.5	3.0	2.5
Average Area (Acres)	3.5	6.75	1.5	2.6
Volume (Acre-Ft)		34.9		18

The conceptual design of the storm water drainage system is shown in Figure 8 and Appendix B.

6.0 ARCHITECTURAL CONTROLS

Crystal Blue Harbour will be designed to ensure an aesthetically pleasing environment. The intent is to create the subdivision such that it enhances the natural beauty of its surroundings. To that end, architectural guidelines will be established and enforced for the development of the site. The architectural guidelines will address setbacks, size of dwelling, garages, roofs, exterior finishes, landscaping, fencing, etc.

7.0 LAKE ACCESS AND DOCK FACILLITIES

A public beach and dock will be provided as part of this development. In addition, a private beach and marina will be provided for residents only. Approval of these facilities will be requested from Bow River Irrigation District and Alberta Environment.

8.0 GEOTECHNICAL ANALYSIS

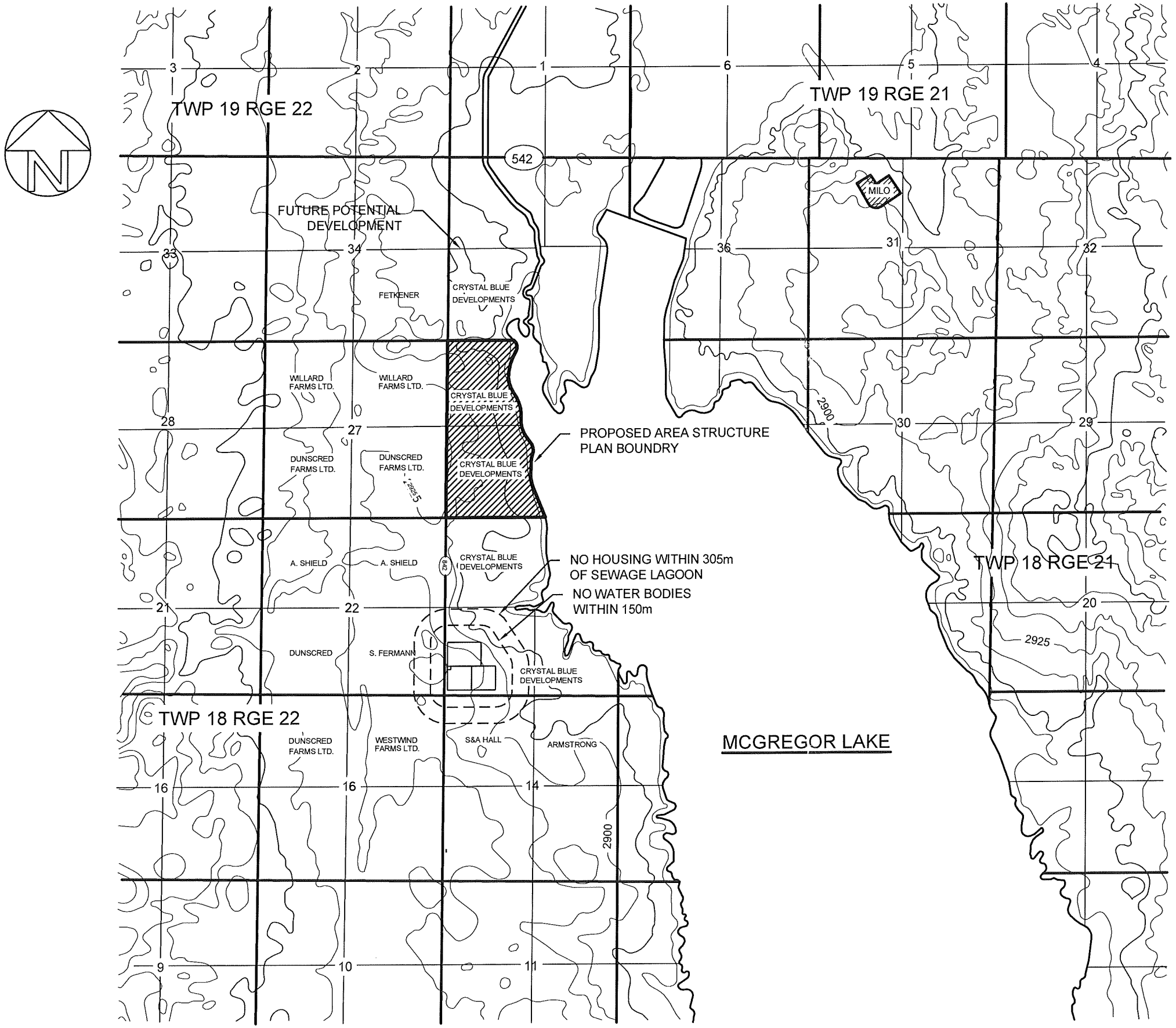
A full geotechnical analysis has not been completed at this stage. Preliminary evaluation of the site and soil survey information indicates that site soils (Lacustrian) should be suitable for a development of this type. A full geotechnical analysis will be completed and submitted as part of the subdivision application.

9.0 ENVIRONMENTAL AND ECOLOGICAL STUDIES

Environmental and ecological studies will be performed and submitted as required by the County.

APPENDIX A

FIGURES



MCGREGOR HARBOUR SUBDIVISION
PORTIONS OF

- NW 1/4 26-18-22-4,
- SW 1/4 26-18-22-4

CONTOUR INTERVAL = 25ft

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CALGARY OFFICE
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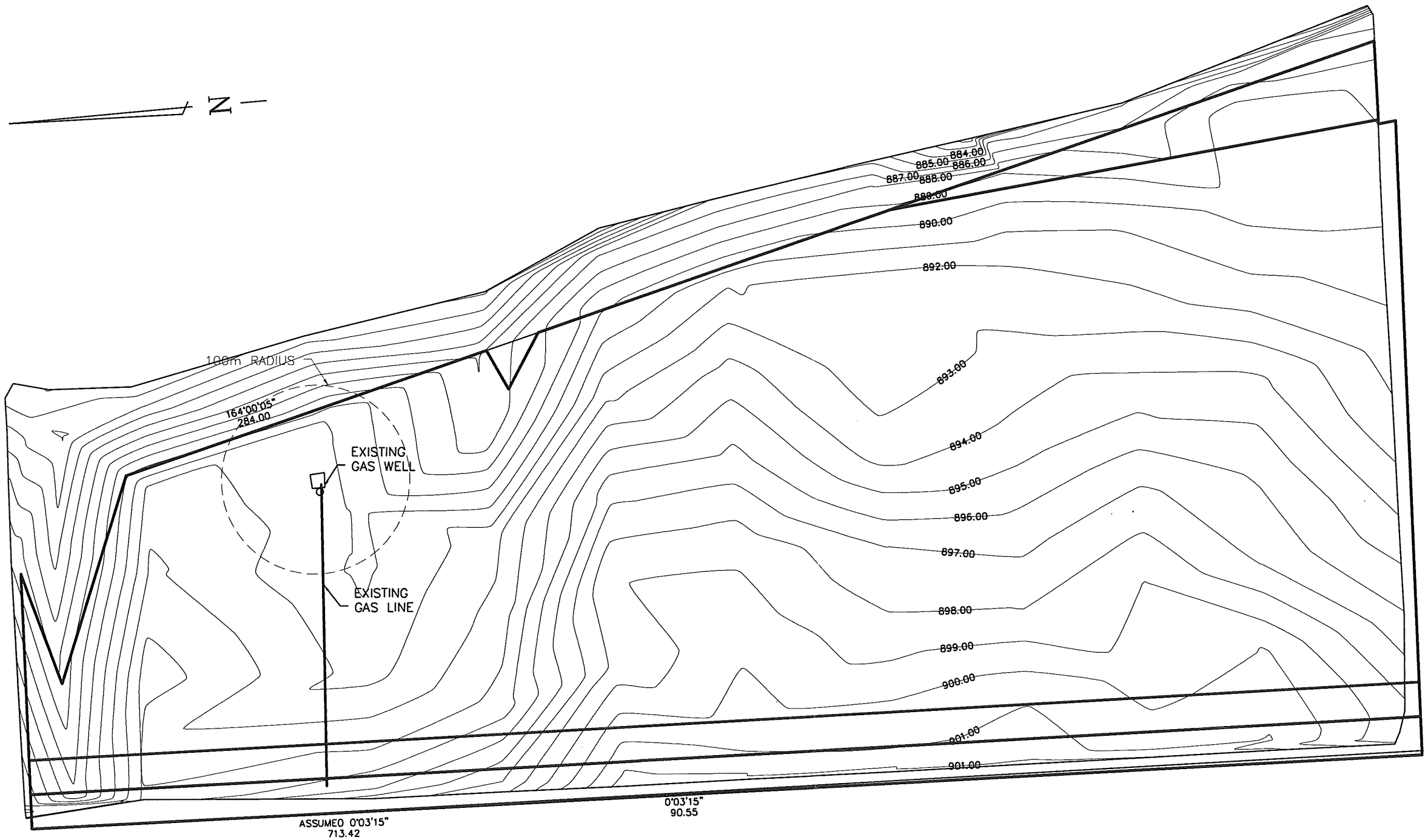
Calgary Alberta T2E 6Z2
Ph: 250–5261

CLIENT
MCGREGOR HARBOUR DEVELOPMENT

PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
LOCATION PLAN

DESIGN: H.E.	PROJECT NO.: 06175
DRAWN: DPB	SCALE: NTS
CHECKED: H.E.	SHEET NO.: FIGURE 1
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	



1: 4000 METRIC

0 40 80 120 160 200

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PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
SITE CONTOUR PLAN

DESIGN: H.E.	PROJECT NO.: 06175
DRAWN: DPB	SCALE: 1: 4000
CHECKED: H.E.	SHEET NO.: FIGURE 2
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	

N

1: 4000 METRIC

0 40 80 120 160 200

LEGEND

- RESIDENTIAL AREA = 128.31 Acres
- MANMADE WATER FEATURE (POND) = 11.74 Acres
- UTILITY EASEMENTS = 0.44 Acres
- OPEN SPACE/RECREATION AREAS = 33.60 Acres
- WALKWAYS = 4.09 Acres
- ROAD R/W = 43.19 Acres

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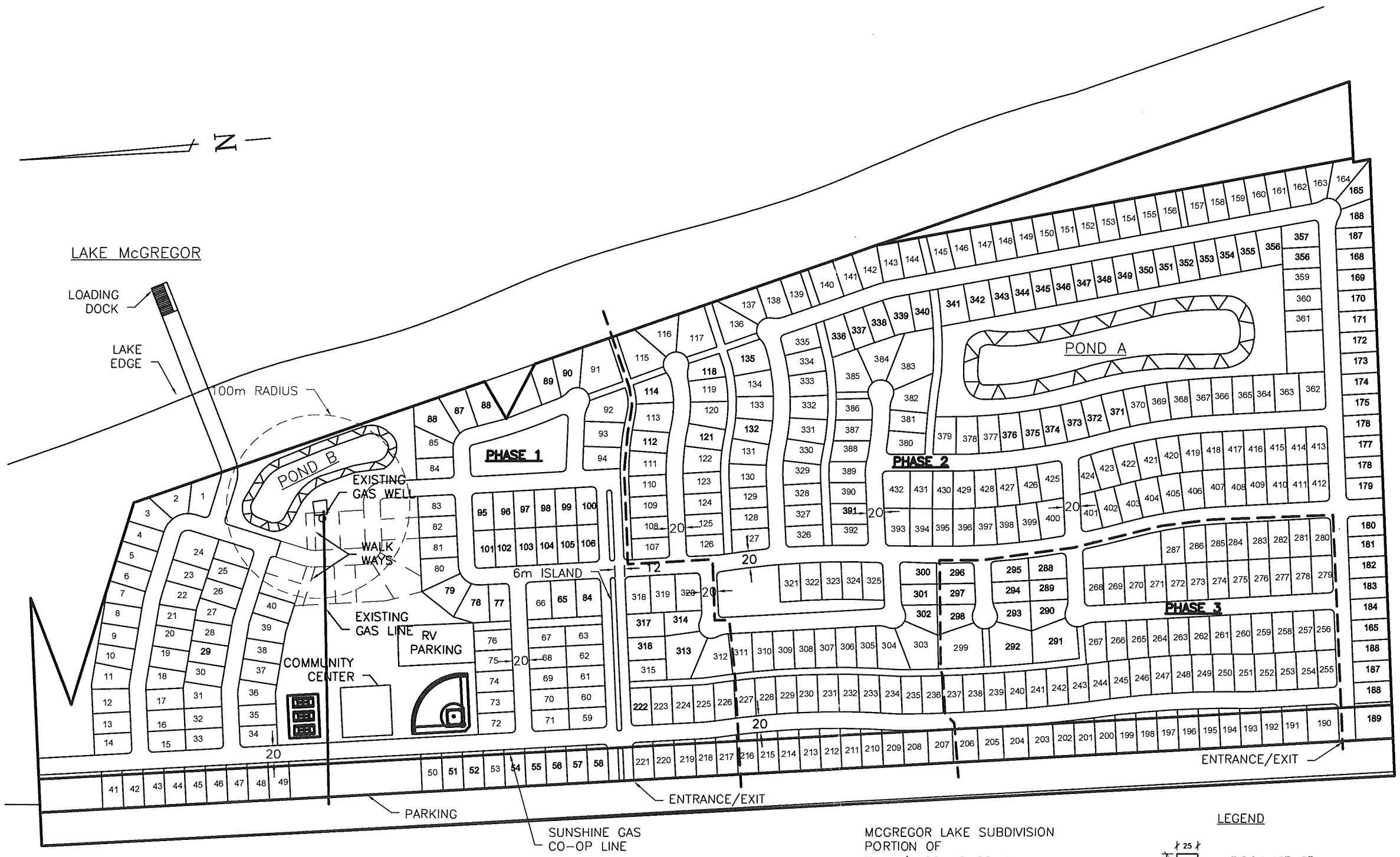
PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
PROPOSED LANDUSE PLAN

DESIGN: H.E.	PROJECT NO.: 06173
DRAWN: DPB	SCALE: 1: 4000
CHECKED: H.E.	SHEET NO.: FIGURE 3
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	



MCGREGOR LAKE SUBDIVISION
PORTION OF
NW 1/4 26-18-22-4,
SW 1/4 26-18-22-4
432LOTS

1:4000 METRIC

0 40 80 120 160 200

LEGEND

25
45 104
TYPICAL LOT AREA
= 1125m²-D.28 ACRES

79
IRREGULAR SHAPED LOTS
LOT DIMENSIONS VARY BUT
MAINTAIN AREA REQUIREMENTS
= D.28 ACRES OR HIGHER

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PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL SITE PLAN

DESIGN: H.E.	PROJECT NO.: 06175
DRAWN: DPB	SCALE: 1:4000
CHECKED: H.E.	SHEET NO.: FIGURE 4
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	

1:4000 METRIC

0 40 80 120 160 200

MCGREGOR LAKE SUBDIVISION
PORTION OF
NW 1/4 26-18-22-4,
SW 1/4 26-18-22-4
432LOTS

LEGEND

25 × 45 — TYPICAL LOT AREA = 1125m²-0.28 ACRES

IRREGULAR SHAPED LOTS
LOT DIMENSIONS VARY BUT
MAINTAIN AREA REQUIREMENTS
= 0.28 ACRES OR HIGHER

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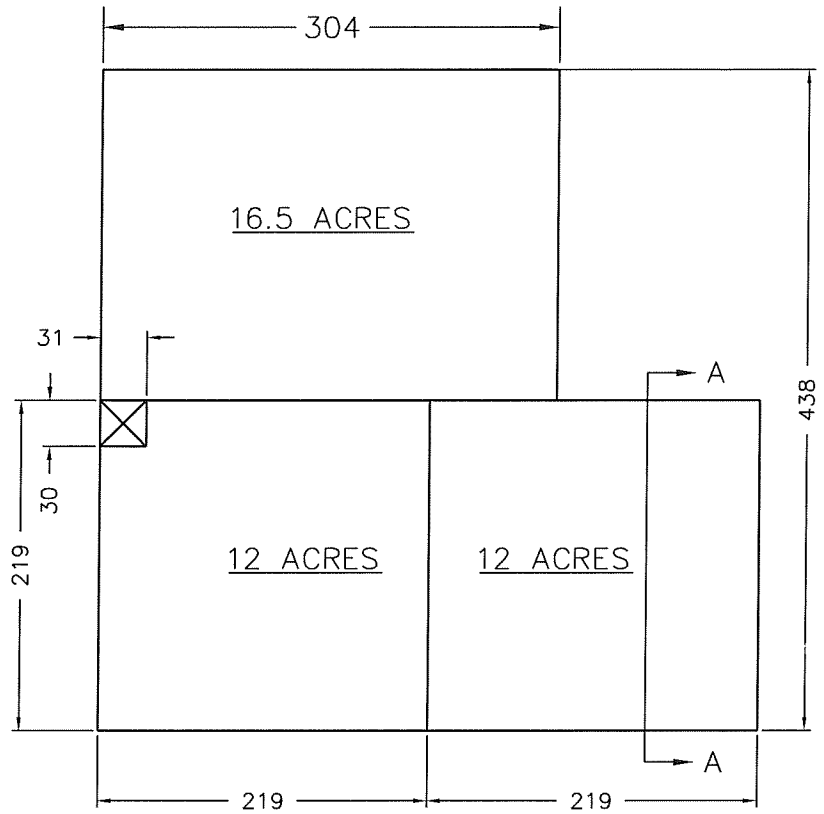
MCGREGOR HARBOUR DEVELOPMENT

PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL SANITARY SEWAGE PLAN

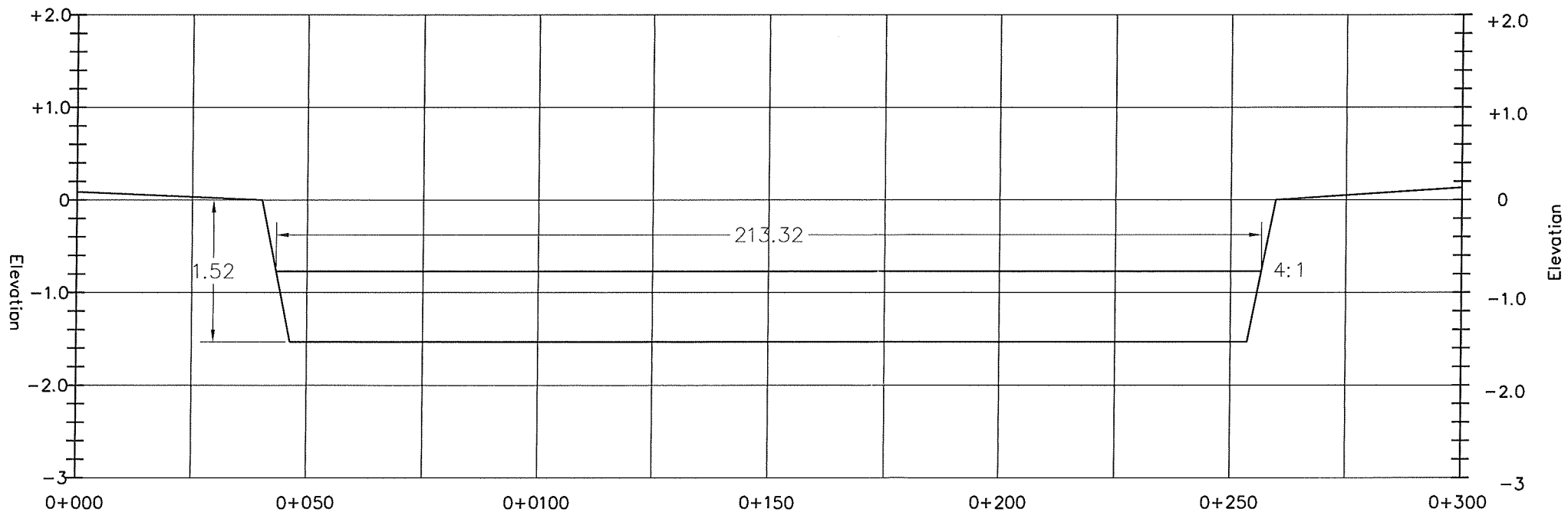
DESIGN H.E.	PROJECT NO. 06175
DRAWN DPB	SCALE 1:4000
CHECKED H.E.	SHEET NO. FIGURE 5
APPROVED H.E.	
DATE DRAWN JUNE 9, 09	



SEWAGE LAGOON
SCALE = NTS

NOTE:
UNITS IN METERS UNLESS OTHERWISE NOTED

SEWAGE LAGOON CROSS SECTION



SECTION A–A
SCALE = NTS

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PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL SEWAGE LAGOON LAYOUT

DESIGN: H.E.	PROJECT NO.: 06175
DRAWN: DPB	SCALE: NTS
CHECKED: H.E.	SHEET NO.: FIGURE 6
APPROVED: H.E.	
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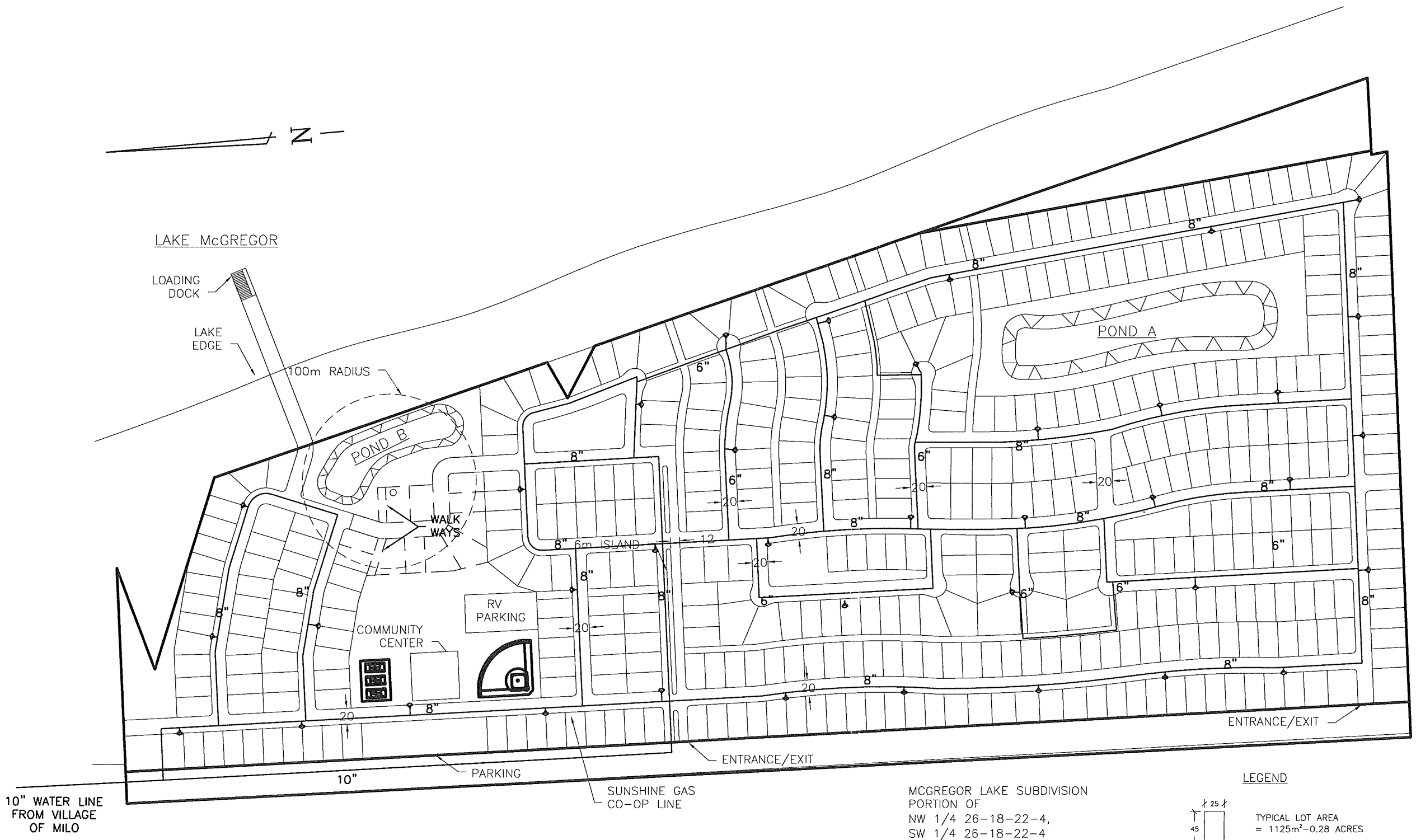

1: 4000 METRIC

0 40 80 120 160 200

MCGREGOR LAKE SUBDIVISION
PORTION OF
NW 1/4 26-18-22-4,
SW 1/4 26-18-22-4
432LOTS

LEGEND

25 × 45 — TYPICAL LOT AREA = 1125m²-0.28 ACRES

IRREGULAR SHAPED LOTS
LOT DIMENSIONS VARY BUT
MAINTAIN AREA REQUIREMENTS
= 0.28 ACRES OR HIGHER

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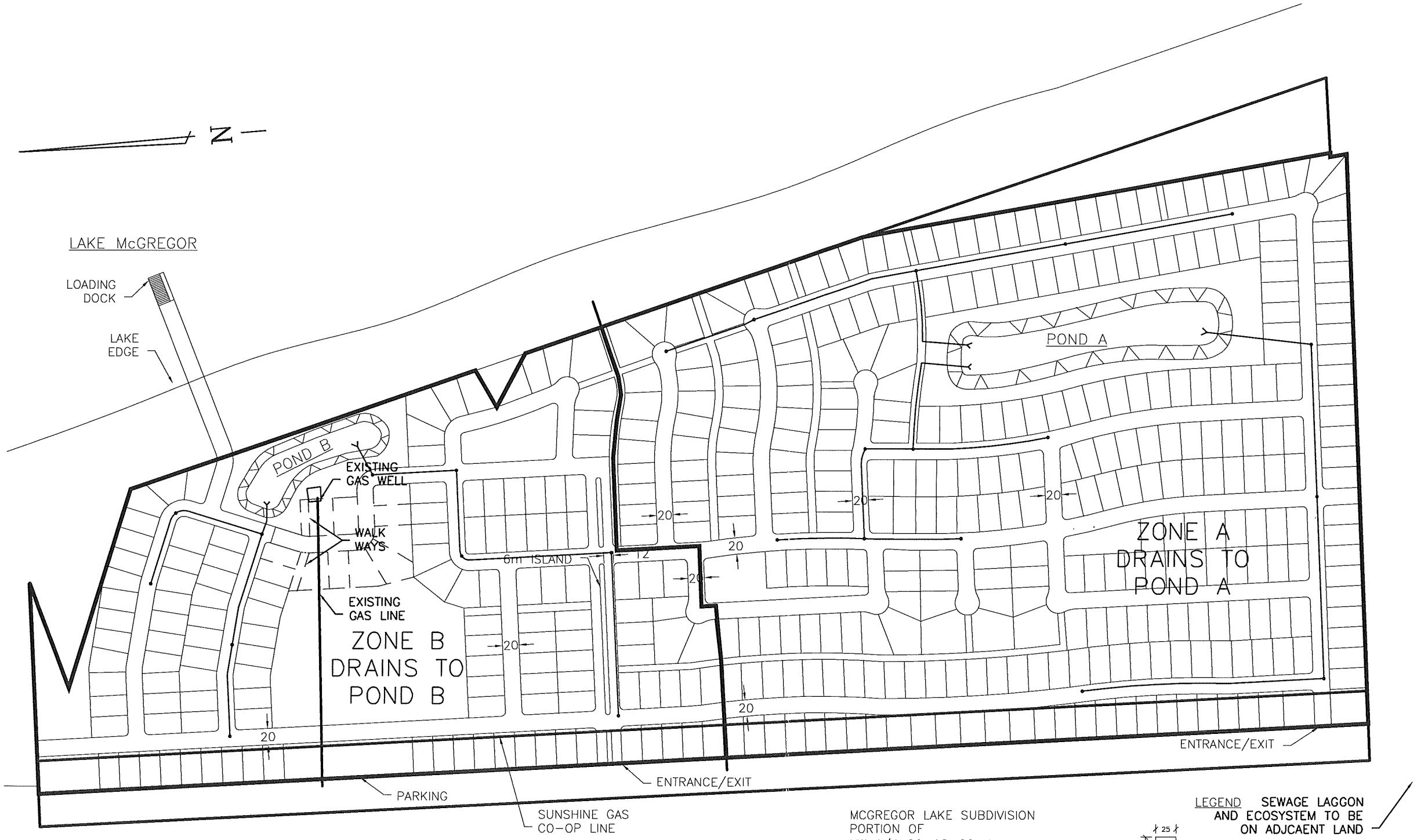
PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL WATER PLAN

DESIGN H.E.	PROJECT NO. 06175
DRAWN DPB	SCALE 1: 4000
CHECKED H.E.	SHEET NO. FIGURE 7
APPROVED H.E.	
DATE DRAWN JUNE 9, 09	



MCGREGOR LAKE SUBDIVISION
PORTION OF
NW 1/4 26-18-22-4,
SW 1/4 26-18-22-4
432LOTS

LEGEND SEWAGE LAGGON AND ECOSYSTEM TO BE ON ADJCAENT LAND

25 × 45
TYPICAL LOT AREA
= 1125m²-0.28 ACRES

IRREGULAR SHAPED LOTS
LOT DIMENSIONS VARY BUT
MAINTAIN AREA REQUIREMENTS
= 0.28 ACRES OR HIGHER

1: 4000 METRIC

0 40 80 120 160 200

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PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL STORM DRAINAGE PLAN

DESIGN H.E.	PROJECT NO. 06175
DRAWN DPB	SCALE 1: 4000
CHECKED H.E.	SHEET NO. FIGURE 8
APPROVED H.E.	
DATE DRAWN JUNE 9, 09	

APPENDIX B

SURFACE RUNOFF AND HYDROLOGICAL ANALYSIS
FOR
CRYSTAL BLUE HARBOUR

HYDROLOGICAL ANALYSIS AND RESULTS

1. INTRODUCTION

On behalf of Crystal Blue Developments, Hasegawa Engineering (HE) has completed this preliminary hydrological analysis at the subject site. The hydrological analysis includes the following major aspects:

1. Overall site layout and conditions
2. Site topography and runoff
3. Precipitation and evaporation analysis
4. Retention pond storage size calculations
5. Offsite drainage bypass analysis

The site is located as shown in Figure B1. For additional information with respect to the project please refer to the Area Structure Plan.

2. SITE CONDITIONS

The site is located within Vulcan County on the West Side of McGregor Lake (refer to Figure B1). The site is used for agricultural purposes and drains to the east into McGregor Lake at a grade ranging from 1% to 5%. The site is bordered by Highway 842 on the west, McGregor Lake on the east agricultural land on the north and south. The only offsite drainage that enters the site appears to come from west of Highway 842 and follows a natural drainage swale shown in Figure B1.

According to the Alberta Geological Survey surface soils on the property consist of Lacustrine - Coarse. This soil type has a relatively high permeability factor when considering infiltration from runoff.

3. SURFACE RUNOFF DESIGN CRITERIA

The total area of the onsite basin is 220 acres. Runoff from the developable land will be captured in two retention ponds located onsite (refer to Figure B2). Total discharge from the site will not exceed 1 l/sec/ha. Retention size has been based on a 24 hour 100 year storm event utilizing a maximum discharge rate as mentioned previously.

In order to determine the volume of runoff from each basin, surface runoff analysis was performed. Rainfall intensity data was obtained for Vulcan County from the Atmospheric Environment Service, which is part of Environment Canada. The input data for each basin was determined using the site information. Runoff estimations were developed using the "TR-55 Urban Hydrology for Small Watersheds" runoff model. Each basin was divided into sheet flow, shallow concentrated flow and stream flow

regions. The model utilizes the information from each sub-basin area to develop a time of concentration. The model then calculates the peak flow and total runoff based on this input. The predevelopment curve number used for each basin was 61, which represents a class B soil utilized for grazing. The post development curve number used for each basin was 81, which represents a class C soil (less permeable) and an urban development with 30% impervious surfaces. Key input data used for this analysis are included in Table B1. The basin size and extent are shown in Figure B2.

Table B1: Runoff Analysis Input Data

Analysis	Drainage Basin (acres)	2 year 24 hour storm (inches)	100 year 24 hour storm (inches)	Average Slope (ft/ft)	Curve number (CN)	Percent impervious area
Pre-development	200	2	5	0.02	61	0%
Post-development	200	2	5	0.025	81	30%

4. SURFACE RUNOFF RESULTS

The results for the post development runoff and pond sizing are included in this section. For results pertaining to pre-development conditions refer to the attached calculations. As mentioned earlier, the storm retention pond has been sized to allow for total retention of a 100-year 24-hour storm with a maximum discharge of 1 l/sec/ha.. As expected, the time of concentration is relatively short, ranging from 0.1 hours to 0.27 hours. The peak flow from the largest basin is estimated to be 101 cfs and total runoff from the design storm is 34.4 acre-feet. The pond location and size are shown in Figures B2-B4.

Table B2: Post development 100 year runoff analysis results

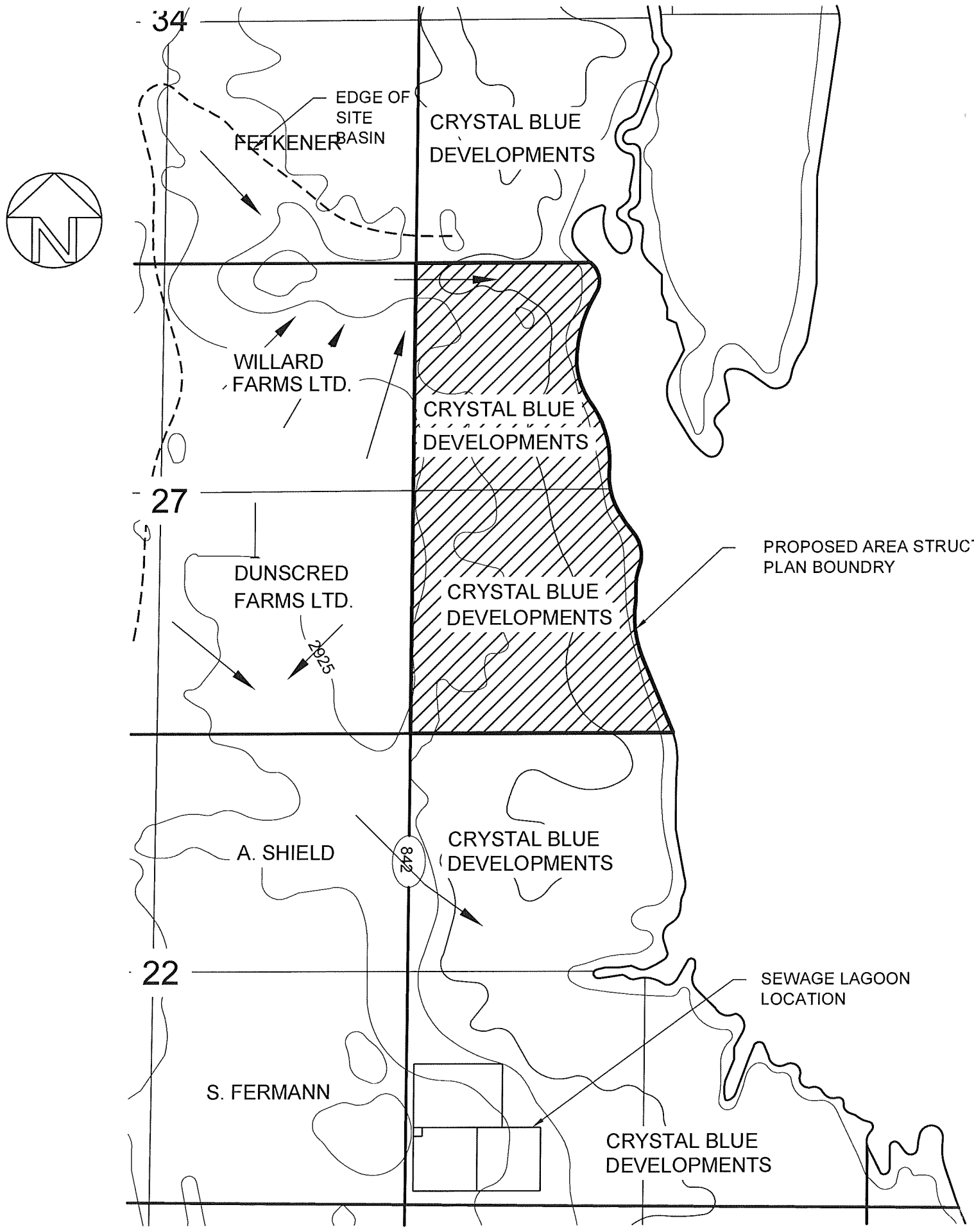
Basin	Time of Concentration (Hours)	Peak Flow 100 year (CFS)	Runoff Volume (In / acre)	Runoff Volume (Acre - ft)	Minimum volume of retention provided (Acre - ft)
A	0.1 - 0.16	101	3	34.4	34.9
B	0.27	36	3	17	18

6. PRELIMINARY RETENTION POND DESIGN

Based on the design information above, a retention pond system has been designed for this project. Locations of the retention pond systems are shown on Figures B2-B4. A plan view and cross-section of the proposed drainage retention area is shown in Figures B3 and B4. A fountain and appropriate aeration equipment will be provided for each pond. The proposed volume of the pond is shown in Table B3 below:

Table B3: Retention Pond Design

	Pond A		Pond B	
	Wet Pond	**Storm retention**	**Pond B Wet Pond**	**Storm retention**
Total depth (m)	3.0	2..5	3.0	2.5
Average Area (Acres)	3.5	6.75	1.5	2.6
Volume (Acre-Ft)		34.9		18



MCGREGOR LAKE SUBDIVISION
PORTIONS OF

- NW 1/4 26-18-22-4,
- SW 1/4 26-18-22-4

CONTOUR INTERVAL = 25ft

LEGEND

NATURAL DRAINAGE ←

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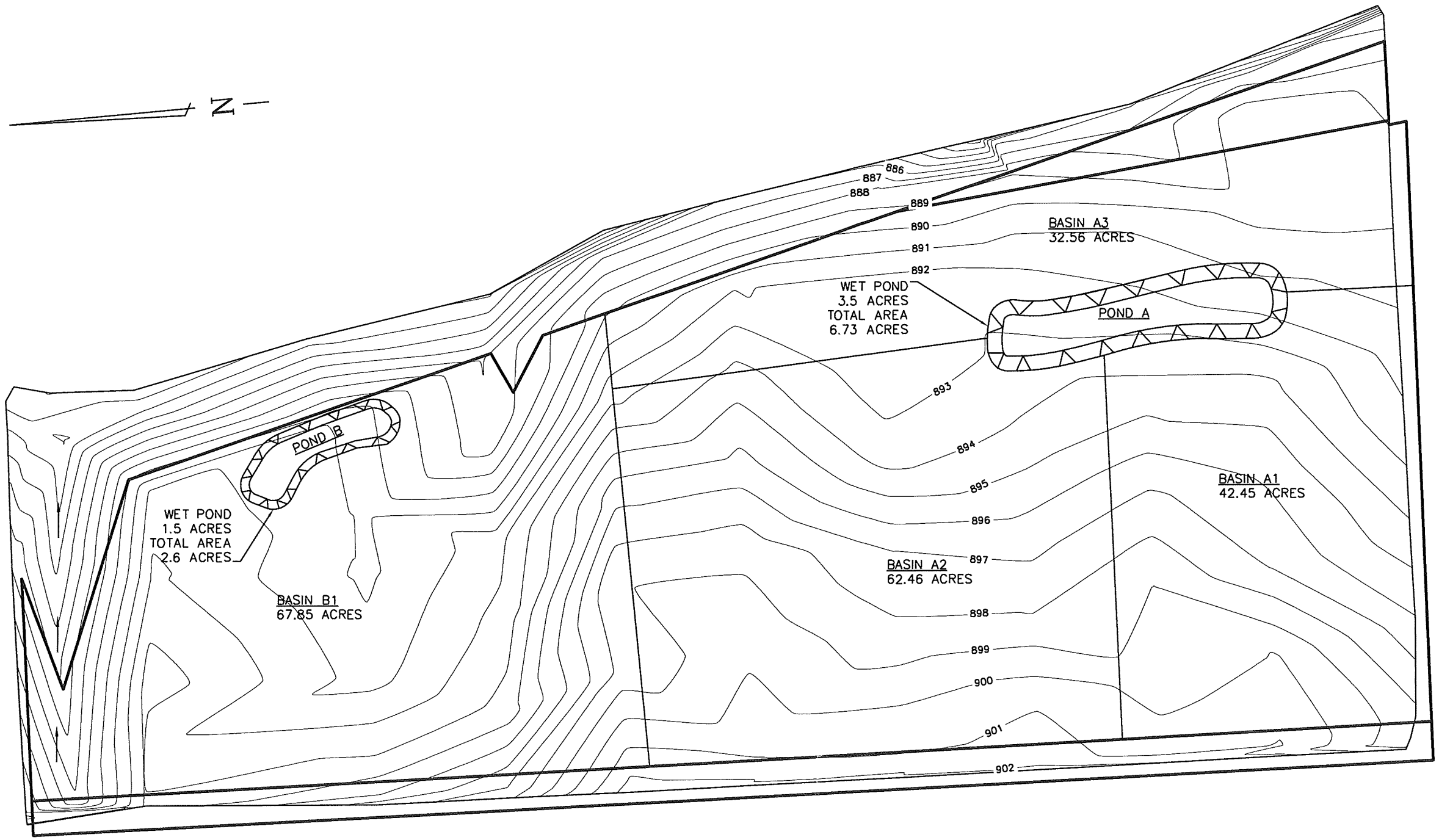
Ph: 250–5261

CLIENT
MCGREGOR HARBOUR DEVELOPMENT

PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
LOCATION PLAN

DESIGN	PROJECT NO.
H.E.	06175
DRAWN: DPB	SCALE: NTS
CHECKED: H.E.	SHEET NO.: FIGURE B1
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	



DRAINAGE BASIN PLAN
SCALE: NTS

NOTE:

OFFSITE DRAINAGE INTERCEPTED BY HIGHWAY 842 EXCEPT WHERE DRAINAGE ARROW IS SHOWN

OFFSITE DRAINAGE PATH ←

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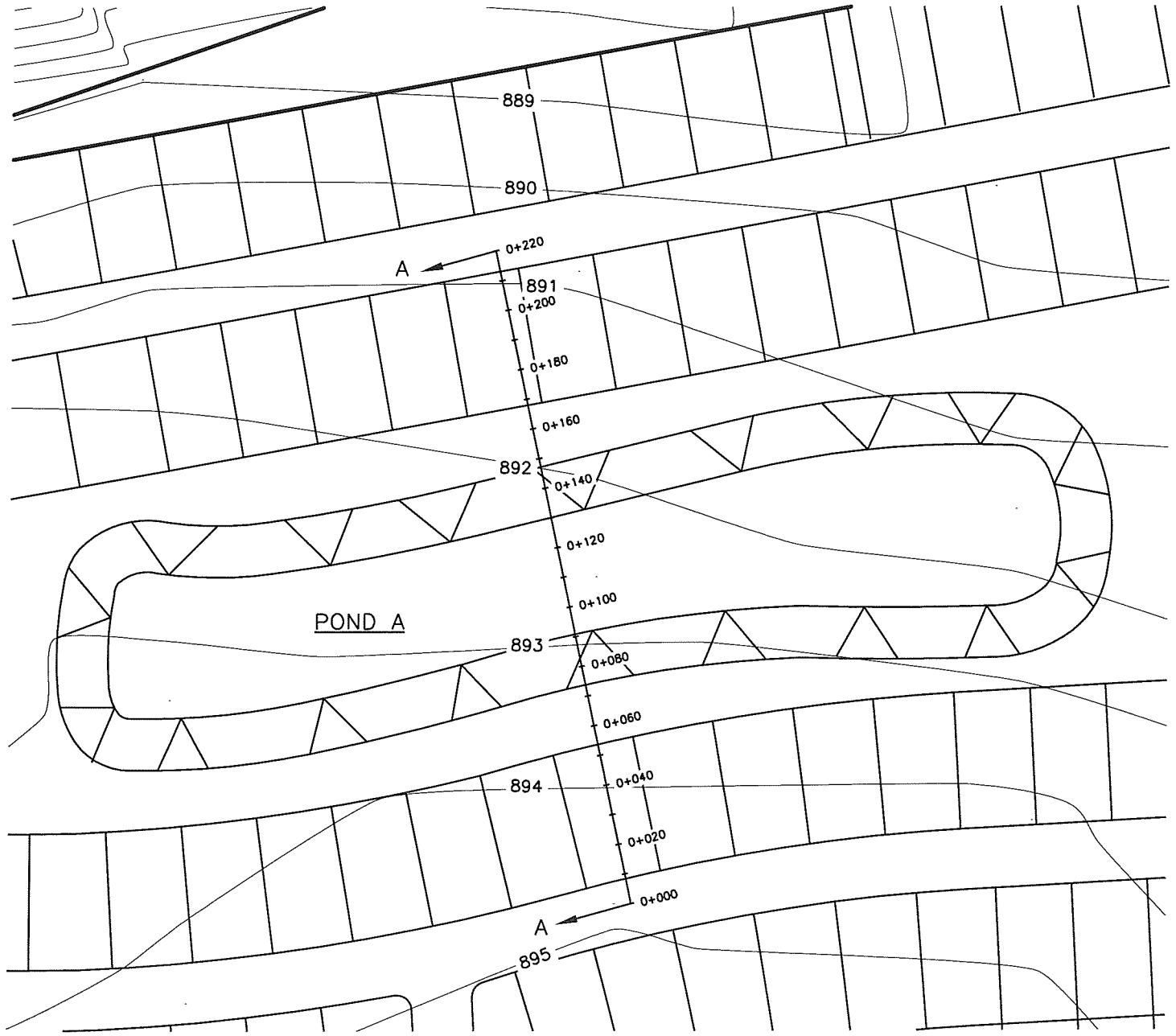
CLIENT
MCGREGOR HARBOUR DEVELOPMENT

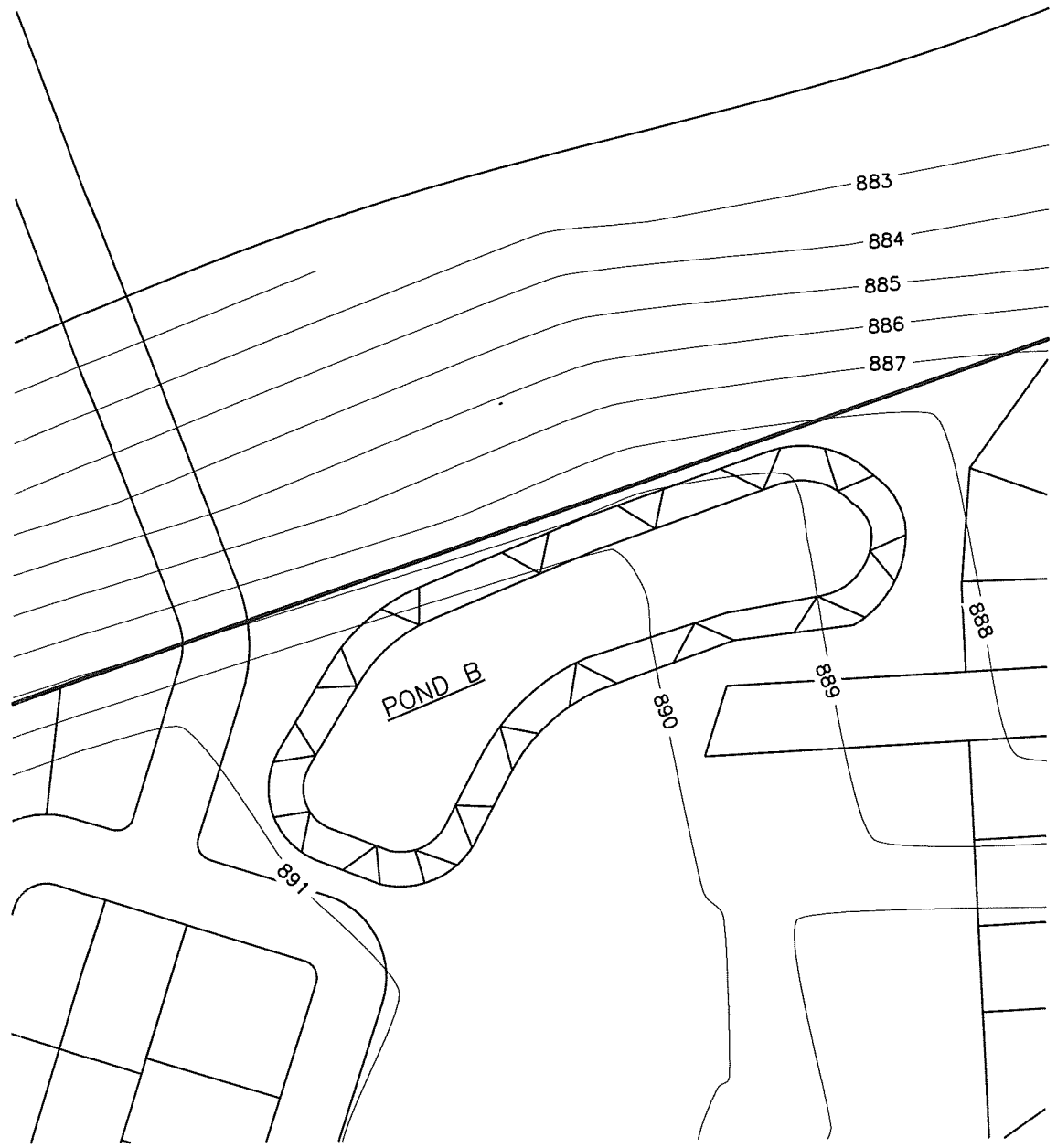
PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
DRAINAGE BASIN PLAN

DESIGN H.E.	PROJECT NO. 06175
DRAWN DPB	SCALE 1:4000
CHECKED H.E.	SHEET NO. FIGURE B2
APPROVED H.E.	
DATE DRAWN JUNE 9, 09	



DRAINAGE POND A
SCALE: NTS



DRAINAGE POND B
SCALE: NTS

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LETHBRIDGE OFFICE
1220 – 31 Street North
Lethbridge Alberta T1H 5J8
Ph: 328–2686
Fax: 328–2728
email:hasgm@telusplanet.net

CALGARY OFFICE
201,2816–21 Street NE
Calgary Alberta T2E 6Z2
Ph: 250–5261

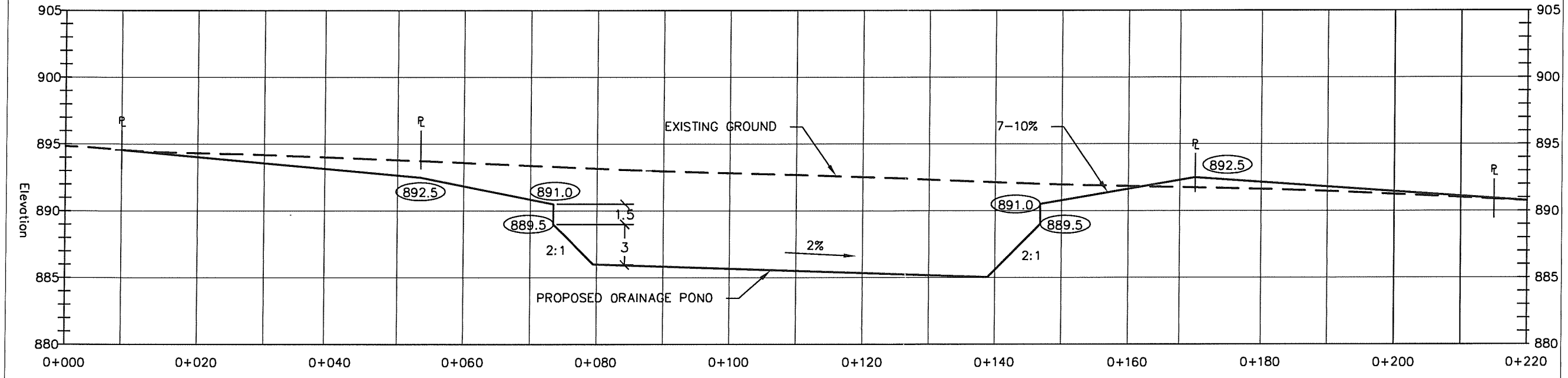
CLIENT
MCGREGOR HARBOUR DEVELOPMENT

PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
CONCEPTUAL DRAINAGE POND LAYOUT

DESIGN: H.E.	PROJECT NO.: 06175
DRAWN: DPB	SCALE: 1: 4000
CHECKED: H.E.	SHEET NO.: FIGURE B3
APPROVED: H.E.	
DATE DRAWN: JUNE 9, 09	

POND CROSS SECTION A–A



NOTE:
TYPICAL CROSS SECTION FOR
ORAINAGE PONO A & DRAINAGE PONO B

Notes:

This is o copyright drowing ond sholl not be reproduced in ony form without written permission of Engineer.

Contractor to check and verify all dimensions before construction, ony errors and omissions reported to Engineer immediately.

Drowing not to be used for construction until so approved.

Do not scale Drowing.

All construction sholl be in accordonce with the lotest code, may it be construction, mechonicol, etc. code.

No	Revision	Date	By

Hasegawa Engineering

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CLIENT
MCGREGOR HARBOUR DEVELOPMENT

PROJECT TITLE
AREA STRUCTURE PLAN

DRAWING TITLE
DRAINAGE POND CROSS SECTION

DESIGN H.E.	PROJECT NO. 06175
DRAWN DPB	SCALE NTS
CHECKED H.E.	SHEET NO. FIGURE B4
APPROVED H.E.	
DATE DRAWN JUNE 9, 09	

APPENDIX C

COPY OF LAND TITLE

CERTIFIED COPY OF

Certificate of Title

LINC
0025 699 216
0025 699 224

SHORT LEGAL
4;22;18;26;NW
4;22;18;26;SW

S

TITLE NUMBER: 071 149 872
TRANSFER OF LAND
DATE: 28/03/2007

AT THE TIME OF THIS CERTIFICATION

CRYSTAL BLUE DEVELOPMENTS LTD..
OF 390 800 6TH AVE S.W.
CALGARY
ALBERTA T2P 3G3

IS THE OWNER OF AN ESTATE IN FEE SIMPLE
OF AND IN

FIRST

MERIDIAN 4 RANGE 22 TOWNSHIP 18
SECTION 26
THAT PORTION OF THE NORTH WEST QUARTER
WHICH LIES TO THE WEST OF THE ADDITION OF THE MCGREGOR RESERVOIR
ON PLAN 6709HX
CONTAINING 34.647 HECTARES (85.61 ACRES) MORE OR LESS
EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES
ROAD	9312155	0.799	1.97

EXCEPTING THEREOUT ALL MINES AND MINERALS

SECOND

ERIDIAN 4 RANGE 22 TOWNSHIP 18
ECTION 26
THAT PORTION OF THE SOUTH WEST QUARTER
IICH LIES TO THE WEST OF THE ADDITION OF THE MCGREGOR RESERVOIR
PLAN 6709HX
ONTAINING 54.778 HECTARES (135.44 ACRES) MORE OR LESS
CEPTING THEREOUT

AN	NUMBER	HECTARES	ACRES
OAD	9312155	0.799	1.97

CEPTING THEREOUT ALL MINES AND MINERALS

BJECT TO THE ENCUMBRANCES, LIENS AND INTERESTS NOTIFIED BY MEMORANDUM UNDER-
TTEN OR ENDORSED HEREON, OR WHICH MAY HEREAFTER BE MADE IN THE REGISTER.

STRATION

ENCUMBRANCES, LIENS & INTERESTS

CALGARY
ALBERTA T2P 3G3

IS THE OWNER OF AN ESTATE IN FEE SIMPLE
OF AND IN

FIRST

MERIDIAN 4 RANGE 22 TOWNSHIP 18
SECTION 26
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PLAN	NUMBER	HECTARES	ACRES
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EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES
ROAD	9312155	0.799	1.97

EXCEPTING THEREOUT ALL MINES AND MINERALS

SUBJECT TO THE ENCUMBRANCES, LIENS AND INTERESTS NOTIFIED BY MEMORANDUM UNDER-
RITTEN OR ENDORSED HEREON, OR WHICH MAY HEREAFTER BE MADE IN THE REGISTER.

GISTRATION NUMBER	DATE (D/M/Y)	ENCUMBRANCES, LIENS & INTERESTS PARTICULARS
01 063 302	24/06/1975	UTILITY RIGHT OF WAY GRANTEE - SUNSHINE GAS CO-OP LTD.
- 078 863	28/02/2004	CAVEAT RE : SURFACE LEASE UNDER 20 ACRES

(CONTINUED)

CERTIFIED COPY OF

Certificate of Title

SHORT LEGAL 4;22;18;26;NW,SW
NAME CRYSTAL BLUE DEVELOPMENTS LTD.
NUMBER 071 149 872

REGISTRATION NUMBER	DATE (D/M/Y)	ENCUMBRANCES, LIENS & INTERESTS PARTICULARS
		CAVEATOR - AVENIR OPERATING CORP.. 200 116 8TH AVE S.W. CALGARY ALBERTA T2P1B3 AGENT - ROBB CRAIGE AFFECTED LAND: 4;22;18;26;NW (DATA UPDATED BY: CHANGE OF NAME 051468798)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 01 DAY OF MAY ,2007

REGISTRAR OF LAND TITLES

SUPPLEMENTARY INFORMATION
VALUE: $1,489,500
CONSIDERATION: $1,489,500
MUNICIPALITY: VULCAN COUNTY
REFERENCE NUMBER:
071 054 834 +7
TOTAL INSTRUMENTS: 002

APPENDIX D

WATER ACCESS AND LICENCE

OFFER AND AGREEMENT OF PURCHASE AND SALE

This Agreement is dated the 7 day of June, 2007.

BETWEEN:

Attn: Mark

From: Ruth Wiens

RIVER KIND RUTTENIAN BRETHREN
Of P.O. Box 37, Meadowlark AB, T0L 1P0
(the "Vendor")

- and -

CRYSTAL BLUE LAND CORP.
Of Calgary Ab.
(the "Purchaser")

The Purchaser hereby offers and agrees to purchase from the Vendor and the Vendor hereby agrees to sell and transfer to the Purchaser:

a. 650 Acre Feet of transferable annual water allocation (the "Allocation"), subject to conservation holdback (if applicable), issued by Alberta Environment under, Water Licence No. 08125 and 19422, at a rate of $2,000 per Acre Foot as amended (the "Assets").

for the total purchase price (including G.S.T., if applicable) of SIX HUNDRED FIFTY THOUSAND ($650,000.00) DOLLARS, plus G.S.T. of $39,000.00 (if applicable) in Canadian funds (the "Purchase Price"). The Vendor also agrees to transfer to the Purchaser the rights to 650 Permanent Irrigation Acres in the Bow River Irrigation District (the "BRID"), before the closing date, subject to the following terms and conditions:

1. DEFINITIONS

In this Agreement:

a. "Closing Date" means that day that occurs seven (7) days after the Date of Transfer, or such other date as may be agreed upon in writing by the parties;

b. "Date of Transfer" will occur when both of the following events have occurred:

(i) the date on which the transfer of the Allocation and/or the Water License from the Vendor to Purchaser and any amendment of use as may be required by the Purchaser is approved and agreed to in writing by Alberta Environment as contemplated in this Agreement; and

(ii) the date on which the transfer of the Irrigation Acres from the Purchaser to the Vendor and any amendment of use as may be required by the Vendor is approved and agreed in writing by the BRID as contemplated in this Agreement.

c. "Termination Date" means the 10 day of April, 2008;

d. "Water License" means that water license which is referred to by Alberta Environment as File No. 15701, Water License No. 08125 and 19427, and all amendments thereto.

e. "Irrigation Acres" means the permanent irrigation acres issued by the BRID, that the Purchaser will provide to the Vendor before the closing of this Agreement, and all amendments thereto.

2. PAYMENT

Subject to adjustment as provided in this Agreement, the Purchase Price shall be payable as follows:

a. A deposit of $100,000.00 (the "Deposit") payable by cheque or bank draft to the Vendor's Solicitors, in trust, within five (5) business days of this Agreement being signed by both parties, to be held by the Vendor's Solicitors in trust in accordance with the provisions of Section 3; and

b. as to the balance of the Purchase Price, by certified cheque or bank draft payable to the Vendor or as it may direct on the Closing Date.

3. DEPOSIT

The Deposit shall be held by the Vendor's Solicitors in an interest bearing trust account, with such interest to follow the Deposit. If this Agreement is not completed solely by reason of a failure of the Vendor to perform its obligations under this Agreement the Deposit shall be returned to the Purchaser forthwith without deduction without derogating from any claims or causes of action the Purchaser may have against the Vendor arising from the Vendor's default. If this Agreement is not completed solely by reason of the failure of the Purchaser to perform its obligations under this Agreement the Vendor shall be entitled to retain the Deposit, without derogating from any claims or causes of action the Purchaser may have against the Vendor arising from the Vendor's default.

In the event that this Agreement is not completed as a result of ~~[illegible]~~ the inability of the Parties to obtain approval of transfer of

allocation and change of use as contemplated herein, then on the Termination Date the Deposit shall be returned to the Purchaser without deduction, and this Agreement will become null and void and of no further force and effect.

4. ADJUSTMENTS

The Purchaser acknowledges that Alberta Environment, or a director appointed by the Minister under the *Water Act of Alberta*, RSA 2000, c. W-3 may withhold up to ten (10%) percent of the Assets that are being transferred. The Purchaser further acknowledges and accepts that the Purchase Price as agreed upon will be paid on the Closing Date regardless of whether up to ten (10%) percent of the allocation of water under either, License No. 08125 or License No. 19427, has been withheld.

5. REPRESENTATIONS OF THE VENDOR:

The Vendor represents and warrants to and in favour of the Purchaser that, as of the date of acceptance of this Agreement or such other date as may be specified:

a. the Vendor is, and will be as of the Date of Transfer, the sole licensee named in Water License No. 08125 and 19427, and is the holder of the rights granted thereby;

b. the Assets shall be free at the Closing Date of any assignments, encumbrances, leases or licenses of use, contractual sales or encumbrances unless otherwise mutually agreed to in writing by Vendor and Purchaser;

c. the Vendor has no indebtedness to any person that constitutes or by operation of law or otherwise might constitute a lien, charge or encumbrance on all or any part of the Assets;

d. The Vendor is not a non-resident of Canada within the meaning of Section 116 of the *Income Tax Act* (Canada);

e. the Vendor is a G.S.T. registrant; and

f. the Vendor, or its representative, are authorized to and have the right to enter into this Agreement and to carry out its obligations hereunder.

6. REPRESENTATIONS AND WARRANTIES OF THE PURCHASER

The Purchaser represents and warrants to and in favour of the Vendor that, as of the date of acceptance of this Agreement or such other date as may be specified:

a. the Purchaser is, or will undertake to possess on the Date of Transfer, 650 Permanent Irrigation Acres issued by the ERID, and be the holder of the rights granted thereby;

b. the Irrigation Acres shall be free at the Closing Date of any assignments, encumbrances, grants or licenses of use, contractual sales or encumbrances unless otherwise mutually agreed to in writing by Vendor and Purchaser;

c. the Purchaser has no indebtedness to any person that constitutes or by operation of law or otherwise might constitute a lien, charge or encumbrance on all or any part of the Industrial Assets;

d. The Purchaser is not a non-resident of Canada within the meaning of Section 116 of the *Income Tax Act* (Canada);

e. the Purchaser is a G.S.T. registrant; and

f. the Purchaser, or its representatives, are authorized to and have the right to enter into this Agreement and to carry out its obligations hereunder.

Notwithstanding the above, the closing of the transaction contemplated by this Agreement by the Purchaser shall be deemed to be a waiver of any conditions in this section not satisfied on or before the Closing Date but shall not relieve the Vendor from liability with respect to agreements, representations and warranties set forth in this Agreement.

7. SURVIVAL OF REPRESENTATIONS

The representations and warranties contained in Section 5 and 6 shall survive the completion of the transaction of purchase and sale contemplated by this Agreement and shall continue in full force and effect for the benefit of the Purchaser and the Vendor for a period of 6 months after the Closing Date, so that written notification of any breach of any representation or warranty must be provided to the other party on or before the expiry of such six (6) month period.

8. VENDOR'S RESPONSIBILITIES BEFORE AND AFTER TRANSFER

During the period from the date of acceptance of this Agreement until the Date of Transfer:

a. the Vendor shall not enter into any assignments or agreements nor shall it amend the Water Licenses or any existing assignments or agreements relating to the Assets without the prior written consent of the Purchaser;

b. the Vendor shall remain responsible for all aspects of the Assets including, without limitation, fulfillment of any reporting requirements and payment of any liabilities relating to the Assets;

c. the Vendor agrees that the Purchaser may make all reasonable enquiries as to the status of the Assets and any title, entitlement, interests, agreements and licenses relating thereto, and the Vendor further agrees that:

i. the Purchaser shall not be held responsible for any modification, cancellation or amendment of the Water Licenses that may be effected by Alberta Environment prior to the Date of Transfer; and

ii. the Purchaser shall not be held responsible for the effects of any reasonable inquiries, including without limitation, the decision of any person to enforce existing agreements or rights against the Vendor.

From and after the Date of Transfer the Purchaser shall assume all responsibilities and liabilities relating to the Acres.

9. PURCHASER'S RESPONSIBILITIES BEFORE AND AFTER TRANSFER

During the period from the date of acceptance of this Agreement until the Date of Transfer:

a. the Purchaser shall not enter into any assignments or agreements nor shall it amend any existing assignments or agreements relating to the Irrigation Acres without the prior written consent of the Vendor;

b. the Purchaser shall remain responsible for all aspects of the Irrigation Acres including, without limitation, fulfillment of any reporting requirements and payment of any liabilities relating to the Irrigation Acres;

c. the Purchaser agrees that the Vendor may make all reasonable enquiries as to the status of the Irrigation Acres and any duties, reports, interests, agreements and licences relating thereto, and the Purchaser further agrees that:

i. the Vendor shall not be held responsible for any cancellation or amendment of the Irrigation Acres that may be effected by the ARD prior to the Date of Transfer; and

ii. the Vendor shall not be held responsible for the making of any reasonable inquiries, including without limitation, the decision of any person to enforce existing agreements or rights against the Purchaser.

From and after the Date of Transfer the Vendor shall assume all responsibilities and liabilities relating to the Permanent Irrigation Acres.

10. ASSIGNMENT TO FACILITATE TRANSFER

The Vendor hereby agrees to:

a. Obtain, or have in its possession on the closing time, an amount of not less than 650 Permanent Irrigation Acres that it will then transfer to the Vendor in consideration for Licence 49125 and 19427;

b. forthwith execute and deliver to Alberta Environment an application to transfer the Acres to the Purchaser and to amend the Water Licence as required by the Purchaser, and to exercise best efforts in facilitating such transfer;

c. execute and deliver all such further documents and instruments and do such further acts and things as may be reasonably required to give full effect to this Agreement;

d. in the event the Vendor receives any notices, correspondences, or payments relating to the Assets from and after the Date of Transfer, the Vendor shall immediately forward such notices, correspondences, or payments to the Purchaser; and

e. during the period between the Vendor's acceptance of this Agreement and the Date of Transfer the Vendor or its representatives shall provide Purchaser with access to all contracts, agreements, books, records and files relating to the Assets which are in its possession or to which it is entitled or has access, in order for Purchaser and its agents, advisors and representatives to review and carry out due diligence examination on all matters which they may consider relevant in relation to the transfer of the Assets.

The Purchaser hereby agrees to: UPON AQUIRING THE IRRIGATION ACRES

a. forthwith execute and deliver to the BRID an application to transfer the Irrigation Acres to the Vendor and to amend any license hereunder, as required by the Purchaser, and to exercise best efforts in facilitating such transfer;

b. execute and deliver all such further documents and instruments and do such further acts and things as may be reasonably required to give full effect to this Agreement;

c. in the event the Purchaser receives any notices, correspondences, or payments relating to the Irrigation Acres from and after the Date of Transfer, the Purchaser shall immediately forward such notices, correspondences, or payments to the Vendor; and

d. during the period between the Purchaser's acceptance of this Agreement and the Date of Transfer the Purchaser or its representatives shall provide Vendor with access to all contracts, agreements, books, records and files relating to the Irrigation Acres which are in its possession or to which it is entitled or has access, in order for Vendor and its agents, advisors and representatives to review and carry out due diligence examination on all matters which they may consider relevant in relation to the transfer of the Irrigation Acres.

11. CLOSING ARRANGEMENTS

This Agreement shall be completed at 12:10 PM on the Closing Date or such place as the parties may mutually agree.

a. Deliveries of the Vendor

On or before the Closing Date the Vendor shall deliver to the Purchaser the following documents, fully executed by the Vendor or such other parties as may be specified:

i. Transfer. Confirmation from Alberta Environment of transfer of the Assets and amendment of the Water Licence as contemplated herein executed by the appropriate government agent; and

ii. Other. Such other documentation relating to the completion of this Agreement as the Purchaser may reasonably require.

b. Deliveries of the Purchaser

The Purchaser shall deliver to the Vendor the following on the Closing Date:

i. Balance of the Purchase Price due on Closing Date. A certified cheque or bank draft payable to the Vendor or as the Vendor may in writing direct in the amount of the portion of the Purchase Price payable in accordance with Section 2;

ii. Transfer. Confirmation from the AIRD of transfer of the Irrigation Assets as contemplated herein, executed by the appropriate representative; and

iii. Other. Such other documentation relating to the completion of this Agreement as the Vendor may reasonably require.

c. All documents and money described in this Section 11 shall be delivered in escrow at the place of closing on or before the Closing Date. It is a condition of closing that all matters of payment, execution and delivery of documents by each party to the other, the registration of the appropriate documents in the appropriate offices of public record as hereinafter provided, and the fulfillment of all other conditions of closing provided for herein, shall be deemed to be concurrent requirements and it is specifically agreed that nothing will be complete at the closing until everything required as a condition precedent at the closing has been paid, executed, delivered and satisfied.

12. AUTHORIZATION TO MAKE INQUIRIES

Both Parties hereby authorize all federal, provincial, municipal, regulatory and provincial departments and agencies thereof, as required by the other side, to inspect their records with respect to the Assets and Irrigation Area, and to release the results of such inspection and any pertinent information from their files to the other party or their solicitors.

13. GOVERNING LAW

This Agreement shall be governed by and construed in accordance with the laws of the Province of Alberta.

14. ENUREMENT

This Agreement shall enure to the benefit of and be binding upon the parties hereto and their respective successors and assigns.

15. ACCEPTANCE

This Agreement shall be open for acceptance by the Vendor prior to 12:00 PM on the 8 day of June, 2007.

CRYSTAL BLUE LAND CORP.

Per: _____

The undersigned hereby accepts the terms of the above Agreement and agrees to carry out the transaction contemplated herein, this 8 day of June, 2007.

RIVER BEND HUTTERIAN BRETHREN

Per: _____

Per: _____