



BEAVER HILLS INITIATIVE

L'INITIATIVE BEAVER HILLS

LAND MANAGEMENT FRAMEWORK:
A GUIDE TO ACHIEVING SUSTAINABLE
DEVELOPMENT IN THE BEAVER HILLS
MORAINE



2014 Update | BHI Planners Group

EXECUTIVE SUMMARY



The *Beaver Hills Moraine*, an area of 1,595 km² (616 mi²) east of Edmonton, has a distinct hummocky “knob and kettle” terrain. With soils unsuitable for agriculture, much of this area has not been cleared nor cultivated, instead supporting native forests, grasslands and wetlands unlike the surrounding landscape. The distinctiveness of the Beaver Hills Moraine adds to the quality of life enjoyed by residents and others that value the area for its recreational and aesthetic qualities. Local natural resources also contribute key ecological goods and services. However, this landscape is under increasing pressure from development and is at risk of degradation and fragmentation of its natural features.

The *Beaver Hills Initiative* (BHI) is a multi-stakeholder collaboration comprised of five municipalities (Beaver, Camrose, Lamont, Leduc and Strathcona), several federal and provincial protected areas agencies and other organizations with interests in the region. In recognition of the moraine’s special qualities, these partners have come together to promote a regional approach to land management that will protect the moraine’s character.

Partners in the BHI promote a science-based approach to land use planning and management. Together, they have worked to build a foundation of knowledge required to support sustainable development in municipal and other decision-making. In 2007, much of this knowledge was compiled into the *Land Management Framework* (LMF) - a document intended to guide the adoption of sustainable planning practices by member municipalities and other BHI partners.

After seven years of implementation, the BHI conducted a review of the LMF in 2014. They looked at its strengths and weaknesses, as well as how to improve it going forward. Today, this revised document includes:

- A look at current **Environmental Policies** in use by each of the five BHI municipalities, a list of **Key Environmental Features** valued by those living, working and playing in the moraine, and a set of **Principles for Sustainable Land Use Management** shared by the BHI partners (Section 2.0);
- An updated (2014) **Environmental Sensitivities** (previously the Land Management Areas or Blue and Yellow) map for the Beaver Hills area, a list of **Principles** to guide broad level land use planning, and a set of updated (2014) **Resource Risk Maps** (available for viewing in a GIS format online) to provide planners and decision-makers more information on areas where development could affect ecological functions such as groundwater supply, air quality or biodiversity in the moraine (Section 3.0);

- An updated (2014) review of relevant federal and provincial **Environmental Legislation** applicable to proposed developments (Section 4.0);
- A suite of **Best Management Practices** to ensure development is sustainable (Section 5.0);
- Specific **Guidance** for municipal policy-makers (Section 6.0), planners (Section 7.0) and landowners (Section 8.0); and
- **Recommendations** for LMF implementation and performance assessment to improve LMF incorporation into municipal policy and planning documents (Section 9.0).

The 2014 LMF review also provided an opportunity to capture shared learnings and gain a better picture of implementation progress. To highlight how the framework has been used to date, several **Case Examples** are interspersed throughout this document.

Since its release in 2007, the LMF has provided the scientific, evidence-based foundation required by the BHI partners to bring environmental sustainability into economic and social decision-making processes. Expanding on BHI principles, the LMF operationalizes development decisions by providing the level of detail required for practical application. Although this type of environmental analysis at the municipal level is relatively new and not well utilized across the province, the risks and consequences of not using this approach are substantial. If mis-managed, environmental issues such as degraded air quality or water supply lead to a lower quality of life, making the area less attractive to both existing and new businesses and residents. The information and tools provided by the LMF can help identify solutions and develop consensus about mitigating such risks through a fact-based management approach. This will help ensure the moraine continues to provide the quality of life valued by residents, now and in the future.

The LMF is a ‘living’ document. A key lesson learned is that its implementation into municipal operations is a process that takes time. Awareness-raising activities and discussion, as well as continued use and performance measurement by managers and planners will help to fine-tune the framework to the specific interests and capabilities of each partner municipality.

How to Use this Document

The BHI Land Use Framework has been developed in an Adobe PDF format in order to make this document more maneuverable. When opened in Adobe Reader, the document should automatically display a table of contents in the “Bookmarks” section on the left hand side of the page. Clicking on various bookmarks will let you move quickly to the sections you need. Bookmarks can also be expanded or collapsed (by clicking on the + or – signs) depending on the level of detail desired by the user. As a PDF, the document can also be searched using the search or “Find” box (usually at the top of the page), or by clicking on Edit/Search, or by typing control F and entering a search term.

LIST OF COMMON ACRONYMS

ACT	Alberta Culture and Tourism
AER	Alberta Energy Regulator
AESO	Alberta Electrical System Operator
AESRD	Alberta Environment and Sustainable Resource Development
ASP	Area Structure Plan
AUC	Alberta Utilities Commission
BHI	Beaver Hills Initiative
BMP	Best or Beneficial Management Practice
CEAA	<i>Canadian Environmental Assessment Act</i>
EIA/EA	Environmental Impact Assessment/Environmental Assessment
EINP	Elk Island National Park
EPEA	<i>Environmental Protection and Enhancement Act</i>
ER	Environmental Reserve
ESA	Environmentally Significant or Sensitive Area
GIS	Geographic Information System
IDP	Inter-municipal Development Plan
LMA	Landscape Management Area
LMF	Land Management Framework
LUB	Land Use Bylaw
LUZ	Land Use Zoning
MBCA	<i>Migratory Birds Convention Act</i>
MDP	Municipal Development Plan
MGA	<i>Municipal Government Act</i>
MR	Municipal Reserve
NRCB	Natural Resources Conservation Board
PEMA	Priority Environment Management Area (Strathcona County)
SARA	<i>Species At Risk Act</i>

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1.0 INTRODUCTION

ABOUT THE BEAVER HILLS MORAINE



The Beaver Hills Moraine, an area of 1,595 km² (616 mi²) east of Edmonton, is a distinct regional landmark (Map 1). This hummocky “knob and kettle” terrain forms a patchwork of depressional areas, many supporting wetlands and small lakes. The moraine lands have low agricultural capability due to terrain and soil conditions, which has largely prevented clearing for agricultural uses. As a result, the area still supports native forests, grasslands and wetlands, unlike the surrounding landscape.

This combination of local geomorphology, hydrology and climate contributes to the distinctive landscape of the Beaver Hills. The natural greenspace and resulting biodiversity add to its character. Together, these features are in sharp contrast to the surrounding agricultural, urban and industrial lands, where natural habitat has been reduced to smaller discontinuous patches. This relatively intact natural landscape provides key ecological goods and services to the region, such as flood mitigation, provisioning of clean air and water, as well as cultural and aesthetic character. For more information about the ecology of the Beaver Hills Moraine and the services it provides, see the [Beaver Hills Ecological Primer](#).

The Beaver Hills lie within five counties (Beaver, Camrose, Lamont, Leduc and Strathcona). There are also several federal and provincial protected areas located entirely within the moraine including Elk Island National Park, Ministik Game Bird Sanctuary, Cooking Lake - Blackfoot Recreational Area, Miquelon Lake Provincial Park and a number of smaller provincial natural areas. Beaverhill Lake, a designated RAMSAR site (a Wetland of International Importance), lies to the east but is beyond the moraine itself. The North Saskatchewan River is within five kilometers to the northwest but is also beyond the moraine. The moraine plays a key role in regional linkages to these areas, and at a broader scale, with the Dry Mixedwood Boreal Forest north of the North Saskatchewan River and the Aspen Parkland to the south.

The moraine landscape is part of the quality of life valued by area residents and others that enjoy its recreational and aesthetic values. However, this area is under increasing pressure due to development. Today, the Beaver Hills ecosystem is at increasing risk of fragmentation and degradation of its natural features. This pressure has the potential to result in significant ecological deterioration and biodiversity loss. This in turn could affect the social and economic well-being of local communities and the quality of life of local residents and visitors to the moraine.

ABOUT THE BEAVER HILLS INITIATIVE

The Beaver Hills Initiative (BHI) is a multi-stakeholder collaboration comprising the five municipalities within the Beaver Hills Moraine, as well as several federal and provincial protected areas agencies, and other organizations with interests in the area. In recognition of the moraine's distinctiveness, these partners have come together to promote a regional approach to land management in the moraine that will protect those natural elements that contribute to its character.

The BHI emphasizes working together through shared initiatives and coordinated action among all of its partner agencies. It also emphasizes voluntary participation, believing that sustainable management should be consensus and science-based in order to succeed. In addition to a vision and mission, the BHI has developed a number of guiding principles to focus its work. For more information about the BHI and its activities, see their [website](#).

The BHI promotes informed decision-making that considers environmental, social and economic factors in achieving sustainable land management.

- **BHI Vision:** *The Beaver Hills Initiative values the region for its natural beauty and quality of life and supports co-operative efforts to sustain its quality of water, land, air, natural resources and community development.*
- **BHI Mission:** *Working together for a sustainable region, through shared initiatives and coordinated action.*

BHI Guiding Principles:

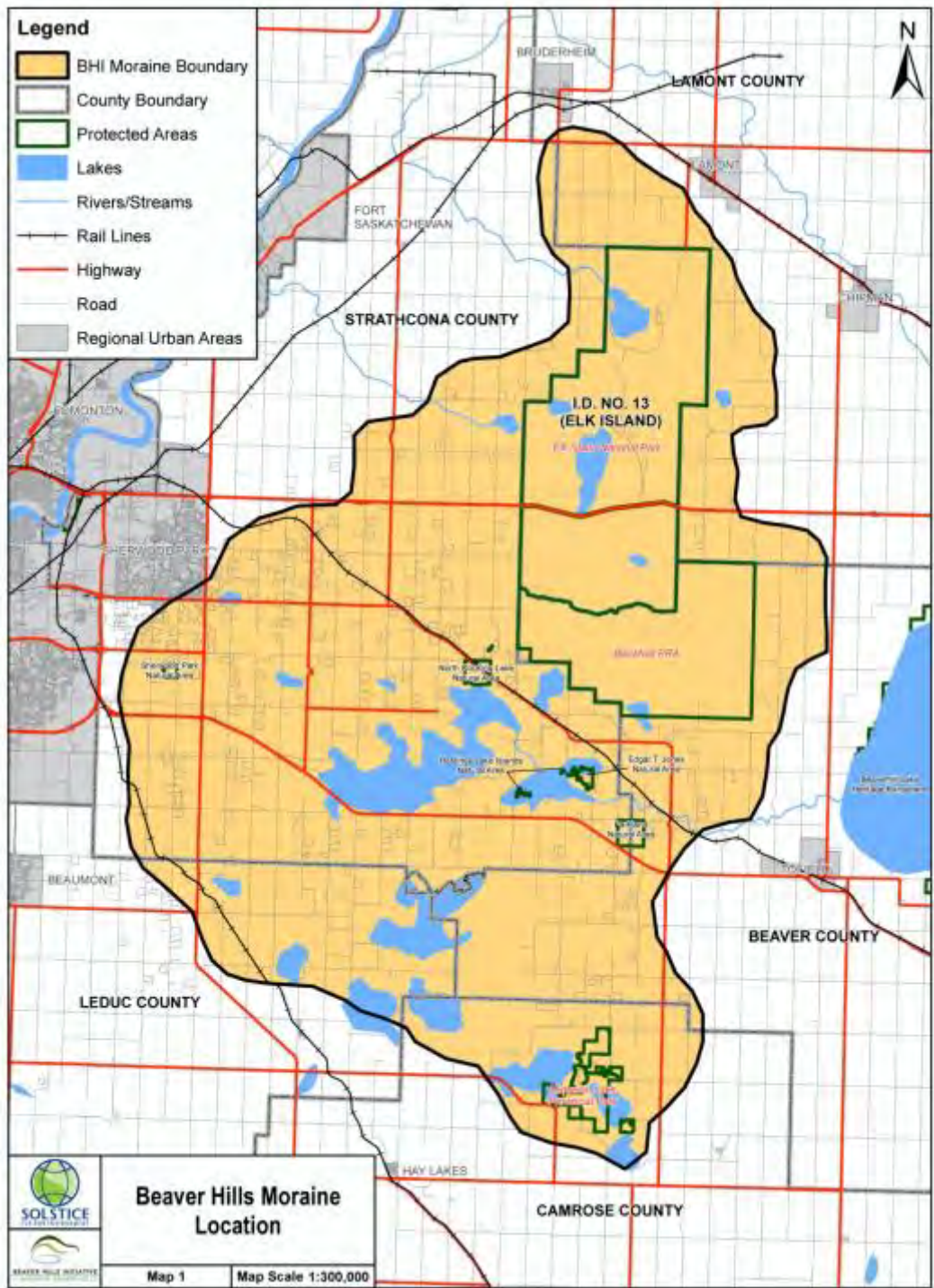
- Respect **appropriate use of land and water** and the **importance of our natural environment** in maintaining or improving our quality of life.
- Foster **long-term land use planning** with clear consistent goals and objectives.
- Promote **regional coordination** by reflecting the regional vision in all municipal land use policies, plans and actions.
- Success requires **community participation, input and support**.
- **Conserve, enhance and monitor** improvements or monitor impacts to the environment.
- Success requires **commitment and leadership** from all levels of government.
- Strive for a **common level of data** (identify critical data needed, improve access and share where appropriate).
- Determine **habitat required** and strive to ensure that the **optimum amount** is maintained.
- Each partner area has a **responsibility to the environmental, social and economic well-being** of the region.

More about the BHI

The BHI is involved in several collaborative projects to manage the moraine sustainably by building knowledge through research, supporting other jurisdictional initiatives and helping to raise awareness among partner agencies and the public. For example, the Beaver Hills Initiative is preparing a nomination for the Beaver Hills Moraine for designation as a *UNESCO Biosphere Reserve*. If obtained, this designation would provide global recognition of the community's commitment to conservation planning and sustainable development. In and of itself, the Biosphere Reserve designation will not affect legislation, policy, permitting or enforcement processes. The LMF is the management tool that will accommodate change management in the Beaver Hills. Hence, implementation of the LMF tool will support the nomination.

The BHI is also working on a State of the Moraine report - a 'snap-shot' showing the condition of the moraine as it is today. This will provide a baseline for future performance measurement of management actions against set criteria. The document will also be a good communications tool for engaging all parties in sustainable land management including landowners, developers, government and non-governmental agencies.





ABOUT THE 2007 BHI LAND MANAGEMENT FRAMEWORK

In 2006, the BHI envisioned the creation of a *Land Management Framework* (LMF) that would guide the adoption of sustainable planning practices by member municipalities. At that time, the status of environmental policy among the BHI partner municipalities was examined. This included looking at the similarities and differences between Municipal Development Plans, Land Use Bylaws and non-statutory environmental policies. It also looked at the tools available to manage environmental resources within the Beaver Hills. This work concluded with a recommendation to develop and implement consistent policies as a package or framework of management practices that could be adopted by each Council. Hence, the LMF document containing such information was drafted and approved in 2007.

The LMF approach supports land use decision-makers providing a consistent, science-based foundation for land use decisions that determine the right land use in the right place.

The 2007 LMF provided the evidence-based foundation for land use decision-making that, ideally, would result in sustainable development. It provided a practical aid for taking a consistent, systematic approach to planning and decision-making to achieve regional coordination of land use planning. It expanded on BHI principles, operationalizing development decisions by providing the details necessary for practical application.

The 2007 LMF introduced a subtle change into the land management approach of the time. Hence, it was introduced gradually into municipal planning operations, at the discretion of each municipality. Implementation was based upon building understanding and a consensus among land use decision-makers regarding good environmental practices and appropriate land uses in defined zones. Natural resources, manpower, knowledge, environmental issues and political context vary within each of the municipalities. The 2007 LMF implementation process acknowledged and allowed for these differences.

Implementation was also seen as a long-term process. Development of the LMF focused on preparing materials that the municipalities and the BHI could use to promote internal and public awareness. The components comprising the 2007 LMF were packaged as a reference manual that was then promoted within the planning departments of the municipal partners and, opportunistically, the public. The material was also used to promote municipal and public awareness of the necessity and means for action, an important preparatory step before attempting to adopt the framework into policy. Adoption of the LMF into formal Land use Bylaws (LUB) or the broader Municipal Development Plans (MDP) was intended to follow at a later date, voluntarily as policies were renewed and at the discretion of each municipal partner. Incorporating the guidelines most suited to their landscape and their political and public environment, changes would be made by the individual municipality.

ABOUT THE 2014 LMF UPDATE

When it was first developed (2007), the 2007 LMF was noted as “*having the potential to be one of the most significant products provided to the BHI’s municipal partners...*” (BHI Strategic Plan 2006-2009). Seven years have now elapsed and uptake and implementation of the 2007 LMF has varied across the BHI municipalities. In 2014, as the BHI moved forward with the UN Biosphere Reserve nomination, the Planners Group decided to take a second look at the LMF, since it is identified as a key management tool in the application. Planners wanted to determine if LMF content (including data and models) needed updating, if the document and tools within it could be improved, and if examples of success or barriers to implementation could be captured and shared.

Work on the update project was carried out by first utilizing a survey and one-on-one interviews with users; then collecting new data layers and fine-tuning models and maps; and finally, updating the LMF document. This 2014 updated document now combines and replaces the 2007 LMF Phase 1 and 2 reports and includes the following components:

- A look at current **Environmental Policies** in use by each of the five BHI municipalities, a list of **Key Environmental Features** valued by those living, working and playing in the moraine and a set of **Principles for Sustainable Land Use Management** shared by the BHI partners (Section 2.0);
- An updated (2014) **Environmental Sensitivities** (previously the Land Management Areas or Blue and Yellow) map for the Beaver Hills area, a list of **Principles** to guide broad level land use planning and a set of updated (2014) **Risk Maps** (also available in a GIS format for viewing online) to provide planners and decision-makers more information on areas where development could affect ecological functions such as groundwater supply, air quality or biodiversity in the moraine (Section 3.0);
- An updated (2014) review of relevant federal and provincial **Environmental Legislation** applicable to proposed developments (Section 4.0);
- A suite of **Best Management Practices** to ensure development is sustainable (Section 5.0);
- Specific **Guidance** for municipal policy-makers (Section 6.0), planners (Section 7.0) and landowners (Section 8.0); and
- **Recommendations** for LMF implementation and performance assessment (including a suite of indicators that municipalities could use to track progress) (Section 9.0).

The 2014 LMF review also provided an opportunity to capture shared learnings and gain a better picture of implementation progress. To highlight how the framework has been used to date, several **Case Examples** are interspersed throughout this document.

Case Example #1 – Using the Land Management Framework for Broad Scale Land Use Planning: The West End Growth Management Plan (Beaver County)

The Challenge

Beaver County's section of the Beaver Hills Moraine (the "West End") is attractive for rural residential development and thus subject to growth pressures from the Capital Region. West End residents value the natural landscapes and lower density relative to neighboring Strathcona County.

Beaver County also recognizes the economic potential of this area from recreational activities and nature-based tourism - dependent on the area's natural features. Current growth pressure is low, but rising. Subdivisions created in the 1980s have been taken up slowly. County administrators, recognizing this growth trend, saw the need for a proactive policy to protect existing quality of life and future economic development options.

This area is in contrast to the rest of the County, where large-scale agriculture dominates and rural residential development is negligible. Existing policies focus on agricultural land use. Although conservation is of interest to local landowners, no specific policy was in place for the West End. Hence, the County initiated the *West End Growth Management Plan* process to set development and conservation goals for the West End.

The Process

Beaver County identified the West End as part of the moraine and identified the need, as members of the BHI, to promote conservation on those lands. Members of the BHI were invited to present information on the BHI, the moraine and tools for sustainable land management. Presentations were made to the public and a steering committee was formed to help guide policy formation. Maps were used to highlight sensitive lands in the area, the factors influencing the ecological function of the landscape, and the distinctiveness of the moraine relative to surrounding lands.

County administrators also provided information on the cost of servicing rural residential development, to counter the misperception of its taxation benefits. This information helped the steering committee come to consensus on conservation and balanced growth as goals for the plan. The committee then moved on to discuss appropriate densities - a key hurdle. Density scenarios helped the committee to visualize the impact of development on sensitive features. Discussions about potential mitigation provided by conservation measures helped the group evaluate the options relative to their goals.

After reviewing various options (status quo of 32 parcels/quarter section or 8 parcels with no conservation, 8 parcels with conservation), the group settled on eight parcels per quarter, with conservation options (e.g., conservation easements). The West End Growth Management Plan then became a special set of policies specific to the moraine area within Beaver County's Municipal Development Plan and Land Use Bylaws.

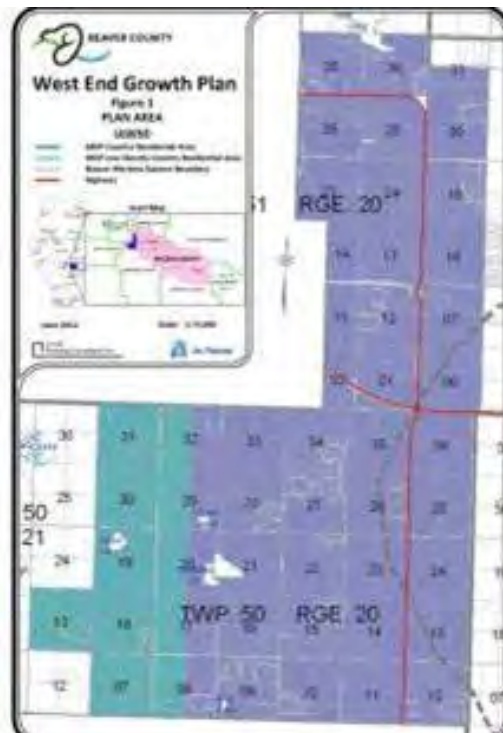
How the BHI and the LMF Helped

Public awareness of the moraine as a special place fostered by BHI information and presentations contributed to the success of this process. Information and maps from the BHI's Land Management Framework (LMF) raised awareness of conservation need, but also helped identify options to meet stated goals and the background to test them through density scenarios.

Natural sensitivities were very obvious and important to landowners. Differentiating the moraine from the rest of the landscape was important to prove its uniqueness and to validate the need to balance conservation and future development. Open sharing of information, a benefit of membership in the BHI, also influenced the process. The balanced development goal became a touchstone for all future planning discussions.

Mapping and scenarios helped visualize the impacts of density scenarios and evaluate Best Management Practices like conservation easements and the transfer of development credits. The steering committee was able to come to consensus on a traditionally difficult planning issue - appropriate development density - and establish public support for the means of achieving conservation goals in a

relatively painless process. The public support generated by an informed decision-making process may have more influence on future planning and development. As an example, a landowner recently volunteered to dedicate as an Environmental Reserve half of a parcel proposed for subdivision, in recognition of its natural values.



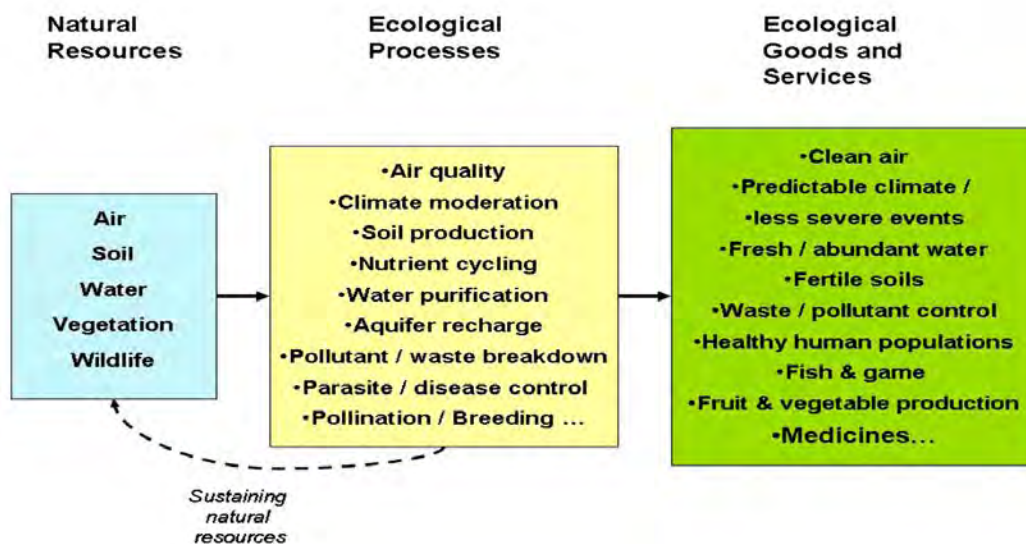
2.0 POLICIES & PRINCIPLES FOR SUSTAINABILITY IN THE BEAVER HILLS

INTRODUCTION TO SUSTAINABLE LAND MANAGEMENT

With the global human population increasing sharply since the 1800s, landscapes have been transformed to provide space and resources for this growth. Human land use now covers 83% of the world's land and globally, human land use is one of the most serious threats to biodiversity.

Only 16% of lands outside the Polar Regions support large, undeveloped wilderness. Area for those species requiring large ranges is increasingly limited. The biodiversity within these large tracts is similarly threatened because large wilderness areas are often isolated within developed or semi-developed landscapes. The same scenario is occurring at smaller scales with habitat loss and fragmentation occurring in agricultural and urban fringe lands, reducing the size of remnant natural areas, increasing their isolation and placing their biodiversity at risk.

Loss of species is not just an aesthetic or ethical issue. Increasingly, we recognize that the natural goods and services on which we depend are critically linked to diverse ecosystems. The ecological processes responsible for air quality, water quality and abundance, soil production, nutrient cycling, climate moderation, pollination, breakdown of pollutants and waste, and control of parasites and disease all rely, to some extent, on diverse plant and wildlife communities.



Ecological goods and services and the aesthetic and spiritual values related to the landscape represent the quality of life for which our communities strive. Globally, land managers (government agencies and private landowners) have adopted science-based management systems that incorporate adaptive management, risk assessment and conflict resolution, to help ensure that these ecosystems and their associated benefits are sustained on the landscape.

The BHI has taken this concept to heart, consistently promoting a collaborative, science-based approach to land-use planning. The LMF provides a means to assess and manage risk, allowing each land manager the ability to evaluate openly the trade-offs that may be required to achieve sustainable land use with minimal conflict. This process has the added benefit of developing consensus among all stakeholders and the public. The BHI is also involved in several other collaborative projects to manage the moraine sustainably by building knowledge through research, supporting other jurisdictional initiatives, and helping to raise awareness among partner agencies and the public.

A Historical Look at the BHI Counties

In the past, a sustainable management approach has been applied somewhat inconsistently in statutory plans and policies among the BHI partners. In many cases, this is a result of past development pressure and planning focus. Lamont, Beaver, Leduc and Camrose counties are primarily dominated by agricultural land use. Naturally vegetated areas are few and typically small; larger areas have already been protected by other jurisdictions (e.g., Miquelon Lake Provincial Park and Game Bird Sanctuary and Ministik Game Bird Sanctuary). The moraine also comprises a relatively small part of the lands under their control and is an anomaly in terms of its typical land management issues. Rural residential demand in their parts of the moraine, and the associated impact on environmental, social and economic resources, has been minimal until recently.

Strathcona's landbase, on the other hand, is dominated by the moraine and much of it remains naturally vegetated. Due to their proximity to the City of Edmonton, the natural features of the moraine were the first to face high demand for rural residential development, pressures that have steadily increased since the 1980s. Hence, Strathcona has had much opportunity to discover unforeseen environmental consequences and to develop policy to deal with those pressures. Not surprisingly, their statutory plans have long incorporated an environmental focus.

Today, however, the need for sustainable development is no longer driven entirely by existing development pressure but also by the threat of future pressure and the corresponding loss of the quality of life valued by residents. For many of the partner municipalities, this is new ground, with nothing other than the threat of development to justify the need for change. Again, the BHI offers the information required to make informed decisions in this uncharted territory, and the participation of the partner municipalities in the initiative recognizes the inherent value in such collaboration.

SUSTAINABLE DEVELOPMENT POLICIES IN THE BEAVER HILLS

Existing municipal policies among the BHI partner municipalities have been reviewed to determine their level of consistency in environmental management. Understanding where opportunities lay to incorporate conservation planning and sustainable development into local land use planning is an important first step in coordinating land management within the moraine. Over the past decade, most BHI municipalities have updated their statutory documents and most have added some aspect of the LMF's environmental practices into those documents.

All five municipalities have added specific environmental goals, objectives and implementation policies into their Municipal Development Plans (MDP), Land Use Bylaws (LUB) and other non-statutory policies (Tables 1 and 2). Most now address country residential development, either in the moraine or across the county. Some have also identified specific policies for eco-tourism and small agricultural developments. Yet the approach and level of detail in addressing environmental concerns still varies considerably among the municipalities. This appears to be driven by differences in the character of the lands administered by each municipality, the land use pressures they now face and the interest of residents in growth, social and environmental issues. Agriculture is clearly a valued aspect of the economy and character of all five municipalities and remains a central focus of their MDPs.

Over the past decade, all five BHI municipalities have strengthened environmental considerations in their policy documents.

Some of the municipalities have now acknowledged the moraine as a distinctive part of their land base and an asset to be protected. Most municipalities clearly want to manage economic development to maintain the character of their community however only two have explicitly identified sustainable development as a goal. Leduc County's MDP emphasizes diversification of economic opportunity but seeks to limit development in environmentally sensitive areas (ESAs). Camrose and Lamont counties aim to direct growth to specific locations to minimize impact on agricultural lands and key environmental areas identified by themselves or other agencies. Strathcona and Beaver counties have both attempted to strike a balance by identifying appropriate zones for development to maintain the distinctive rural and environmental features of their communities and of the moraine. The types of statements included in MDP and LUB documents may be an artifact of the definition of environment in the provincial *Municipal Government Act* (MGA). The MGA considers the environment in only three contexts:

- Environmental features that pose a threat to development and should be considered in development proposals ("hazard lands");
- Lands that should be protected by the municipality for environmental reasons, typically those same hazard lands or lands suitable as park resources (Environmental and Municipal Reserves); and

- Lands of significance within the local environmental context that could be managed through landowner agreements (conservation easement provisions or other management provisions within the Subdivision Regulation).

In the past, most of the BHI municipalities had addressed only the first two aspects of the environment. Few had taken advantage of their authority under the MGA to manage locally significant lands. Today, most of these municipalities have defined circumstances for the use of conservation easements or broadened their definition of environmental and municipal reserves.

For example, Camrose County's new MDP allows the county to take lands supporting groundwater recharge or discharge as environmental reserve. Strathcona County can claim 'Priority Environmental Management Areas' (PEMAs) as environmental or municipal reserve or encourage use of a conservation easement to protect them. Beaver County has a similar policy in its MDP. Leduc and Lamont counties have retained the past definition of environmental reserve, though, and have no mention of conservation easements in their policies.

Municipalities are using tools under the Municipal Government Act, such as environmental and municipal reserves and conservation easements, to protect environmental resources throughout the Beaver Hills Moraine.

Within their LUBs, the five municipalities again have considerable variation in environmental regulations and the resources addressed (Table 2). Wastewater treatment is consistently addressed in most LUBs (mainly restating provincial requirements) and water supply is sometimes considered (e.g., country residential zones in Camrose). Tree and vegetation removal is also restricted through statutory means in all policies. Camrose County has specifically established water and vegetation controls around recreational lakes and in its two country residential districts. Strathcona and Leduc also provide statutory requirements for Dark Sky lighting. Leduc and Strathcona are the only municipalities to require a comprehensive environmental assessment for any development, although Leduc limits those assessments to lands within an ESA.

Hence, a coordinated suite of resource guidelines has yet to be adopted by all municipalities. New policies reflect the environmental resources considered important to councils and residents. Yet there is a growing municipal recognition of the moraine. Strathcona County and Beaver County have identified the moraine explicitly in policy and Camrose County has developed the Miquelon Area Structure Plan for its part of the moraine. Leduc recognized the moraine in a recent update study of its ESAs. Lamont has yet to identify specifically the moraine in mapping or in policy but it does recognize the BHI for referral of development proposals. Despite these differences in approach, significant strides are being made in terms of incorporating environmentally sustainable practices into the policies of each municipality.

Table 1. Municipal Development Plan Policies for Sustainable Land Use in the Beaver Hills Moraine

Legend: Yes No

MDP Component	Nature of Provision	Strathcona (2007)	Beaver (2013)	Leduc (2004)	Lamont (2007)	Camrose (2013)
Goals and Objectives	Environmental (General)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Sustainable Development	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Beaver Hills (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Beaver Hills Moraine Map / Planning Area	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agriculture	Environmental Protection Provisions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Diversified (Small Parcel) Agriculture Policy	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Beaver Hills (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Country Residential	Environmental Protection Provisions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Beaver Hills (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Biophysical assessment (EIA)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Maximum lot density	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Environment/Wildlife	General	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Beaver Hills (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Historical Resources	General	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Tourism / Ecotourism	General Policy	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Beaver Hills (Specific)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conservation Tools	Environmental Reserve (MGA definition)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Environmental and other reserves (broader definition)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	GW, WL*
	Conservation Easements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	GW
Riparian Protection	Riparian Area Protection (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Water (surface & groundwater)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Implementation	Environment (Specific)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Definitions	Environment (wildlife, water, & habitat)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* GW = Groundwater, WL = Wildlife

Table 2. Land Use Bylaw Policies for Sustainable Land Use in the Beaver Hills Moraine

Legend: Yes  No

Land Use Bylaw Component	Nature of Provision	Strathcona (draft 2014)	Beaver (2013)	Leduc (2008)	Lamont (2007)	Camrose (2014)
Application Requirements	EIA/ESA/Other Specific Requirement	√		√	√	
	Additional Information (Non-Specific)		√			√
Application Referrals	General Requirement	√	√	√	√	√
	Environment (Specific)	√		√	EINP	
General Regulations	Environmental Standards	√	√	√	√	√
Land Use Districts	Country Residential (CR) (with lot size for each applicable zone)	(2 – 4.9 ac.) (2 – 4.9 ac.) * (0.3 ac.) *	(3 ac.)	(2.5 – 9.88 ac.) (1 – 3 ac.) (0.33 – 1.48 ac.)	(1 ac.)	(1 ac.) (5 ac.)
	Environment/Conservation	Conservation Zone		Lakes Watershed (2.5-4.9 ac. – CR) (19.8 ac-woodlot)		Watershed Protection (16 ac.)
	Other District	Rural Residential / Ag (19.8 – 80 ac.)		Rural Residential /Ag (80 ac.)		Lake Resort Low Density Lake Resort
	Tree Removal or Other Restriction	√	√	√	√	√
Definitions	Environment or Related Terms	√		√		
Non-Statutory Requirements	Environmental Protection	√				

* With conservation-minded planning and connections to municipal servicing, higher density permitted.

KEY FEATURES AND SHARED PRINCIPLES FOR SUSTAINABLE LAND USE

To combat some of the issues around differing environmental policies and their application between the five counties, the BHI partners agreed to a list of key features of the moraine that should be considered in planning decisions. These key features include:

- Quality of Life
 - Essential Character
 - Property Rights
- Biodiversity
 - Wetlands
 - Native Upland Habitat and Corridors
 - Species of Concern
- Water
 - Watersheds
 - Water Quality
- Land
 - Land Use
- Air
 - Air Quality

The BHI partners also developed a set of principles around these key features. In carrying out their mandate to make decisions on land use regulations, these principles serve as guidelines to municipal and other government decision-makers.

1. Quality of Life

Essential character: *The essential character of the Beaver Hills will be conserved in its natural beauty, clean and unspoiled environment and quality of life.*

- Conserve the present character and quality of the moraine landscape by protecting those aspects of the landscape valued by its residents and visitors for their distinctive natural or cultural configuration.
- Maintain patches of woodlands and wetlands that now form linkages between or surround Green Areas Protected Areas and support a variety of plant and animal species.
- Maintain natural areas that provide the aesthetic feel of abundant greenspace and consider those sites that, if allowed, could return to a more natural state.

Property rights: *We will respect existing land use designations. We will respect the rights and responsibilities of private and public landowners and enlist their voluntary cooperation to manage their lands and the resources of the Beaver Hills in a sustainable manner.*

- Allow current individual land management practices to continue but promote sustainable practices where issues are identified.
- Provide incentives for rehabilitation of natural features damaged by past and current land use.
- Revise existing land uses proposed within planning documents if they are determined to pose a risk to sustainability of natural features.
- Maintain the distinctive aesthetics (character and quality) of the area associated with natural features.
- Engage in coordinated inter-agency land management strategies to manage broader issues (e.g., wetland restoration, weed and disease control, etc.).
- Encourage environmentally friendly residential, industrial, recreational and agricultural practices.
- Plan for future development consistent with BHI Land Management Principles.

2. Biodiversity

Wetlands: *Existing natural wetlands and their associated riparian upland margins will be conserved both in regards to their biodiversity and functional aspects.*

- Conserve intact wetlands where possible, particularly those critical to the hydrology of the Beaver Hills Moraine.
- Focus development near less critical wetlands.
- Provide a riparian buffer on wetlands to preserve water quality and biodiversity.
- Abide by the provincial Wetland Policy (i.e. avoid, minimize or mitigate loss of wetlands).

Native Upland Habitat and Corridors: *Development will retain native upland habitat (woodlands and grasslands) prominently featured within the Beaver Hills to maintain the majority of the existing greenspace and its associated biodiversity. Connectivity of habitat will also be retained such that continuous corridors remain within the Beaver Hills and between it and the surrounding region.*

- Maintain existing green spaces that provide habitat and wildlife corridors.
- Fill in gaps in wildlife corridors between Protected Areas to form a band not less than two kilometres wide.

- Focus restoration on fragmented or disturbed habitats that can support healthy natural ecosystems or provide linkages with other habitat in other landscape units.
- Focus expanded development on areas most suited to agricultural, industrial, recreational or residential land use.
- Direct new development to cleared, disturbed, isolated and fragmented areas with existing infrastructure to support development.
- Encourage environmentally sustainable development and land management practices.

Species of Concern: *Promote land use and land management activities that will not compromise the ability of currently present rare and sensitive species or species important for human use to persist in the Beaver Hills.*

- Conserve habitat demonstrated to support species of concern and, where possible, adjacent habitat that could support other populations of such species.
- Retain habitat, including fragmented areas that will help sustain species of concern, on an opportunistic, site-by-site basis.
- Encourage education, awareness and voluntary action to conserve rare species and their habitat.

3. Water

Watersheds: *Maintain function of local watersheds to sustain regional surface and groundwater systems.*

- Maintain intact watershed features that are critical to the hydrology of the Beaver Hills Moraine.
- Rehabilitate disturbed areas that are critical to natural hydrology.

Water Quality: *Sustainability of local watersheds to maintain the water quality of surface and groundwater systems.*

- Manage wetlands and their riparian buffers to protect water quality.
- Permit those land uses that incorporate measures to protect water quality of waterbodies within and adjacent to the property.
- Abide by letter and intent of federal and provincial legislation regarding surface and groundwater.

4. Land

Land Use: *Support an appropriate mix of agricultural, industrial, recreational and residential development in areas with lower environmental sensitivity and maximum potential for sustainable business operations, thus maintaining the character of the distinctive landscape.*

- Continue existing agricultural, residential and industrial land uses that complement the ecological integrity of adjacent natural areas, and particularly, protected areas.
- Focus future development in areas with existing infrastructure (e.g., roads, water and wastewater, schools, etc.) to minimize additional development requirements.
- Consider minimal impact designs for future developments.
- Encourage land use that supports quality of life goals held by residents in the more natural parts of the moraine.

5. Air

Air quality: *Industrial growth in the region will maintain the clean air and current air quality valued by Beaver Hills' residents.*

- Maintain current air quality standard.



CASE EXAMPLE #2 USING THE LMF TO SUPPORT DETAILED LAND USE MANAGEMENT: MIQUELON LAKE AREA STRUCTURE PLAN (CAMROSE)

The Challenge

Camrose County's section of the Beaver Hills Moraine is rugged and dominated by knob and kettle terrain and water. A large part of this area is already protected within Miquelon Lake Provincial Park and Bird Sanctuary, which links to Ministik Bird Sanctuary, just outside the County's northwestern border. Adjacent privately held lands, with soil quality too poor for agriculture, have retained significant natural forest cover.

This natural landscape is attractive for rural residential and commercial recreational development. Both have grown in recent years, although the few existing subdivisions are not yet fully occupied. The area has limitations for water supply and septic treatment. It has few paved roads and its distance from adjacent urban areas constrains provision of other services (i.e. ambulance, fire and recreation). Recognizing the need for a growth management plan to proactively guide development and mitigate the potential for speculative land development, the County hired a land use-planning consultant to complete an Area Structure Plan.

The resulting draft plan ran into some opposition at its public presentation. This was due in part to confusion about the implications of its modest development limitations. To respond to this reaction, the County formed a citizen advisory group to review the plan and agreed to adopt its recommendations after public comment on its findings. Future adoption into policy remained an open question, pending the results of the review and public comment.

The Process

Advertising for members of an advisory group attracted 11 applications from local residents. The group represented various interests and educational backgrounds including members with environmental training and farmers or rural residential landowners with an interest in development. The Planning Manager and two ex-officio councilors supported the group.

A presentation to the group by the Beaver Hills Initiative (BHI) helped to put information into a regional context, emphasizing the moraine's distinctive natural resources and regional environmental significance. In preparing the plan, the consultant team had used mapping information and Best Management Practices (BMPs) from the BHI's Land Management Framework (LMF). This background was provided to the advisory group along with other relevant information.

The group reviewed the plan closely over several months, meeting frequently to discuss each section of the plan and making revisions based on consensus. They periodically asked for additional information to clarify planning rationale and inform discussion. Their final review document contained relatively minor changes to the plan and largely upheld its recommendations.

The group presented the amended plan to Council. Then, at a public hearing, they recommended plan approval. With considerable public support for the plan, Councilors approved it and council subsequently adopted it into policy as the *Miquelon Lake Area Structure Plan*. The advisory group members have maintained a sense of community, coming together for other, unrelated initiatives. The County has adopted this inclusive model for other area structure plans now underway.

How the BHI and LMF Helped

The original plan was presented to the public assuming broad-level understanding of the land use planning process and consensus on a sustainable land management approach. Preliminary public consultation made it clear that residents valued the moraine's natural resources and its contribution to their quality of life. However, understanding of the regional environmental significance of the moraine and need for its conservation were not shared by all. Recommendations for development controls thus appeared to have no justification, particularly in light of a lack of familiarity with the subdivision planning process, ecological management principles and assumptions regarding individual land 'rights'. The implications were unclear and thus, residents resisted the original draft proposal.



Presentation of the underlying information supporting the plan, including the LMF maps and BMPs, helped clarify the rationale behind plan recommendations. The group was also able to establish a shared interest in conserving the natural character of the moraine as one of the main goals for the plan. This set the stage for later discussion of development limitations. Information alone was insufficient. Key members within the group were able to translate concepts, describe implications of choices on the moraine's resources and legitimize BMPs as standard practice. This helped the group develop a shared, deeper understanding and trust in the plan.

The final revised plan increased some development restrictions, with full support of the group. Unanimous endorsement by such a diverse group satisfied the concerns of other residents and gave politicians firm direction, building support for the policy before adoption. This process thus avoided the potential backlash experienced earlier with the traditional top-down approach. Instead, the consensus-building process led to a new sense of community among residents. Informed decision-making, supported by the LMF, played a critical role in achieving this public consensus.

3.0 ENVIRONMENTAL SENSITIVITY AND RESOURCE RISK MAPS

ENVIRONMENTAL SENSITIVITY MAP

To better understand and manage valued natural features in the Beaver Hills Moraine, a geographic information system (GIS) analysis (originally conducted in 2007) was updated in 2014. This analysis revised the original *Land Management Areas* or *Blue and Yellow Map* as a more clearly titled Environmental Sensitivity Map (Map 2).

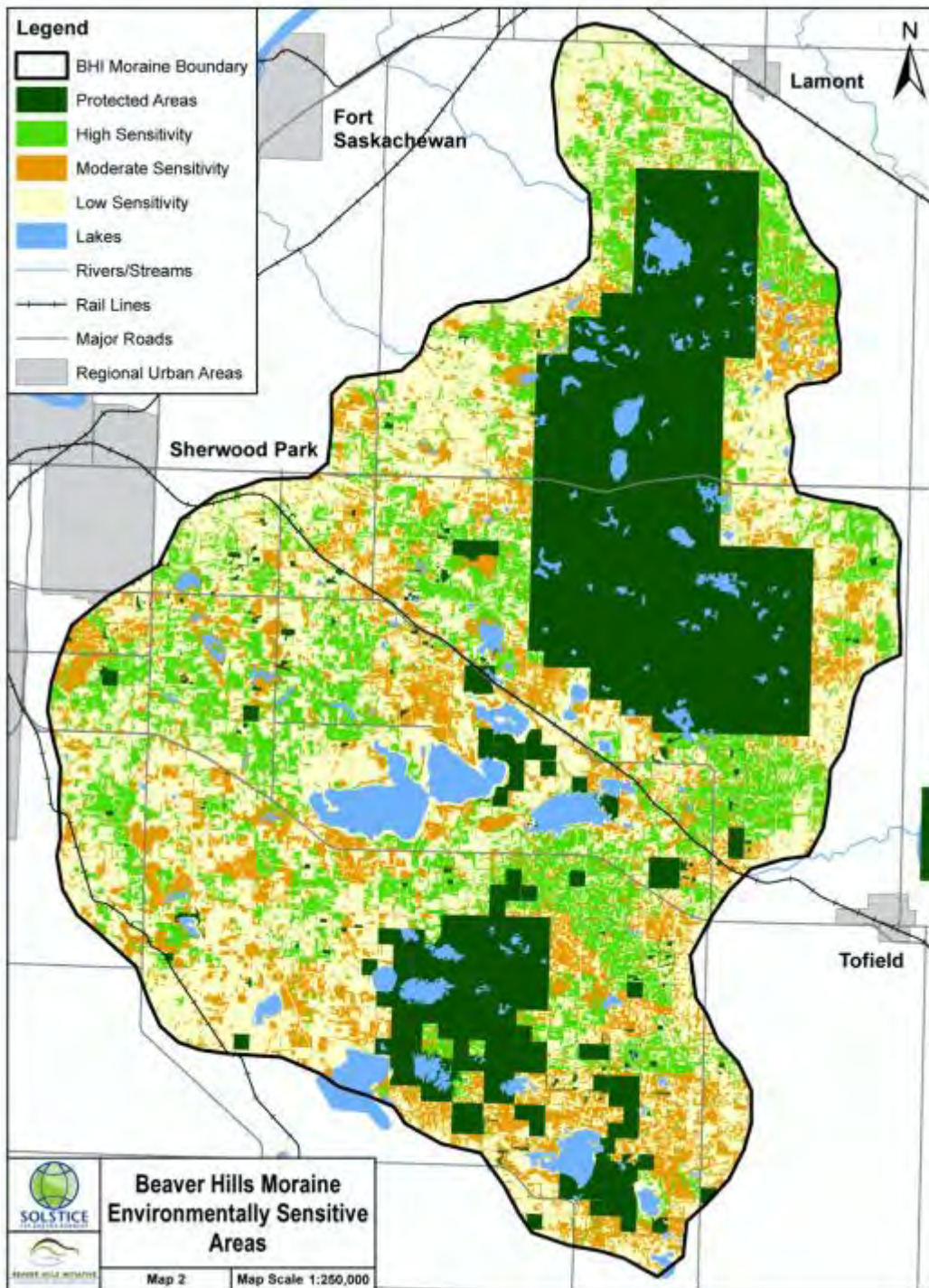
Previously, *Land Management Areas* (LMA) in the Beaver Hills Moraine were based on the presence of biophysical features representing the BHI's Land Management Principles. The combination of these elements in a given location determines its potential management needs. The 2014 Environmental Sensitivity Map used a similar approach. Protected Areas are existing protected areas managed for conservation by federal, provincial, municipal or environmental organizations. High Sensitivity Areas contain several sensitive features including natural water, high biodiversity and wildlife corridors. Moderate Sensitivity Areas are lands with some natural features but low biodiversity. Low Sensitivity Areas contain limited natural ecological features. All three of these sensitivity areas lie within municipal jurisdiction. Protecting landscapes with valued natural assets (High and Moderate Sensitivity Areas) from extensive or inappropriate development is required to satisfy the BHI's Land Management Principles.

The distribution of High and Moderate Sensitivity Areas, the two areas with relatively abundant environmental features, roughly follows the pattern of either surface water, forested lands or groundwater recharge zones. The other factors in the model (rare species and lower capability agricultural soils) tend to coincide with these features and are, in fact, what separates the two classes.

As seen from Map 2, key areas are the mostly continuous High Sensitivity Areas along the length of the moraine (its 'spine') and extending west toward Sherwood Park. These areas often provide links to protected areas and the more discontinuous High Sensitivity areas associated with water features through the rest of the moraine. The Moderate and Low Sensitivity Areas that fill the rest of the moraine lands are not without value. They buffer High Sensitivity lands from potential disturbance and provide vital linkages between High Sensitivity areas, protected areas and other significant ecological features outside the moraine (e.g., the North Saskatchewan River).

The maps in this document can be seen in a GIS format by going online to the Solstice Canada map viewer at:

http://geo.solsticecanada.com:8080/solsticemap/indexBHI_AI.html



Strathcona County and the Environmental Sensitivities Map

Strathcona County is unique in that half of the county lies within the Beaver Hills Moraine. It is also unique due to the character of the moraine in this area. The land slopes to the northwest, being particularly steep in the northern area. Thus, in addition to the lakes and wetlands found throughout the moraine, numerous drainage channels also run through the county. As a result, many of the High Sensitivity Areas (which tend to be concentrated around lakes, wetlands and streams) in the more developed parts of the county are related to these drainage courses. There is no transition to predominately Moderate Sensitivity Areas at the edges of the moraine as there are in the other BHI counties.

Residential development in Strathcona has expanded east from the Edmonton area, while industrial development has concentrated at the eastern and northern edges of the county. Although there has been some clearing for agriculture and country residential subdivision within the moraine, large areas of forested lands and wetlands remain in the eastern part of the county. These privately held lands, together with the forested lands to the east in Beaver County, provide a continuous link from Elk Island National Park to the north through the Cooking Lake/Blackfoot Provincial Recreation Area and Ministik Game Bird Sanctuary and Miquelon Lake Provincial Park and Game Bird Sanctuary to the south. These forested lands surrounded the protected areas on all sides, with the exception of cleared lands in the center of the moraine's 'spine', between Cooking Lake, Hastings Lake and the Cooking Lake/Blackfoot Reserve boundary, in both Strathcona and Beaver Counties. These lands have good soils. Hence, they were developed for agriculture long ago.

Country residential development in these lands through the 1980s sparked initial awareness of the moraine's uniqueness and a drive for sustainability in land use policy by County residents. More recently, awareness of the lack of connection through the Cooking Lake Area spurred the cooperative purchase of the Golden Ranch by several conservation organizations, facilitated by Strathcona County, thus conserving this important link through the spine of the moraine.



ENVIRONMENTAL SENSITIVITY AREAS - POLICIES AND PRINCIPLES

The extent to which the High and Moderate Sensitivity Areas (previously Blue and Yellow LMAs) were protected under MDP policy areas and LUB zones was assessed in the original LMF through a mapping exercise that attempted to identify locations of inconsistent policy. This required standardization of each county's MDP policy areas and land use zoning, by land use type. That analysis found standardization was complicated by the variation in land use planning policies between municipalities, in turn driven by local development demand.

For example, past interest in Country Residential development and small and large agricultural operations in Strathcona and Leduc had led to several densities and development limitations for a land use type, yet undifferentiated in the other counties. Further, while some municipalities had identified specific zones for protection, others relied on general restrictions and conditions for development to protect key resources wherever they may occur. With such differing approaches to development policy across the partner municipalities, a generalized map was impractical.

Despite this issue, it was clear from the assessment that some of the older municipal policies in particular did not always protect the High Sensitivity Areas from intensive development. The 2007 LMF concluded that appropriate development controls for High and Moderate Sensitivity Areas were an achievable goal, though each municipality would require the flexibility to adopt the most appropriate method for their situation. This approach appears to have succeeded, and each partner municipality has created new policy areas, land use zoning or general restrictions tailored to the current and anticipated demand for development in the moraine lands. Tables 1 and 2 (previously presented on pages 20-21) document the growing consistency in general policies.

Given the differences in planning context between each municipality, the original LMF identified guidelines for future policy adaptation, relating relevant planning principles for each Land Management Principle, in the High, Moderate, Low and No Sensitivity Areas (Table 3). These planning principles are still relevant, and presented below for reference (with updated nomenclature).



Table 3. Planning Principles for Ecologically Sensitive Areas

	PRINCIPLE	PROTECTED AREA	HIGH SENSITIVITY AREA	MODERATE SENSITIVITY AREA	LOW SENSITIVITY AREA
Description		Protected Landscapes	Natural Water & Wildlife Linkage Landscapes	Country Landscapes	Multiple Use Landscapes
Purpose	<i>The Beaver Hills Moraine is valued for its natural beauty, quality of life, and supports cooperative efforts to sustain the quality of water, land, air and natural resources and community development.</i>	<ul style="list-style-type: none"> ➤ Conservation of the moraine’s most significant natural features ➤ Retention of representative natural habitats in relatively large areas & reduced human footprint; ➤ Link protected areas together in a relatively continuous band through the moraine, and beyond to other regional features 	<ul style="list-style-type: none"> ➤ Retention or restoration of habitat to complete a network of wildlife habitat connecting the Protected Areas and other regional natural features ➤ Maintaining continuity of surface and ground water hydrology 	<ul style="list-style-type: none"> ➤ Management of existing residential, agricultural, recreational and industrial land uses within the principles of the BHI ➤ Maintenance, restoration or replacement of habitat encouraged on an opportunistic basis, particularly where continuity of habitat connectivity is a priority 	<ul style="list-style-type: none"> ➤ Maximize connectivity and natural area retention by integrating land uses, protecting existing natural areas and enhancing or restoring linkages between existing natural areas
Quality of Life					
Essential Character	<i>The essential character of the Beaver Hills will be preserved in its natural beauty, clean and unspoiled environment and quality of life.</i>	<ul style="list-style-type: none"> ➤ Manage landscape components with the objective of maintenance or restoration of the ecological integrity of the area, subject to existing land use regulations. ➤ Protected areas include Elk Island National Park, Blackfoot/ Cooking Lake Recreation Area, and Miquelon Lake Provincial Park, Ministik Bird Sanctuary, and Provincial Natural Areas, plus lands owned or under conservation easement by ENGOS 	<ul style="list-style-type: none"> ➤ Maintain patches of woodlands and wetlands that now form linkages between Protected Areas, or surrounding them, or that support a variety of plant and animal species ➤ Maintain the aesthetic appeal of the distinctive landscape of the High Sensitivity Area 	<ul style="list-style-type: none"> ➤ Maintain natural areas that provide the aesthetic feel of abundant greenspace, or if allowed, could return to a more natural state ➤ Maintain the aesthetic appeal of the distinctive pastoral landscape of the Moderate Sensitivity Area 	<ul style="list-style-type: none"> ➤ Subject to existing land use policies with recognition of the Land Management Principles of the BHI
Property Rights	<i>We will respect and maintain existing land use designations. We will respect the rights and responsibilities of private and public landowners and enlist their voluntary cooperation to manage their lands and the resources of the Beaver Hills in a sustainable manner.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Current individual land use practices continue ➤ Incentives for rehabilitation ➤ Some prohibition of existing land uses where affecting sustainability ➤ Maintain the distinctive aesthetics of the area ➤ Coordinated land management strategies (e.g., wetland restoration, weed control) 	<ul style="list-style-type: none"> ➤ Current individual land use practices continue ➤ Encouragement of environmentally friendly /sustainable residential, industrial, recreational, and agricultural practices ➤ Maintain distinct area aesthetics ➤ Future development must be consistent with the Land Management Principles of the BHI 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices

	PRINCIPLE	PROTECTED AREA	HIGH SENSITIVITY AREA	MODERATE SENSITIVITY AREA	LOW SENSITIVITY AREA
Biodiversity					
Wetlands	<i>Existing natural wetlands and their associated riparian upland margins will be conserved (including both their biodiversity and functional aspects).</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Conserve intact wetlands that are critical to the hydrology of the BH ➤ Identify and protect riparian buffer on wetlands to preserve water quality and biodiversity ➤ Abide by provincial Wetland Policy and maximize opportunity to compensate in situ 	<ul style="list-style-type: none"> ➤ Conserve intact wetlands where possible ➤ Direct intensive development away from any wetland where possible ➤ Attempt to incorporate wetlands (or naturalized stormwater facilities) into development where possible ➤ Abide by provincial Wetland Policy and maximize opportunity to compensate in situ 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices ➤ Abide by provincial Wetland Policy and maximize opportunity to compensate in situ
Native Upland Habitat and Corridors	<i>Development will retain native upland habitat (woodlands and grasslands) prominently featured within the Beaver Hills to maintain the majority of the existing green space and its associated biodiversity. Connectivity of habitat will also be retained so that continuous corridors remain within the Beaver Hills and between it and the surrounding region.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Maintain existing green spaces that provide habitat and wildlife corridors ➤ Fill in connectivity gaps in wildlife corridors between Protected Areas in a band no less than 2 km wide ➤ Focus restoration on fragmented or disturbed habitats that can support healthy natural ecosystems or provide linkages with other habitat in other landscape units on a no-net-loss basis 	<ul style="list-style-type: none"> ➤ Focus expanded development on areas most suited to agricultural, industrial, recreational or residential land use ➤ Direct new development to cleared, disturbed, isolated and fragmented areas with infrastructure to support development ➤ Encourage environmentally sustainable development and land management practices, including naturalized landscaping 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices, including naturalized landscaping
Species of Concern	<i>Promote land use and land management activities that will not compromise the ability of rare and sensitive species or species important for human use now present to persist in the Beaver Hills.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Conserve habitat required by species of concern, or which could support adjacent populations of such species ➤ Consider restoration of degraded habitat as compensation for habitat lost to development elsewhere 	<ul style="list-style-type: none"> ➤ Retain habitat, including fragmented areas that will help sustain species of concern, on an opportunistic, site-by-site basis ➤ Conserve areas demonstrated to support species of concern ➤ Encourage education, awareness and voluntary action to conserve habitat ➤ Consider restoration of degraded habitat as compensation for habitat lost to development elsewhere 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices ➤ Consider restoration of degraded habitat as compensation for habitat lost to development elsewhere

	PRINCIPLE	PROTECTED AREA	HIGH SENSITIVITY AREA	MODERATE SENSITIVITY AREA	LOW SENSITIVITY AREA
Water					
Watersheds	<i>Maintain function of local watershed to sustain regional surface and ground water systems.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Maintain intact watershed features that are critical to the hydrology of the BH ➤ Rehabilitation of disturbed areas that are critical to natural hydrology ➤ Encourage Low Impact Development concepts to manage stormwater & flood flows 	<ul style="list-style-type: none"> ➤ Maintain intact watershed features that are critical to the hydrology of the BH ➤ Encourage Low Impact Development concepts to manage stormwater & flood flows 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices ➤ Abide by provincial Wetland Policy ➤ Encourage Low Impact Development concepts to manage stormwater & flood flows ➤ Link to North Saskatchewan Watershed Alliance programs
Water Quality	<i>Sustain ability of local watersheds to maintain the water quality of surface and ground water systems.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Both wetlands and the riparian buffers surrounding them are managed to protect water quality ➤ Permit land uses that incorporate measures to protect water quality of waterbodies within and adjacent the property ➤ Abide by letter and intent of federal and provincial legislation 	<ul style="list-style-type: none"> ➤ Both wetlands and the riparian buffers surrounding them are managed to protect water quality ➤ Permit land uses that incorporate measures to protect water quality of waterbodies within and adjacent the property ➤ Abide by letter and intent of federal and provincial legislation 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices ➤ Encourage Low Impact Development concepts to manage stormwater & flood flows

	PRINCIPLE	PROTECTED AREA	HIGH SENSITIVITY AREA	MODERATE SENSITIVITY AREA	LOW SENSITIVITY AREA
Land					
Land Use	<i>Support an appropriate mix of agricultural, industrial, recreational and residential development in areas with lower environmental sensitivity, maximum potential for sustainable business operations, and maintaining the character of the distinctive landscape.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Continue existing agricultural, residential and industrial land uses that complement the ecological integrity of the adjacent Protected Areas ➤ Future development should consider minimal impact design ➤ Encourage land use supporting quality of life goals of High Sensitivity Area residents 	<ul style="list-style-type: none"> ➤ Continue existing agricultural, residential, recreational and industrial uses ➤ Focus future development in areas with existing infrastructure, e.g., roads, water & wastewater, schools, etc. ➤ Encourage land use supporting quality of life goals of Moderate Sensitivity Area residents 	<ul style="list-style-type: none"> ➤ Raise sensitivity and awareness of environmentally sustainable land use and land management practices ➤ Encourage or incent environmentally sustainable land management practices ➤ Link to existing municipal jurisdictions and cooperative efforts such as the North East Industrial Heartland
Air					
Air Quality	<i>Industrial growth in the region will maintain the clean air and current air quality valued by Beaver Hills' residents.</i>	<ul style="list-style-type: none"> ➤ Subject to the management plans for each protected area 	<ul style="list-style-type: none"> ➤ Current air quality standards met for new and existing infrastructure ➤ Greenhouse gas reduction measures are encouraged where feasible 	<ul style="list-style-type: none"> ➤ Current air quality standards met for new and existing infrastructure ➤ Greenhouse gas reduction measures are encouraged where feasible 	<ul style="list-style-type: none"> ➤ Current air quality standards met for new and existing infrastructure ➤ Greenhouse gas reduction measures are encouraged where feasible ➤ Link to the Fort Air Partnership and its activities

MAPPING THE RISK TO ECOLOGICAL RESOURCES

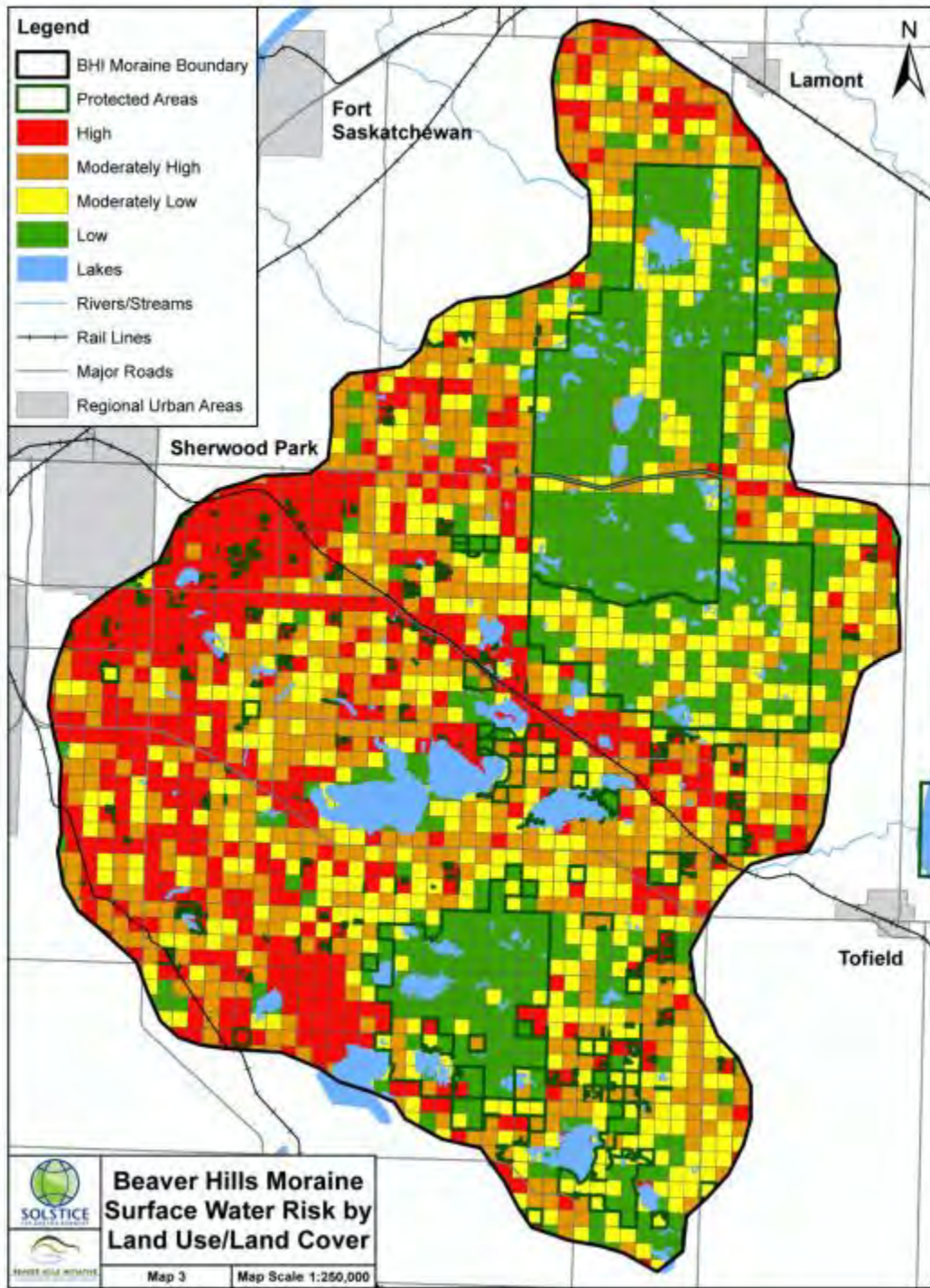
Phase 2 of the 2007 LMF analyzed the natural resources identified in the BHI principles that contribute to a High or Moderate Sensitivity Area (e.g. biodiversity, water, land, air). This analysis created models of the key resources that contribute to the ecological function of the moraine. A well-functioning environment provides the ecological goods and services on which we rely (such as clean air, drinkable water and flood control, among other benefits) thus maintaining the quality of life and economic prosperity valued by residents and visitors to the moraine. The resulting maps highlighted areas within the moraine where such ecological resources might be sensitive or at risk to land use and development.

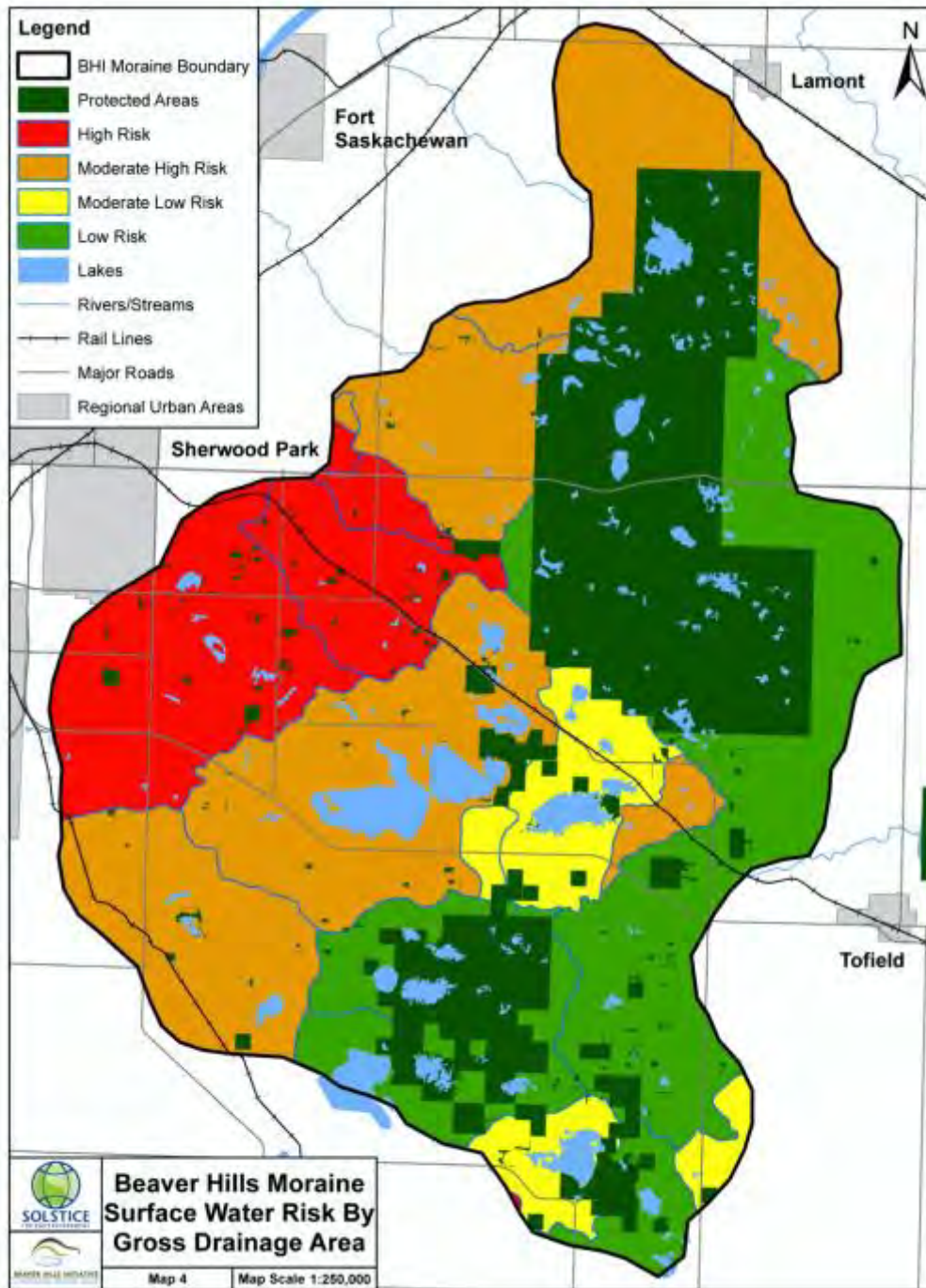
Those models were rerun in 2014 with more current data, in particular, refined (1:5,000 scale) mapping of wetlands, local hydrology and current natural vegetation, and more recent 1:50,000 scale agricultural land cover. These data, particularly the wetlands data, improved the resolution of the models significantly, and provided an opportunity to address a data gap regarding agricultural soil capability. Land use planners assessed the original maps in regards to their utility. Those with little use were dropped from analysis (e.g., functional landscape connectivity). The updated models are described briefly below. Documentation that is more detailed is provided in Appendix 1.

SURFACE WATER RISK

The **Surface Water Risk Model** is designed to identify the sensitivity of land parcels to sediments and contaminants potentially introduced by existing development and land use zoning within the smaller watershed units (Gross Drainage Areas) of the Beaver Hills Moraine and at the quarter section level. Clearing of natural vegetation for development in areas with extensive surface water removes a natural filtration system that can capture and degrade sediments and contaminants before they reach waterbodies. The loss of natural vegetation also exposes the soil to sun, increasing the rate of evapotranspiration, ultimately reducing the amount of surface water retained on the landscape. The model effectively evaluates the proportion of ‘positive’ (retention of natural and agronomic vegetation) to ‘negative’ (cleared/disturbed) land development and proposed uses. For the quarter section, the assessment examines only this ‘health index’. For the Gross Drainage Area, this health index can then be used with the proportion of surface water to quantify the risk to surface water, based on past development and zoning at the sub-watershed level. Note that the Gross Drainage Area model was modified from the 2007 version to incorporate better the proportion of surface water into the analysis.

Surface Water Risk Maps show areas of risk to surface water at two scales: the quarter section (Map 3) and the Gross Drainage Area (Map 4). High risk areas in both analyses were identified by the main factor associated with that risk: the extent of existing and proposed development. For the Gross Drainage Area, the extent of surface water present is included in the analysis, to weight risk relative to the extent of water. In some areas, such as Cooking Lake, surface water covers much of the landbase. In such areas, any development must be approached carefully, as a limited landbase contributes run-off to waterbodies, which in turn, could affect water quality and supply. Areas at the urban-rural edge, near Sherwood Park have had more development, and thus, have the highest risk levels relative to the rest of the moraine.





GROUNDWATER RISK

The **Groundwater Contamination Risk Model** identifies areas within the Beaver Hills Moraine that may require special management when considering applications for development with high potential for contaminant release, such as industrial development, intensive livestock operations or subdivision septic treatment systems. The concern with such activities, with respect to groundwater, is the potential for contaminants to enter groundwater reserves, percolating through surface water or permeable soils.

The **Groundwater Contamination Risk Map** (Map 5) is tied to locations where surface water, coarse soils and groundwater recharge and discharge overlap. Within the moraine, such overlap is common around many waterbodies. Contaminants can spread quickly through water and the water table is often high near waterbodies (spread to shallow groundwater can occur quickly). Once into groundwater, contaminants are difficult to remove and underlying aquifers may be at risk. Moderate risk areas associated with recharge and discharge zones and coarse soils are widespread throughout the area. However, there is some potential for error, given the broad scale of the groundwater data, and potential inaccuracies acknowledged within this dataset. This includes the lack of data to map recharge and discharge zones within Elk Island National Park. Development proponents should confirm groundwater risk through site-specific investigation and incorporate appropriate mitigation where required.

LANDSCAPE CONNECTIVITY

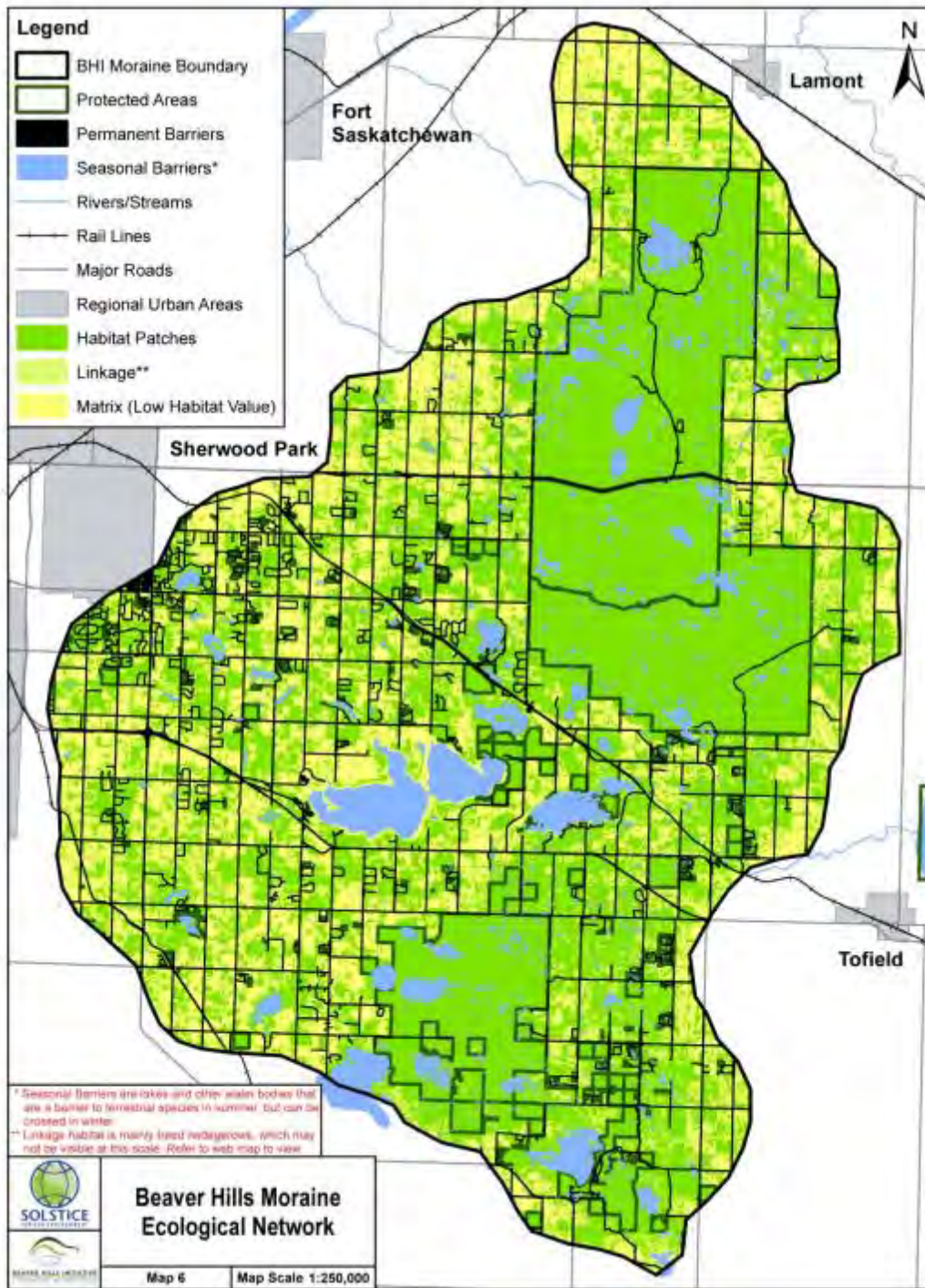
Landscape connectivity modeling and analysis confirmed the critical role of protected areas, large natural areas on private lands, and the habitat linking these areas in supporting biodiversity within the moraine. Biodiversity is the main mechanism supporting ecological goods and services. Biodiversity is maximized in a landscape that contains large areas of useful habitat. Often, these habitat patches lie within a matrix of less beneficial lands. Hence, plants and animals must rely on connective habitat (corridors) that allow them to travel between suitable patches. Ideally, an ecological network comprises:

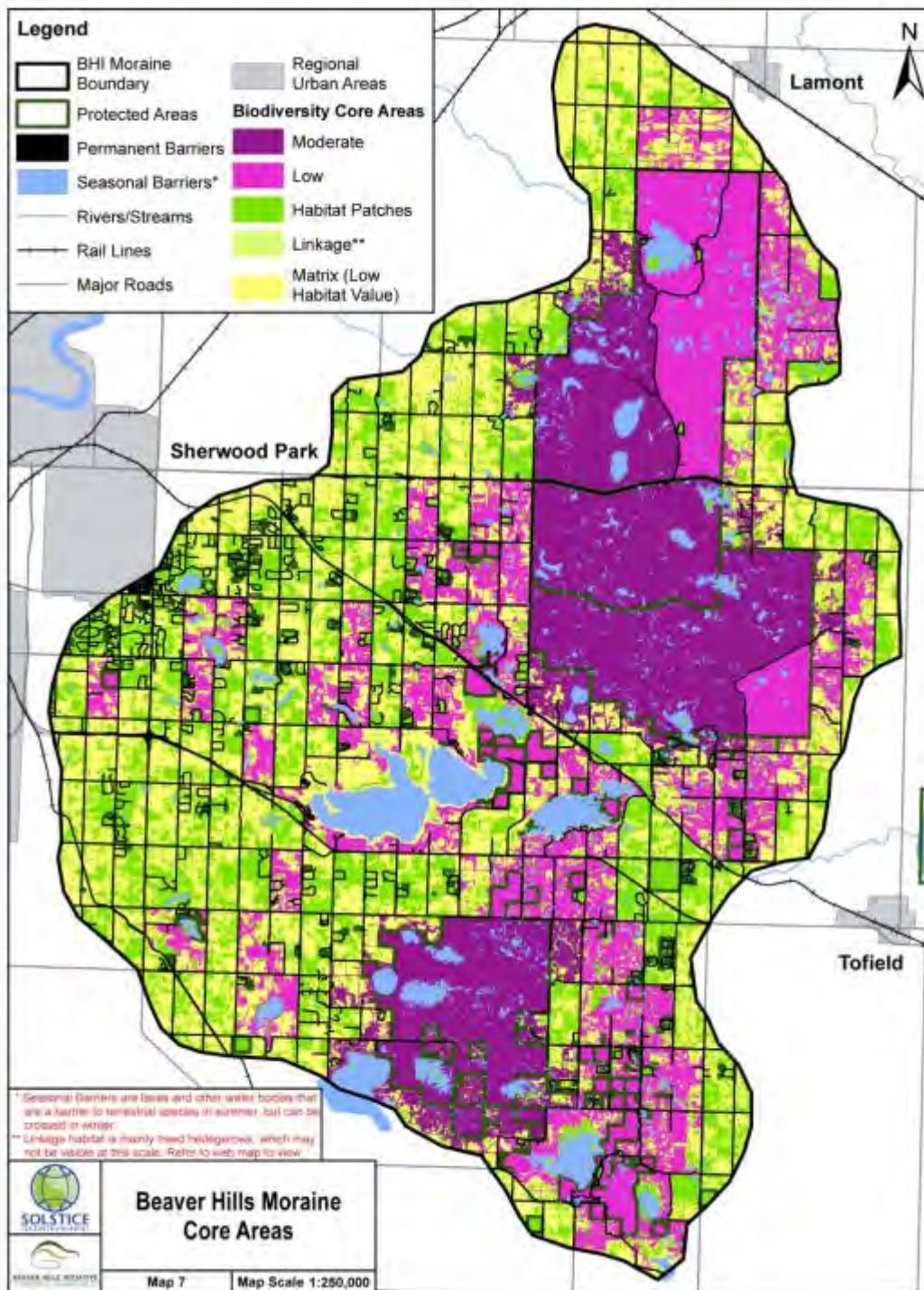
- Larger patches of habitat that can sustain sizeable populations of various species (*Core Areas*) and so may act as a source supporting the biodiversity of a region;
- Smaller or linear habitats that can link such patches (*Corridors*);
- Large groupings of several patches linked by corridors (*Connected Habitat*) that together provide the larger area habitat needed by larger animals (e.g., moose, deer) and add to regional biodiversity, and
- Few *Barriers*, which are areas that pose mortality risks and effectively block movement.

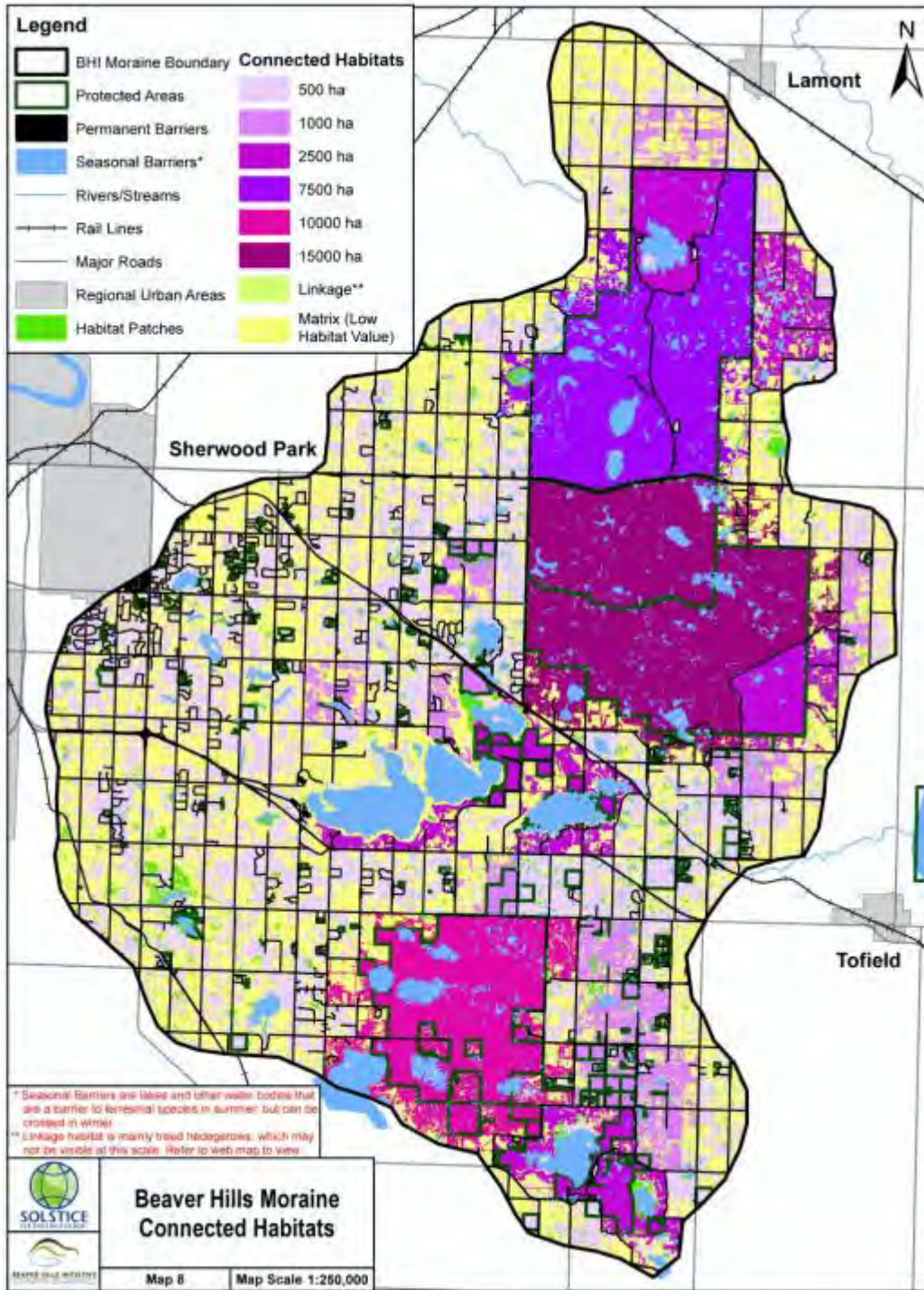
The landscape connectivity model generated several map products that help to highlight areas of the moraine critical for the support of biodiversity including the:

- *Ecological Network Map* (Map 6) showing habitat patches, corridors, barriers and matrix lands,
- *Core Areas Map* (Map 7) showing the level of biodiversity individual habitat patches could sustain, without consideration of linkage through corridors, and
- *Connected Habitat Map* (Map 8) showing the area of contiguous habitat available when both habitat patches and corridors are considered.







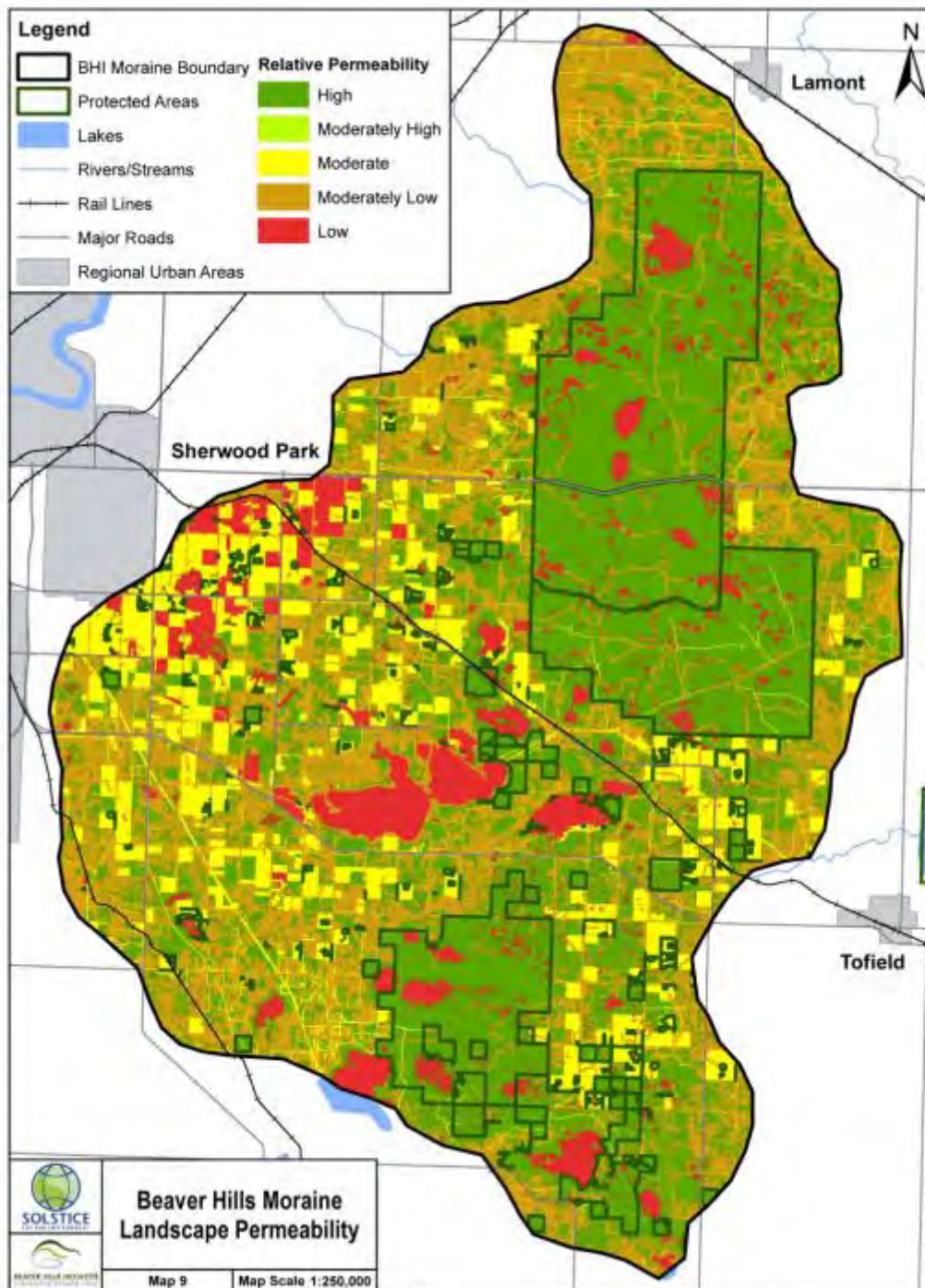


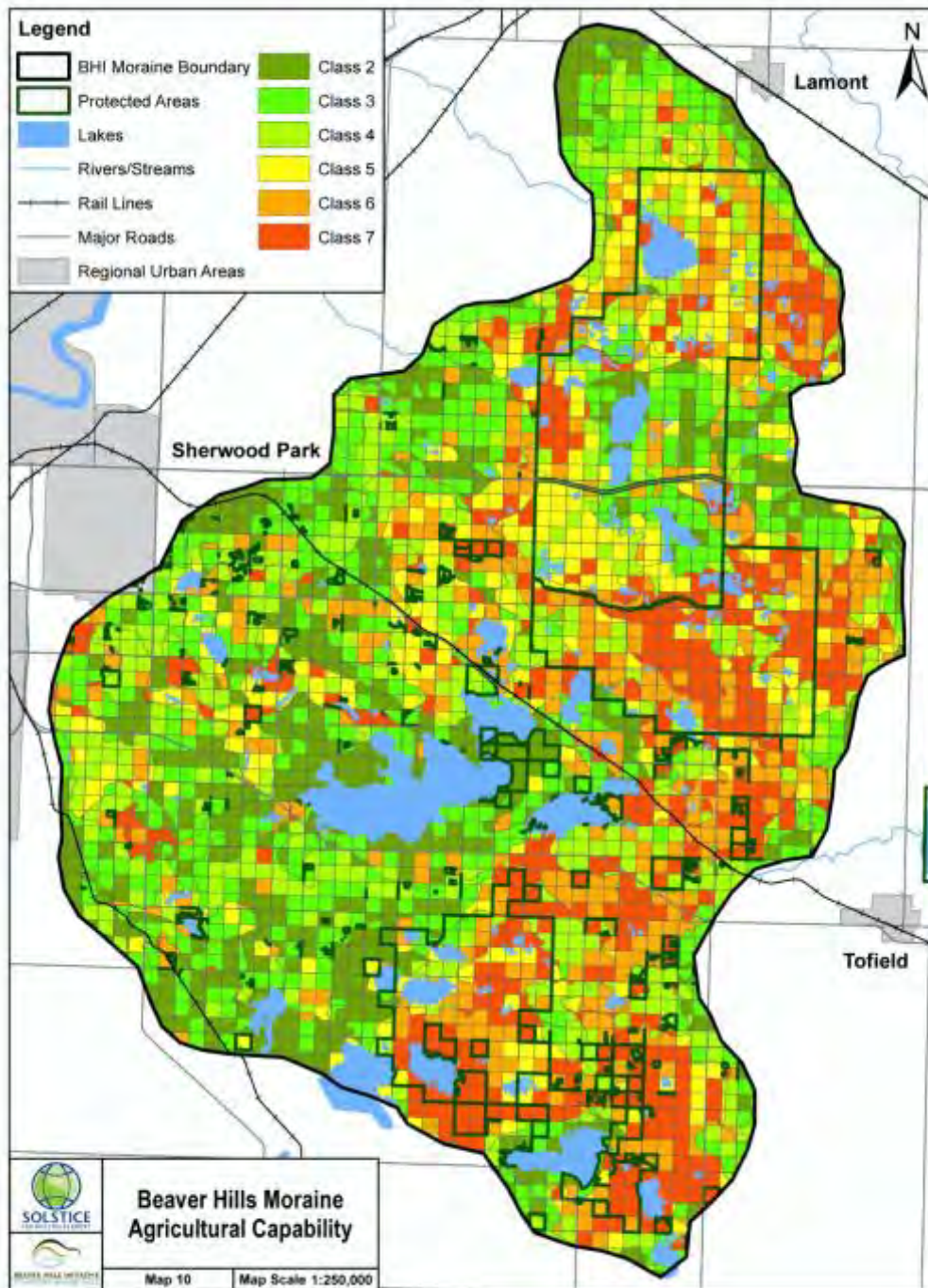
Finally, the entire landscape can be analyzed to determine the level of connectivity (*Landscape Permeability*) in any given location. The Landscape Permeability model considers the effect of habitat patches and corridors and the isolation imposed by barriers or by impassible land uses in the matrix. This model and resulting map (Map 9) provide both a snapshot of landscape ecological health at the land parcel level as well as an indication of the role of the parcel in sustaining biodiversity (and the ecological goods and services associated with it) at the local and municipal scale. Together, these map products show that the moraine currently provides sufficient habitat and corridors to sustain a high level of biodiversity, including a broad range of species with small to large habitat area requirements.

AGRICULTURAL CAPABILITY

The Agricultural Capability or **AgCap© Model**¹ developed for this update addresses a key data gap for land use planners in areas experiencing urban expansion. Past agricultural capability mapping (Canada Land Inventory Agriculture mapping and provincial Land Suitability Rating System [LSRS]) aimed to inventory highly productive soils located in landscapes amenable to agricultural use (mainly for production of cereal crops, but also forage). The resulting maps were at a coarse scale that does not differentiate local variation in capability. Although protection of good agricultural land is a common goal of many rural municipalities including the BHI partners, this broad scope mapping was often not sufficiently refined to aid in zoning for new development. By adding-in finer scale terrain and wetland data, the 1:50,000 scale LSRS data were refined to provide a map with better resolution. The resulting Agricultural Capacity (AgCap©) map (Map 10) highlights larger areas of land more suitable to large-scale cereal production, as well as smaller parcels capable of supporting smaller scale forage, specialty crop or livestock operations, the range of agricultural options relevant to municipalities on the urban fringe.

¹ Note that both the AgCap© model and the PLUM© model are copyrighted to Solstice Canada.





CASE EXAMPLE #3 - LEVERAGING RESOURCES THROUGH PARTNERSHIPS & COLLABORATIONS: ALTALINK PROPOSAL (LEDUC AND STRATHCONA COUNTIES)

The Challenge

AltaLink proposed two alternative alignments for a new high voltage power line running through Leduc and Strathcona County, respectively. Typical review under the Alberta Utilities Board (AUB) process requires extensive consultation with affected stakeholders early in the process and includes a site-specific review of landowner and engineering concerns. Detailed environmental assessment is deferred until a preferred alignment is selected.

Preliminary assessment is based solely on publically available, coarse-scale information. Although this approach has sometimes missed important environmental constraints that required wholesale changes to the alignment, and considerable redesign and construction cost, AltaLink justified the approach based on efficiency and cost. When AltaLink began its consultation process with Strathcona County, the County's environmental planners and the BHI alerted AltaLink to the availability of site-specific environmental information that would be useful in their evaluation of the two alignments.

AltaLink was initially reluctant to incorporate the information into their assessment, for two reasons. First, this moved assessment up to an earlier stage than AUB process would typically require and appeared to double the cost because of a detailed environmental review of both alignments. Second, because they were unfamiliar with the data, they were uncertain that it was comprehensive enough to allow fair comparison of the two alignments. Regardless, the BHI and Strathcona County both continued to promote the LMF maps and underlying data to AltaLink's environmental specialist and consulting team, citing the opportunity to conduct an informed decision-making process, and potentially improve the AUB process in terms of cost-effectiveness and community relationships.

The Process

Strathcona County personnel met with AltaLink over the course of preliminary review and consultation and provided the BHI data for its part of the moraine. On review of the data (species at risk, wetlands, connectivity data, etc.), AltaLink accepted its potential utility for assessment and asked for Leduc's data as well. The BHI facilitated the required data access with Leduc. Once received and assured of the comprehensiveness of the data, AltaLink used the information in their review. They also met with one of Strathcona's environmental planners and a BHI representative, who outlined site-specific issues and broader contextual concerns on a field tour (e.g., the conservation efforts at Golden Ranches, immediately north of the alignment).

This was a significant deviation in process and involved municipal stakeholders in the preliminary review assessment. It also resulted in direct communication of environmental concerns, at a scale comparable to the land use review conducted during preliminary route assessment. The route eventually selected was supported by balanced consideration of the LMF data, as well as site-specific landowner, engineering and other economic concerns. Although not all municipal stakeholders were pleased with the selected

alignment, precedent has been set in the assessment process, regarding the role that can be played by municipalities with comprehensive, local-scale data.

How the LMF Helped

The availability of the LMF information, in a transferable digital format facilitated a more thorough desktop review than is typically possible for powerline alignment reviews. Data alone did not support informed decision-making though. An intermediary was required to promote the value of the information to the decision-making process. Because this was the first time LMF data had been provided to an external party, data sharing agreements were not as convenient as they could have been, but regardless, once the information was made available to Altalink, they agreed it provided a valuable resource.

The data also helped bring to light all relevant concerns (environmental, social and economic) so that they were considered at the same scale and same time. Neither municipality's residents were happy to have a high voltage power line constructed in a rural landscape. However, consideration of potential environmental concerns early enough in the process did ensure balanced review of impacts in selecting the alignment. Use of the LMF data to inform decision-making also reinforced a key purpose of the LMF: to ensure development decisions proceed with the best available environmental, social and economic information.



4.0 ENVIRONMENTAL LEGISLATION

Before municipalities can develop their own environmental policies, they must understand the limits of their own jurisdiction and the jurisdiction of other levels of government. Development projects in Alberta may be subject to legislative requirements at the federal, provincial and, sometimes, municipal level. The division of responsibilities across jurisdictions is not necessarily clear; the historical development of environmental legislation has led to shared, separate and sometimes, generalized responsibilities. Below is a general discussion of relevant federal, provincial and municipal environmental legislation. Detailed information on each specific act is provided in Appendix 2.

HISTORY OF ENVIRONMENTAL LEGISLATION IN CANADA

The current legal framework for environmental management in Canada is a reflection of both the historical development of Canada as a nation and shifts in societal views about the management of natural resources globally, nationally and provincially. The resulting patchwork of federal and provincial legislation incorporates both economic and ecological management objectives and an underlying tension between federal and provincial control of natural resources and economic development.

Municipalities, in contrast have been delegated broad, explicit scope to manage for healthy, sustainable communities, which implies scope to address environmental as well as social and economic concerns. Clarification of the jurisdictional responsibilities of federal and provincial governments can help municipalities understand the limitations of higher levels of government to address local concerns and to identify aspects of environmental management that they can regulate under their own legislated powers.²

When Canada's *Constitution Act* was first established in 1867, natural resources were seen as valuable commodities, and central to economic development of the country. The young federal government delegated legislative control of Canada's resources to either the federal government or existing provinces, which in turn created legislation for specific resources, and management systems focused on sustainable economic gains.³ Creation of the western provinces in the early 1900s eventually led to delegated responsibility for resource management and hard-fought provincial control over resources with economic value. Alberta finally secured control of key resources in 1930, through the *Transfer of Natural Resources Act*, 25 years after it had become a province.

² Mallet, J. S. (2005). *Municipal powers, land use planning, and the environment: Understanding the public's role*. Edmonton, AB: Environmental Law Centre.

³ Boyd, D. R. (2003). *Unnatural law. Rethinking Canadian environmental law and policy*. Vancouver, BC: UBC Press.

The battle over economic control of resources set up an enduring tension between Alberta and the federal government, centered on the economic benefits of provincial resources.⁴ The Act allowed the province to establish its own legislation over air quality, timber, water, wildlife, land, soils, mineable minerals and energy resources, but the new laws maintained the economic and utilitarian objectives of previous federal laws.⁵

Canada retained control over transboundary resources (migratory species, water, fish and fish habitat) and broad-level issues (pollution, navigable waters) and the utilitarian focus in associated legislation. The result was a system of shared jurisdictional control over water, fish and some wildlife species, and provincial control over most other natural resources; a focus on economic rather than ecological benefits; and government tensions over resource control.⁶

In the past, environmental legislation focused on the management of individual resources such as fur-bearers or fish stocks. Starting in the 1980s, with definitions for environment and sustainable development, legislation has started to shift away from single resources to a more holistic, ecosystem approach.

Later global emphasis on sustainable development and protection of biodiversity through the 1980s and 1990s led to international treaties that required a shift in management approach in both federal and provincial legislation. New legislation was developed to implement a system for sustainable development (the *Canadian Environmental Assessment Act (1992)*, the *Canadian Environmental Protection Act (1999)* and the *Canada National Parks Act (2000)*) and to manage national biodiversity (the federal *Species at Risk Act (2002)*, based on ecological management and the precautionary principle.

The *National Biodiversity Strategy (1995)* and an international treaty on sustainable development required provincial governments to follow suit, which led to the *Alberta Environmental Protection and Enhancement Act (1992)*, and changes to other provincial legislation through the late 1990s and early 2000s (*Parks Act, Water Act, Wildlife Act*). These new pieces of legislation incorporated an ecological management approach, a dramatic shift to the ‘triple bottom line’ approach to development.

⁴ Elton, D.K. (1979). Alberta and the federal government in historical perspective, 1905-1977. In C. Caldarola (Ed.), *Society and politics in Alberta* (pp. 108-130). Toronto, ON: Methuen.

Gibbins, R. (1992). Alberta and the national community. In A. Tupper and R. Gibbins (Eds.), *Government and politics in Alberta* (pp. 67-84). Edmonton, AB: University of Alberta Press.

Patriquin, D. L. (2014). *Landscape of hope: The influence of place and social capital on collaborative action in sustainable management*. PhD Thesis. Edmonton, AB: University of Alberta.

⁵ Boyd, *op. cit.*

⁶ Boyd, *op. cit.*, Patriquin, *op. cit.*

Environmental Law Centre. (2003). *The ABC's of environmental jurisdiction. An Alberta guide to federal, provincial and municipal responsibility*. Edmonton, AB: Environmental Law Centre.

The resulting legacy of legislative change is a mix of economic and ecological objectives and shared, separate and sometimes unclear jurisdictional divisions between the federal and provincial governments (Table 4). Federal legislation is sometimes duplicated in provincial acts, to ensure consistent management of resources under federal jurisdiction across all provinces (e.g., the Alberta *Wildlife Act* is consistent with requirements of the federal *Migratory Birds Convention Act*). Similarly, federal, then provincial law, supersedes municipal bylaws affecting the same resource.

Jurisdiction is further complicated by land management within the province. Where natural resources lie entirely within federally controlled lands, such as in national parks, federal legislation supersedes provincial law (e.g., for water, wetlands, wildlife). Despite these difficulties, the respective federal and provincial authorities have resolved shared environmental management, at least among the respective agencies, such that regulatory approvals have often been coordinated for most proposed developments. This offers an opportunity for those agencies to assess the potential for environmental impacts, and require mitigation to reduce negative effects, through the permitting and enforcement system. Ultimately then, this complex mix of jurisdictional processes has defined what sustainable development means in Canada, and Alberta today.

More recent legislative changes will impose new and yet untested land management restrictions, and potentially, complications in the environmental management process. The *Alberta Land Stewardship Act* (2009) aims to coordinate land use planning across the province, through regional land use plans that will address environmental, social and economic goals within each major provincial watershed. The North Saskatchewan Regional Land Use Plan has not yet been completed but based on plans from other areas, it will set broad land use objectives specific to the regional environment, social and economic context. The Capital Region Plan also sets regional planning goals and a process for coordination of municipal planning efforts. Municipalities will be expected to maintain consistency with this broader policy document, as well as all other federal and provincial legislation. The implications of yet another policy player in municipal land use planning and environmental management have yet to be realized, and will depend heavily on the interpretation of the jurisdictional objectives of existing environmental legislation within each regional plan.



Table 4. Federal and Provincial Environmental Legislation & Policy Areas

		Provincial										Federal									
		Environmental Protection and Enhancement Act	Water Act (including COPs and Wetland Policy)	Public Lands Act	Wildlife Act	Weed Control Act	Soil Conservation Act	Natural Resources Conservation Board Act (and Agricultural Operation Practices Act)	Alberta Energy Regulator administered Acts	Alberta Utilities Commission Acts	Historic Resources Act	Fisheries Act	Canadian Environmental Protection Act (CEPA)	Navigation Protection Act	Canada Wildlife Act	Migratory Birds Convention Act	Species At Risk Act	Federal Water Act and Policy	Federal Policy on Wetland Conservation	Canadian Environmental Assessment Act	National Energy Board
Legislative Powers	Permitting	√	√	√	√		√	√	√	√	√	√	√	√					√	√	√
	Enforcement	√	√		√	√	√		√	√	√	√	√		√	√	√				
	EIA (process or trigger)	√	√	√				√	√	√	√	√		√					√	√	√
	Policy Development	√	√		√	√		√	√	√			√		√		√	√			√
Land Use	Industry	√	√	√	√	√	√	L*	√	√	√	√	√	√		√	√		F*	F	F
	Commercial		√	√	√	√	√			√	√	√	√			√	√		F	F	
	Agricultural	√	√	√	√	√	√	L			√	√	√			√	√			F	
	Intensive Livestock Operations	√	√	√	√	√	√	√			√	√	√			√	√		F	F	
	Urban Residential	√	√	√	√	√	√				√	√	√			√	√			F	
	Rural Residential	√	√	√	√	√	√				√	√	√			√	√			F	
	Recreational	√	√	√	√	√	√	L			√	√	√	√		√	√		F	F	
	Institutional	√	√	√	√	√	√			√	√	√	√	√		√	√		F	F	
Supporting Infrastructure	Utility Facility or Lines	√	√	√	√	√	√	L	√	√	√	√	√	√		√	√		F	F	
	Stormwater Facility	√	√	√	√	√	√				√	√	√	√		√	√		F	F	
	Roads		√	√	√	√	√				√	√	√	√		√	√		F	F	
Misc. Projects	On federal lands or with federal participation											√	√	√	√	√	√	√	√	√	

* L = applies mainly to large projects; F= applies only for projects with federal funding, federal agency proponent, federal lands, or crossing provincial or international boundaries

LEGISLATION AND SUSTAINABLE DEVELOPMENT TODAY

Sustainable development has been both a top-down initiative, driven by international concern, and a bottom-up response. Public demands for better environmental management and reinforcement of policy by various court decisions have placed increasing pressure on all levels of government.⁷

Often, public demands have been directed to municipal governments, the most accessible government to the public,⁸ and residents within the Beaver Hills moraine have been no exception.⁹ However, a traditional focus on economic development, the complexity of resource management law and a lack of clarity about municipal scope for environmental management has left many Alberta municipalities unsure of their capacity to address sustainable development.¹⁰ With regard to land development in particular, municipalities are probably better placed to address sustainability, but often lack the information and tools to do this effectively.

Recognition of policy opportunities relies first on an understanding of the problem. Defining ‘sustainable development’ was a turning point in environmental management globally and within Canada. Defining ‘environment’ was no less important. With those definitions came recognition of the need for development to be managed at the ecosystem level. The definition of sustainable development by the Brundtland Commission (1987) has influenced most Canadian policy:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

That definition became a guiding principle for new federal and provincial environmental legislation and was included verbatim in the 1992 *Canadian Environmental Assessment Act (CEAA)*. The 1992 CEAA also established a definition for environment subsequently adopted by other jurisdictions, including Alberta. The current CEAA (2012) retained the original principles and that comprehensive definition of environment:

“Environment” means the components of the Earth, and includes:

- (a) land, water and air, including all layers of the atmosphere,*
- (b) all organic and inorganic matter and living organisms, and*
- (c) the interacting natural systems that include components referred to in paragraphs (a) and (b).*

⁷ Boyd, *op. cit.*, Mallet, *op. cit.*,

Atkins, L. E. (Ed.). (2009). *Environmental conflict and democracy in Canada*. Vancouver, BC: UBC Press.

⁸ Boyd, *op. cit.*

⁹ Patriquin, *op. cit.*

¹⁰ Boyd, *op. cit.*, Environmental Law Centre, *op. cit.*, Mallet, *op. cit.*

Recognition of the environment as a complex, interactive system was an important shift from the earlier management view of resources as independent, ignoring the dependencies between them. This holistic definition of environment created a broader, cross-jurisdictional approach to environmental management. It has also given some municipalities the confidence to create policies that define what sustainable development means within their own communities and how that vision will be implemented.

New in 2012

A recent change in federal legislation has changed Canada's sustainable development approach. The previous CEAA required review of any proposed project that involved federal permitting, funding, lands or projects, which allowed review of many projects, small and large. Often, such comprehensive review would lead to improved project design and minimize potential impacts that could result in cumulative impacts. More routine projects could bypass assessment, provided mitigation measures identified through a class screening process were implemented. Under the previous CEAA, most projects underwent environmental assessment, which resulted in consistent review of environmental effects during project development, and for some developers, instituted a cultural shift to incorporate environmental mitigation into project design.

The goal of sustainable development for all development under federal control remains in the purpose statement of the new 2012 CEAA, but now not all projects must undergo an environmental assessment. Instead, only designated, larger scale projects likely to produce significant environmental effects must be assessed, a process similar to Alberta's policy. Other projects can be subject to an assessment at the Minister's discretion, or if significant public concern is expressed. As a result, some projects may require an environmental review only for a specific resource permit. Smaller scale projects with no regulatory permitting requirements may not be reviewed at all.

This focus on larger projects leaves small projects with no standard to meet. The rationale for the change is that impacts of smaller projects are typically addressed by other jurisdictions. In Alberta, this may not necessarily be so. The concern with this recent change is that past gains in terms of environmental controls may slip, or that smaller projects will no longer have the incentive to address environmental concerns, other than through threat of enforcement. Smaller operators are often unaware of the environmental requirements and costly mistakes may be incurred, simply through poor design.

This situation opens an opportunity for provincial and particularly municipal governments to consider a broader range of projects within their environmental policies. It also emphasizes the need for environmental professionals to be aware of federal and provincial legislation for specific resources, to ensure that projects in which they are involved have considered implications of all regulatory requirements.

PERMITTING, ENFORCEMENT AND ENVIRONMENTAL ASSESSMENT

Policy development also requires an understanding of how environmental laws are typically applied by higher levels of government, to identify the gaps relevant to municipalities. Federal and provincial environmental legislation is applied through both permitting and enforcement processes, affecting projects at the development and operational stage. Management through either permitting or enforcement is an important aspect of environmental law, because it identifies two distinct points for direct control of resource use. An understanding of how, when and where those controls are applied by higher levels of government can help municipalities understand where gaps may exist, and where they may choose to develop new policies to protect locally important resources within their own jurisdictions.

Permitting processes are typically applied before development proceeds, based on an assessment of potential impacts, plans to mitigate impacts and the capacity of the environment to sustain use. An approval will often include prescriptive conditions to ensure measures to reduce environmental effects are undertaken. Environmental assessment laws mandate a comprehensive review of all potential environmental impacts associated with a project, and approval depends on the ‘greater public interest’ in terms of economic, social and environmental effects.

Resource-specific laws often permit use through approvals and licenses, based on an assessment of use given resource availability (e.g., water licenses). Finally, some activities are strictly forbidden and the agency is responsible only for enforcement of infractions, a threat intended to incent compliance with rules of resource use. Each of these legislative processes incites proponents to follow formal or informal standards (Best Management Practices) regarding environmental management, throughout the lifetime of their project.

Environmental impact assessment (EIA) is arguably the best means to achieve sustainable development, since it is essentially an ecosystem level assessment. An EIA considers the overall impact of a project, early in its development when potential negative effects can best be avoided. Under both the *Canadian Environmental Assessment Act (CEAA)* and Alberta’s *Environmental Protection and Enhancement Act (EPEA)*, development is evaluated by weighing impacts on all relevant environmental features and the cumulative effect of development within a given location. EIA approval is a pre-condition for application for federal and provincial resource use permits, which avoids the piecemeal approach to resource management that has caused significant environmental problems in the past (e.g., air and water pollution).

Yet not all developments will require approvals, or a comprehensive EIA of their potential impacts. Both federal and provincial EIA laws are selective in the scale of project triggering assessment, particularly under the new CEAA (2012). Large projects likely to cause significant, regional level effects are assessed (e.g., large energy developments), but smaller projects may trigger only resource permitting or enforcement laws (or no approvals requirements). Thus, at the local level, sustainable development under federal and provincial laws is neither consistently applied nor locally specific, leaving concerns of the

municipality unaddressed, whether regarding specific natural areas or environmental matters under their control (e.g. storm and wastewater, slope stability).

Recognizing that their interests may not necessarily be addressed by higher-level jurisdictions, some municipalities have created their own EIA processes, often for locally significant natural areas (e.g., the City of Edmonton's River Valley Bylaw 7188 process; Strathcona County's Priority Ecological Management Areas EIA process). Some have created resource-specific approvals (e.g., wetland policies of Strathcona County and the City of Calgary). In such cases, the permitting requirements have been linked to the municipal development approval process, as a precondition of subsequent approvals.

Legislation at the federal and provincial levels is applied using permits, enforcement and environmental impact assessments. Municipalities can also make use of these tools to address local issues not addressed by federal and provincial processes.

Such policy ensures that locally relevant concerns are addressed during project planning (e.g., stormwater management, traffic management, fragmentation of natural spaces) under a review process independent of those required under federal and provincial legislation. While the potential to duplicate federal and provincial reviews has been eliminated through the *Canada-Alberta Agreement for Environmental Assessment Cooperation*, no similar formalized agreement currently exists between those municipalities and higher levels of government. Instead, coordinated review is typically undertaken by informal agreement, a minor administrative issue.

Those municipalities who have created their own environmental review and management policy have done so under the rather broad mandate "to develop and maintain safe and viable communities" granted under the *Municipal Government Act* (MGA). Environmental management has been increasingly recognized as a delegated responsibility under this clause of the MGA,¹¹ yet many municipalities are still reluctant to apply this power. Understanding this paradox requires an understanding of the MGA, and the means by which other municipalities have interpreted "safe and viable communities" (MGA, s.3) in the context of land use planning.

¹¹ Environmental Law Centre, *op cit.*, Mallet, *op. cit.*

MUNICIPAL AUTHORITY

The *Municipal Government Act* delegates to municipalities the role of land use planning and local level administration of any resource, activity or thing critical to the health of the community. However, specific mention of natural resources is lacking. Consequently, areas of potential jurisdictional conflict are not clarified, leaving municipalities to test the limits of their delegated responsibilities through creation of bylaws and internal policy development.

THE MUNICIPAL GOVERNMENT ACT

In Alberta, general responsibility for good governance is conferred onto municipalities through the MGA. The MGA provides considerable latitude to manage issues relevant to the community, limited only by superseding federal or provincial legislation and the boundaries of fair and reasonable treatment of residents. It is also the means by which some municipalities have incorporated environmental management into their policies. Under the Alberta MGA, the general purposes of a municipality are:

- (a) to provide good government,
- (b) to provide services, facilities or other things that, in the opinion of council, are necessary or desirable for all or a part of the municipality, and
- (c) to develop and maintain safe and viable communities (s.3).

At its broadest, municipal jurisdiction includes those matters affecting the safety, health and welfare of people and the protection of people and property (MGA, s.4 (a)). Further, municipal control can be applied to any development, activity, industry, business or thing within municipal boundaries (s.8). That jurisdiction is exercised through bylaws that can be passed and enforced by the municipality. Bylaws can regulate or prohibit; divide development, industry and other activities into classes that can be managed in specific ways; establish a process for permitting and approvals of activities (s.8). The MGA defines the scope of bylaw powers as follows:

- a) *“to give broad authority to councils and to respect their right to govern municipalities in whatever way the councils consider appropriate, within the jurisdiction given to them under this or any other enactment and,*
- b) *to enhance the ability of councils to respond to present and future issues in their municipalities”* (s.9).

The MGA also provides a variety of tools for conservation of natural areas, including control over rivers, streams, lakes and other natural waterbodies within their boundaries (s.60(1)). Municipal authority extends also to the air space above those waterbodies. Although the municipality controls the waterbodies, the province owns any waterbodies and their beds and shores and can influence management in the capacity of an owner. Municipalities do not often exercise their management option, likely due to this fact, although both Strathcona County and the cities of Calgary and Edmonton have recently implemented wetland policies and other municipalities show similar interest.

LAND USE PLANNING AUTHORITY

The MGA gives municipalities' considerable authority over private land use with responsibility for planning land use objectives. The Act allows municipalities to specify both the type and location of development and to regulate development within their boundaries. Several planning instruments are available under the Act, all of which are considered statutory, with a force of law:

- **Municipal Development Plan (MDP):** the broadest guiding document that sets out the goals and objectives of future development, outlining the future vision of the community.
- **Area Structure Plan (ASP) and Area Redevelopment Plan (ARP):** general in scope, these documents outline planning guidelines for a specific area within the municipality. They provide a framework for subdivision and development of an area, outlining sequencing, land uses, density and general location of supporting infrastructure (roads, utilities). Councils can request that these documents address other matters it considers necessary.
- **Land Use Bylaw (LUB) and districting:** a regulatory tool used to implement the vision of the MDP. It creates the structure and processes to manage development, as well as the specific rules and guidelines for subdivision and development. It also divides the municipality into districts or zones for specific forms of development.
- **Inter-municipal Development Plans (IDP):** a plan outlining consistent broad future land use principles for lands within jurisdiction of two or more councils: adopted through bylaws passed by each council.

Under the *Alberta Land Stewardship Act*, regional land use plans, once in place will identify regional priorities that must be incorporated into municipal land use plans. The Act also requires approval of MDP and LUB documents by the regional authority to ensure consistency. The North Saskatchewan Regional Land Use Plan has only begun to be prepared and it is unclear what regional priorities might be identified. Various provincial partners of the BHI have been actively involved in preliminary work to identify key resources across the region, and have highlighted initiatives such as the nature-based tourism project undertaken with the BHI. Municipalities can also promote key interests at this time, including the land use planning achievements accomplished by cooperation in the BHI and the environmental sensitivities identified in the LMF.

The Capital Region Plan (2010) also aims to coordinate land use planning in the Edmonton Capital Region, but by outlining regional planning priorities to manage growth. The Capital Region Board, established under the *Capital Region Board Regulation* (AR 49/2008) of the MGA, is responsible for developing the regional plans, which are subject to approval by the province. As with the North Saskatchewan Regional Land Use Plan, member municipalities can promote key interests that they feel should be addressed regionally. The current plan (*Growing Forward*) encourages coordination on development, infrastructure and policy through regional partnerships. The Beaver Hills Moraine was recognized as an Environmentally Sensitive Area within the current plan, based on concerns raised by the BHI municipalities. Future regional environmental concerns or management approaches could be similarly promoted through this mechanism, through Leduc, Lamont or Strathcona county representatives.

In developing a LUB, the municipality must protect agricultural operations (s.639.1) - a land use specifically addressed by the MGA. The MGA also provides specific tools for conservation. Environmental Reserves (ERs) can be taken during the subdivision process to protect certain natural features (mainly steep slopes and wetlands). Municipal reserve (MR) lands are intended for parks, schools, recreational areas or other public amenities. Typically, MR lands represent 10% of the subdivision parcel, although the municipality can request a larger proportion. Municipalities can also place restrictive covenants on the land title for the benefit of lands under their control (s.651.1 (2)). Additionally, under the provincial *Environmental Protection and Enhancement Act* (EPEA), a municipality can enter into agreements with landowners to create a conservation easement limiting development of the parcel, or portions of it.

The *Historical Resources Act* also allows certain natural areas to be protected for their cultural value. Finally, the *Alberta Land Stewardship Act* provides new tools for conservation of natural, cultural and agricultural features, including conservation easements, directives, and offsets and market-based tools such as transfer of development credit (TDC). (This section of the Act has yet to be proclaimed, and timelines for adoption are not yet certain.) The province has only just begun to investigate potential use of these tools through pilot projects, including the BHI's transfer of development credits project. The Beaver Hills TDC pilot project helped demonstrate how municipalities might protect locally significant areas through market-based tools. Both urban and rural municipalities have also been lobbying the province for an updated definition of environmental reserve to include sites with high ecological value, rather than simply natural features that might affect development.

REGULATION OF SUBDIVISION AND DEVELOPMENT

MDPs and LUBs outline how a municipality will manage land use and development. Conditions for new development can be added to the LUB to address specific municipal concerns but the subdivision process is one aspect that is clearly defined in the regulations of the *MGA*.

The *Subdivision and Development Regulation* outlines the elements that must be included in a subdivision application and the discretionary powers of a municipality to add other requirements. It also directs the subdivision authority to refer applications with resources outside municipal jurisdiction to the responsible agencies including:

- public utilities and other rights-of-way,
- highways and access,
- bed and shore of any river, stream, watercourse, lake or other body of water within the parcel,
- existing or proposed water wells, and
- existing or proposed sewage system.

Other jurisdictions include school authorities, Alberta Energy Regulator, Alberta Utilities Commission, Ministries of Infrastructure, Transportation, Environment and Sustainable Resource Development and adjacent municipalities. The subdivision authority can require other information including:

- the location of the 1:100 year floodplain,

- surrounding land use and land surface characteristics in the surrounding parcels,
- information from AER regarding sour gas facilities within 1.5 km of the parcel,
- a conceptual scheme of future subdivision and development of adjacent areas, and
- any additional information that may be required to determine if the application meets Section 654 of the *MGA* regarding subdivision approvals.

The Regulation further outlines the criteria on which a subdivision authority must base its approval of a subdivision application. Environmental considerations include topography, soil characteristics, stormwater management, potential for subsidence, erosion or flooding, available water supply and capacity for sewage and solid waste disposal. These criteria address the hazards related to the environment and conservation of key resources (e.g., soils). The clause also has an open-ended statement that allows consideration of “any other matters [the municipality] considers necessary to determine whether the land ... is suitable for the purpose for which the subdivision is intended” (s7 (i)). However, there is little guidance as to what other environmental conditions might be considered. Environmental Reserve is also defined in the regulation and similarly framed in terms of hazards to development. Nowhere in the *MGA* or the Regulation is the environment defined as a comprehensive, interactive unit, as it is in federal and provincial environmental policy.

PROPERTY RIGHTS

Land in the province is held either privately or publicly through the federal government, the province or the municipality. Use of private lands can be regulated by any level of government, provided the authority acts in accordance with legislation conferring that power. Areas of regulation must be authorized through laws created within parliament, legislature or municipal council, providing the public opportunity to comment and adapt legislation before it is enacted.

Once passed, there are other opportunities to question and clarify legislated authority. If such legislation appears to create limitations that seem unfair, unreasonable or oppressive, an individual can challenge that authority through the courts. Interpretation of such matters creates a body of common law that identifies specific limits or a requirement for adaptation of the laws in question. Under common (case) law, the courts have interpreted private ownership to include a bundle of rights belonging to the landowner. The largest, most comprehensive right is called *title in fee simple*, which permits the landowner to:

- sell, mortgage, lease or will the estate in land,
- use or develop land in accordance with law,
- grant to others some of the rights in the bundle of rights (e.g., through lease, easement or restrictive covenant), and
- exclude others from entering their land.

Surface water, groundwater and sub-surface minerals are owned and regulated by the province, even on private land. Thus, the province can grant businesses and individuals’ permission to extract oil, gas, coal and other minerals on some private and all public lands and own the resource once extracted. The province can also regulate access and use of both surface and groundwater. Some exceptions apply

regarding private lands. Subsurface rights (mineral rights) were included with the original land title for some private lands, giving the landowner ownership of those resources. The owner of land adjacent to a natural watercourse or waterbody or overlying groundwater resources (a ‘riparian owner’) has certain rights with respect to that water under common law. These rights include:

- Right of access to the water, right to unpolluted water (quality) and rights and consequences relating to the accretion and erosion.
- Rights of use and quantity (flow). These have been modified under legislation (notably, the *Alberta Water Act*).
- Rights regarding flooding. These may be somewhat limited by the *Alberta Water Act*, but those limits have not yet been tested in the courts.

Private land owners have some independence regarding land use, but ultimately, governments have considerable flexibility to impose restrictions to protect the public interest. Although municipalities have a broad scope of influence over privately held lands under the *MGA*, that power is checked by the right of the individual to challenge bylaws made under the Act through the courts. As a result, municipalities carefully consider the extent of their authority and the aim of any proposed policy before imposing any restriction on private land ownership.

THE MGA AND ENVIRONMENTAL MANAGEMENT

A lack of clarity regarding environmental management and a definition of environment in the *MGA* consistent with that now used by federal and provincial authorities has caused considerable confusion for municipalities. Environment has been defined by many municipalities solely in terms of specific hazards to development, as identified in the *MGA*’s *Subdivision and Development Regulation*. Others have borrowed the definition from federal or provincial legislation and expanded their scope of planning to incorporate environmental features and functions. In part, this seems related to the level of experience of the municipality with development.

The scope of delegated municipal interests in the *MGA* (safe and viable communities) and the means of implementing controls are broad, which suggests authority to address environmental concerns. However, the *MGA* clearly prohibits enacting municipal bylaws contradictory to federal or provincial law. As noted though, there are gaps in federal and provincial jurisdiction and considerable room for municipalities to address locally relevant concerns. Controls can and have been imposed by municipalities through enforcement, development permitting and land use planning.

Enforcement has been applied by some municipalities to control situations that could pose a risk to public or environmental health and safety. Agricultural service personnel have long had the authority to penalize landowners for weed infestations. Nuisance impacts such as odor and noise have also been addressed. Other environmental concerns (e.g., release of pollutants, infill of wetlands) have been addressed by new bylaws. For example, the City of Calgary has created a bylaw that penalizes developers who allow the release of sediments to city stormwater systems.

Bylaws have similarly been used to link environmental standards to development permits, rezoning and subdivision applications and other land use approvals processes. Wastewater and stormwater handling standards have been incorporated in the permitting process for new development and redevelopment in many municipalities. More recently, municipalities have begun to add an environmental assessment process to the development approval process. Many municipalities also address conservation issues through bylaws or policy that encourage retention of natural areas, wetlands or treed lands. Examples include the wetland policies of the cities of Edmonton and Calgary and Strathcona County, the natural areas conservation policy of St. Albert and environmental assessment requirements in natural areas within the cities of Edmonton, Red Deer and St. Albert. Such restrictions require both resources and expertise, which smaller municipalities may not have. They also address lands considered for development, rather than protection of natural lands.

Long-range land use planning is perhaps the key area in which municipalities facing development pressures can address environmental concerns. MDPs and LUBs required under the MGA are intended to identify a vision for the community, which can include natural areas and resources important to residents. These plans were only introduced in the 1980s, when the MGA was updated to consolidate land use planning. The MGA mandates updates to statutory plans to address change in policy and community context, but the updates require considerable research, planning and public consultation. As a result, few municipalities have had opportunity to incorporate environmental management.

Regardless, some municipalities have added environmental policies to their MDPs and LUBs. A notable example within the moraine is the expanded protection achieved by Strathcona County in their 2007 MDP update. The City of Edmonton has identified natural areas as a specific land use zone, with certain development limitations within their LUB. The examples of wetland management and environmental assessment requirements mentioned in previous sections have been similarly enacted through changes to the municipal LUB.

Municipalities facing rapid growth have also grappled with the issue of protecting natural areas on private lands. Prohibition against clearing identified natural areas, unless the land is protected through a conservation easement, is perceived by landowners as an unreasonable restriction of land ownership rights. This is despite clear authority in the *MGA* to manage for common good and the lack of guarantees within the Act regarding economic rights of landowners.

Such non-traditional applications have been legally challenged at the Supreme Court of Canada. A landmark case in Quebec in 2001 affirmed the right of a municipality to restrict the use of private lands. The challenge addressed the authority of the Hudson, Quebec municipality to regulate the use of pesticides for cosmetic purposes. Like the Alberta *MGA*, the Quebec *Cities and Towns Act* prohibits municipalities from enacting bylaws that would contradict federal or provincial law. The broad scope implied by the Quebec Act was central to this case and the decision established precedent for municipalities across Canada to create such policy.

In their defense, the municipality pointed out the assumption that since the province originally conferred powers to a municipality, it would ensure that any potential overlap would be prevented in the enabling legislation. While the resulting scope of the *Cities and Towns Act* is admittedly broad, other case law cited in the defense established that it is the *intent* of the bylaw that is critical. Bylaws constructed in an obviously unfair, unreasonable or oppressive manner, or that exercise powers in bad faith, would contravene the Act.

As seen above, there are many opportunities for municipalities to manage environmental issues through their delegated responsibilities. However, to implement such laws with minimal public resistance or litigation, municipalities must proceed cautiously and with broader objectives clearly communicated. Extensive consultation may be necessary where the new policy direction may not be evident to some residents. The science-based approach promoted by the BHI provides critical support to such land use changes, as illustrated in the five case examples presented throughout this document.

5.0 BEST MANAGEMENT PRACTICES

INTRODUCTION

Knowledge of the location of natural resources is an important first step. Knowledge of the best means to manage those resources provides the tools to sustain them in perpetuity. In this section, we identify Environmental Best Management Practices (BMPs) for resource management that can be incorporated into municipal land use policy and the development approval process, or can inform landowners who might wish to adopt sustainable land management practices.

Land use decisions handled by municipal planning departments cover two different scales. On one hand, planning departments review site-specific applications, evaluating the degree to which the proposed development meets land use guidelines and objectives outlined in policy. Periodically, they also revisit those policies, to update MDP, LUB and other supporting policies. BMPs can be applied at both scales, with adaptation for the level of planning.

The Policy BMPs presented below can be incorporated into municipal policies to manage a given resource at the landscape level. The more specific Planning BMPs provided for each key resource are relevant to the land use permitting and approvals process for new development. Implementation of BMPs follows a similar process, regardless of scale:

- Identify specific natural resource concerns within a site or broader planning area;
- Identify impacts likely to result from proposed development or land management (i.e., from disturbing, degrading or removing those resources);
- Identify mitigative measures (BMPs) that will reduce the severity of those impacts, either within the design or through specific management actions; and
- Identify monitoring needs to ensure management is successful.

Where referrals to other environmental jurisdictions might apply, we have provided a listing of the activities that might trigger environmental permitting, and the agency to which the municipality should refer. Referral requirements could be incorporated into statutory policy to formalize the supporting role other jurisdictions play sustainable management.

Managing existing developed lands sustainably is more difficult, as there is no direct, regulatory control other than enforcement of regulatory requirements, many of which lie outside municipal jurisdiction. Municipalities can however foster sustainable land management practices through more subtle means: leading through example, promoting alternatives and providing incentives. Landowner cooperation and voluntary adoption of BMPs are the best means of achieving management goals at the landscape level. Convincing landowners of the need and benefit of sustainable management ultimately offers the best chance for success in the long-term.

AIR QUALITY BEST MANAGEMENT PRACTICES

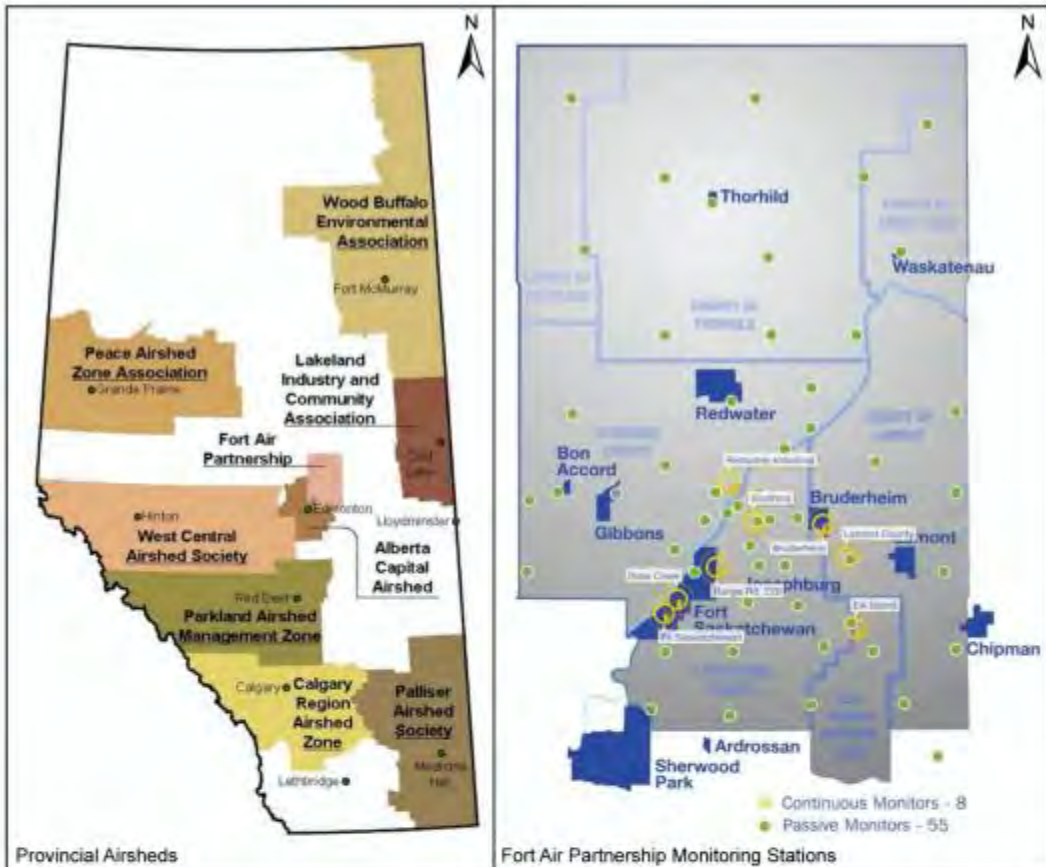
CONTEXT/ISSUES

Substances such as carbon monoxide, ozone, sulphur oxides (SO_x), nitrogen oxides (NO_x) and hydrogen sulphide are airborne contaminants associated with industrial and urban areas. At higher concentrations, they can cause adverse localized environmental and health effects, including acid rain (NO_x and SO_x). Regulation and reduction of such emissions have become important because of the range of potential effects on humans and ecosystems. The Canada-Wide Air Quality Objectives and the Alberta Ambient Air Quality Guidelines identify permissible emission levels applicable to industrial, commercial, agricultural and residential activities.

When these contaminants are inhaled by animals (including humans), they are absorbed into the bloodstream from the lungs and transported to the heart, causing cardiovascular damage and chronic health issues. Similarly, plants can be affected when airborne contaminants enter the plant through stomata and are absorbed directly into leaf tissue; or are taken up by roots and transported to leaves. Sensitive plant species can die if exposed for long periods or to high concentrations. Animals may also absorb some of these substances when they feed on affected vegetation. Lastly, airborne contaminants can be deposited into waterbodies, which can reduce water quality and affect the health of aquatic organisms. Since all organisms in an ecosystem interact with one another to maintain a healthy ecosystem, these cumulative effects may lower ecosystem resilience. Less resilient ecosystems may not be able to sustain important ecological goods and services valued by moraine residents, including clean air and water.

Air quality is regulated by AESRD according to provincial and national standards and objectives. Ideally, air should be odourless, tasteless, colorless and have no measurable effects on people, animals or the environment. AESRD monitors air quality at stations across the province at one, eight or 24-hour intervals, depending on the location to track trends and alert communities to health risks. Air quality in areas with many pollution sources is managed within airsheds. The Alberta Capital Airshed (City of Edmonton) and the Fort Air Partnership (FAP) Airshed (Industrial Heartland) are near the moraine and upwind of the prevailing southwest wind direction (Map 12). Only the FAP Airshed extends into the northeast moraine - risk is likely less elsewhere. Air quality is measured at sites within Edmonton and at Fort Saskatchewan, Bruderheim and Lamont within the FAP Airshed. Another station in Elk Island National Park checks for ecological effects. A new station is being established at Ardrossen. Air quality at these stations has generally been good (low health risk). The cumulative Air Quality Health Index (AQHI)¹² used by AESRD to report air quality averaged around 2.3 within the FAP Airshed over 2014 and slightly higher in Edmonton (2.87). At times over the year though, short-term spikes of 7 to 12 were recorded.

¹² The AQHI combines all daily measures of air quality parameters to provide an index between 1 (low health risk) and >10 (high health risk). Historical data obtained from <http://esrd.alberta.ca/air/>.



 	<h3>Air Quality Monitoring in the Beaver Hills Area</h3>		<p>DATA SOURCES: Provincial Airsheds http://esrd.alberta.ca/air/monitoring-and-reporting/ambient-air-monitoring/albertas-airshed-zones.aspx Fort Air Partnership Monitoring Stations http://www.fortair.org/wp-content/uploads/2014/05/FAP-Network-Monitoring-Map.jpg Capital Region Monitoring Stations http://capitalairshed.ca/station-map</p>
	Map 12	Map Scale NA	

The Capital Region Air Quality Management Framework (2010) established ambient air quality targets for four key contaminants (nitrogen dioxide, sulphur dioxide, fine particulate matter and ozone) within the Edmonton Capital Region. The framework takes a cumulative effects approach based on collaboratively established air quality limits and management response actions triggered by local monitoring data. The monitoring network on the eastern side of the moraine (within the Capital Region Airshed) thus plays a critical role in the framework, signaling need for response action. With such policy initiatives, future development within the moraine should seek to minimize pollutant emissions.

POLICY BMPS TO MAINTAIN AIR QUALITY

Consider current air quality monitoring results and research in MDP and LUB policy reviews. Establish additional air monitoring stations within the moraine to monitor ambient air quality.

- Although air quality is currently considered good across the moraine region, areas close to industrial zones may be susceptible to longer-term ecological impacts of airborne contaminants. Air quality in the east part of the moraine, downwind of the growing Capital Region, is not monitored, and thus trends are unknown. Policies and the management framework developed by the Capital Region Airshed could provide useful justification for new monitoring stations.

Consider alternative land uses compatible with industry (e.g., landscaping businesses, woodlots) and naturalized landscaping standards as buffers for improved air quality.

- Most municipalities are sensitive to public perceptions of air quality near industrial areas and attempt to buffer these areas from more densely populated zones, often using agricultural areas to separate humans from industry. Yet, the public is also increasingly wary of potential impacts of airborne contaminants on food products. Alternative land uses such as tree nurseries, woodlots or landscaping businesses can serve as windbreaks between industrial and more populated areas.

Consider less dense, non-residential or recreational land uses to buffer intensive agricultural operations.

- Odiferous operations such as poultry and pig farms can conflict with densely populated rural residential or urban areas. Although the NRCB regulates odour issues associated with intensive livestock operations, municipalities can minimize future conflict by identifying both livestock zones and buffer zones of suitable intermediary land uses during the MDP planning process.
- Encouraging retention or creation of buffers of vegetated land, preferably wide, treed buffers, around such operations in land use policy can help minimize odour impacts to adjacent lands, defuse potential landowner conflicts, and create carbon sinks for greenhouse gases.

Consider policy that encourages 'greenscaping' in areas of new development, or retention of vegetation in already developed areas.

- Naturalized landscaping can act as a carbon sink, storing CO₂ emissions resulting from various urban and industrial activities and reducing the associated carbon footprint.
- Vegetation can also improve air quality by the natural process of photosynthesis, which uses atmospheric CO₂ to support the plant's metabolism, and releases oxygen as a by-product.

To reduce air pollutants in the longer-term, encourage the use of clean energy, such as solar and wind power, or other more energy-efficient technologies for heating, transportation and power.

- If possible, investigate means of incorporating clean energy into municipal operations, or inciting clean energy use in the private sector.

PLANNING BMPS TO MAINTAIN AIR QUALITY

The province manages air quality associated with large industrial operations through the approval processes of the Alberta Utilities Commission, the Alberta Energy Regulator and AESRD. Air quality impacts from intensive livestock operations are regulated by the Natural Resources Conservation Board (NRCB). Although municipalities are not involved directly in these approval processes, municipal concerns and land use policies must be addressed in the project’s design. This situation provides an opportunity for municipalities to identify requirements for buffers or air quality protection measures within land use zoning and policies. Inclusion of such policies proactively informs other jurisdictions of municipal objectives, and provides justification for comments on individual proposals, if needed.

The municipality can also stipulate best management practices for those land uses regulated solely by the municipality, including smaller farm operations (e.g., greenhouses, U-pick operations), commercial operations (e.g., trucking and storage areas) and municipal utilities (e.g., wastewater management, waste disposal). Although these industries typically release fewer airborne contaminants or toxins, minimizing releases from energy generation or materials storage, or creating carbon sinks through landscaping helps reduce the cumulative impact on regional air quality. Working with proponents at the project development stage to incorporate the recommendations identified in the preceding section will help ensure consistency across all levels of planning. Specific recommendations follow below for each stage of the planning process.

Development Design Stage:
<i>Establish best practice guidelines encouraging industries to adopt the most efficient technology for reducing air emissions and incorporating green space as carbon sinks.</i>
Planning Review:
<p><i>Minimize local odor and other air quality issues by managing potential land use conflicts. Investigate existing and future adjacent land uses and management to determine whether a proposed development may eventually result in conflict.</i></p> <ul style="list-style-type: none"> • Many municipalities recognize the potential conflict between agricultural operations and multi-lot subdivisions. Conditions to protect the existing land use may be appropriate in such circumstances, to place the onus on the new development to mitigate future impacts through vegetated buffers, odor controls or modified operations.
Construction Stages:
<i>Encourage natural vegetation retention and landscaping where possible, to maximize the filtration and carbon sink functions provided by vegetation.</i>

POTENTIAL REFERRALS FOR DEVELOPMENTS IMPACTING AIR QUALITY

Activity	Legislation	Note
Any activity resulting in the release of air emissions	<i>Alberta Environmental Protection and Enhancement Act (industrial approvals); Natural Resources Conservation Board Act (ILO approvals, operating guidelines); Canadian Environmental Protection Act (enforcement)</i>	Municipalities should ensure that the proponent contacts AESRD and Environment Canada, respectively, for approvals, advice and comment.

SURFACE WATER BEST MANAGEMENT PRACTICES

CONTEXT / ISSUES

Reliable, quality water supplies are critical for people, ecosystems and economic growth. Unfortunately, a number of issues can negatively affect this resource. Point sources, such as intensive livestock operations and heavy industry can release effluent or waste products into waterways. Non-point sources, such as golf courses and croplands can diffusely release fertilizers or other chemicals through runoff, which can affect downstream water quality.

Storm water runoff is another source of non-point pollution and can lead to erosion and subsequent sediment inputs into watercourses and wetlands if not managed correctly. Runoff increases with increasing impervious cover, since water is unable to percolate into the ground. Sedimentation can reduce habitat quality by obscuring visibility or smothering aquatic plants and substrates or by stressing aquatic fauna (e.g., causing respiratory difficulty in fish).

Surface waterbodies often provide a water source for domestic or industrial use. If the volume of water withdrawn is greater than its typical input, water levels may drop, affecting surrounding vegetation, aquatic organisms and wildlife. Substantial withdrawals of surface water can also lower groundwater tables, contributing to drought conditions.

Watercourse alteration can increase stream flow velocities. A doubling of the speed of a stream's flow allows it to erode the channel four times as much and to carry 64 times the amount of sediment. Increased stream flow also reduces opportunity for water to soak into surrounding soils. Similarly, the infilling of wetlands and floodplains can affect the ability of the land to slow flows and attenuate floods. Most municipalities do not allow building development within the 1:100 year floodplain, but they may allow other structures that can be affected by flooding, or cause flooding elsewhere.

Streambanks can be degraded by livestock browsing and hoof shear, recreational use and resource extraction, which break up bank structure and expose soils to erosion and higher evaporation. Healthy riparian vegetation buffers help to stabilize banks, control nutrient cycling, trap contaminants and sediments, reduce water velocity, provide fish cover and food, reduce erosion and reduce the rate of evaporation. These buffers also allow for wildlife movement. Recommended buffer width for these functions varies depending on the ecological service and between references and agencies, but most researchers agree that wider buffers will capture the broadest range of ecological functions.

Water is critical to human health but a number of human activities can affect surface waters.

Impacts to surface water often begins with consideration of the levels and types of development at the landscape or watershed level but ultimately must be managed at the site level. Terrain dictates surface water flow. Water generally remains within a small catchment defined by height of land, spilling over only in high water periods. Catchments can be grouped into increasingly larger landscapes, from the more

localized gross management area to the much larger regional watershed level. Balancing the amount and type of human development and land use at the watershed scale most relevant to the municipality (e.g., the gross drainage area) will ensure that the impacts described above are minimized, and water quality and quantity are sustained.

POLICY BMPS TO MAINTAIN SURFACE WATER RESOURCES

Consider potential watershed level impacts in decisions regarding the location, type and intensity of land uses in a municipality, allowing new development only where surface water risk will not be pushed past natural limits.

- Consider the type and density of existing development within gross drainage areas when determining future development zoning, to avoid overdevelopment and increased risk of surface water impacts.
- Direct intensive livestock operations or heavy industrial land use to gross drainage areas with less abundant water and ensure that new operations are located well away from surface waterbodies.
- Avoid development in environmentally sensitive areas such as the flood zone around waterbodies and encourage retention of natural riparian buffers.

Manage for adequate water supply.

- Encourage water use reporting and monitor to ensure use does not exceed capacity. Consider re-zoning to lower the densities of future water users where water supplies are declining or sparse. Encourage water conservation through bylaws and/or incentives.
- Encourage retention or restoration of naturally vegetated riparian buffers around waterbodies to minimize evaporation impacts.

Maintain stable shores with diverse vegetation along watercourses/wetlands and in floodplains.

- Consider a water protection policy, incentives or conditions for development to encourage landowners to maintain a minimum vegetated buffer of 30 m around waterbodies to protect water quality. Develop user awareness programs promoting BMPs for grazing and off-highway vehicle use near waterbodies. Rehabilitate degraded sections of streams where required. Do not allow development in 1:100 year floodplains.

Avoid wetland/watercourse loss, diversion or alteration from development.

- Adopt a wetland protection policy that references the provincial *Wetland Policy* (2013) and discourages activities causing wetland loss. Establish a wetland-monitoring program to record the losses or gains in wetlands across the moraine.

Encourage land and water management strategies that will help to protect water quality.

- Implement a bylaw to discourage discharge of pollutants, including sediment to a wastewater or stormwater system.

- Promote naturalized stormwater drainage designs in new subdivision developments to maximize biological means of flood control, water filtration and purification, and other ecological goods and services associated with natural waterbodies and riparian habitat.
- Educate urban residents to improve storm water quality through pollution prevention and appropriate use of pesticides, fertilizers and other hazardous materials. Promote agricultural best management practices including crop nutrient management, pest management, conservation tillage and irrigation water management.
- Consider an Aesthetic Herbicide and Pesticide Bylaw to regulate use of these chemicals on landscaped areas, where over-use can result in release to waterbodies through run-off.
- Review municipal operations and guidelines for use of these chemicals to minimize use where possible (e.g., naturalized rights-of-ways and parkland may not require chemical treatments).

Discourage use of impervious cover (such as asphalt) in rural subdivisions, particularly where groundwater recharge or discharge is suspected.

- Reduce demands for impermeable road infrastructure by promoting public transportation and community walkability where feasible, or by encouraging environmentally friendly methods of dust control.
- Rehabilitate areas already constructed with impervious materials by replacing such cover with more permeable materials (e.g., gravel) on an opportunistic basis.

PLANNING BMPs TO MAINTAIN SURFACE WATER RESOURCES

On review of a proposed plan, supporting air photos and the Surface Water Risk Maps, implement those BMPs applicable to the site.

Development Design Stage:
<i>Minimize or avoid watercourse and wetland disturbance and/or alterations that may lead to increased stream flow velocities and subsequent erosion.</i>
<i>Maintain a minimum vegetative buffer of 30m along watercourses/ wetlands to capture and degrade potential contaminants, stabilize banks, prevent erosion and reduce sedimentation from overland water flow and wind-eroded materials into waterbodies.</i>
<p><i>Construct within a minimal footprint and minimize lot clearing to the area required for building.</i></p> <ul style="list-style-type: none"> • Development design should avoid natural water features and avoid removal, culverting, blocking or realignment of watercourses/wetlands. Clustered residential developments (conservation planning designs) that locate higher density in less sensitive areas provide an effective planning alternative for such circumstances.
<i>Design subdivision road networks with linkage to existing road networks as much as possible and avoid creating access roads that will cross watercourses or disturb wetlands.</i>

Planning Review Stage:

Ensure full Environmental and Municipal Reserve is utilized to protect sensitive water features.

- Consider including the vegetated riparian buffer as part of the Environmental Reserve taken around wetlands and other watercourses. Particularly wide buffer areas in good condition could be protected under a Conservation Easement or as municipal reserve, an option that should be considered where other ecological functions might be present (e.g., wildlife corridors). Lot bonusing systems and cluster (conservation planning) designs may be useful incentives to increase conserved lands.

Ensure the appropriate buffer required for protection /promotion of relevant ecological functions at watercourses/wetlands has been included in the design (e.g., to enhance connectivity).

Ensure that wastewater systems are located, constructed and can be maintained to avoid impacts to surface and groundwater quality. The Alberta Private Sewage Systems Standard of Practice 2009 provides relevant advice, including appropriate setbacks from waterbodies to prevent release (particularly septic fields), considerations for local soil conditions, and systems that have proven long-term performance.

- Because pollutant discharges from stormwater and other sources, such as septic systems, illicit discharges and spills, are illegal under various provincial and federal legislation, assuring that proposed developments would not pose a contravention is due diligence on the part of the municipality.

Require new developments to provide a storm water management system that provides some form of sedimentation and contamination filtration prior to release to natural waterbodies (e.g., bioswales, forebays, oil and grit separation).

- Naturalized drainage designs can provide various ecological benefits, including filtration, reduced evaporation, contaminant removal, wildlife habitat and improved aesthetics.

Discourage replacement of existing natural areas (areas of relatively undisturbed native vegetation) and wetlands with development and impervious cover, particularly where groundwater recharge or discharge is suspected.

- Consider a condition to rehabilitate areas of extensive impervious cover where groundwater recharge or discharge is known to occur for re-development approvals.

Encourage developers to build up rather than out to reduce impermeable surface within lots.

Encourage use of “low-impact” surface runoff systems (e.g., release roof run-off into vegetated areas, rather than collecting in storm systems).

For proposals that will require large volumes of surface water withdrawal to support the development, confirm that the water source can sustain such use and that a withdrawal license under the Water Act has been obtained from Alberta Environment and Sustainable Resource Management.

- Farmers and residents adjacent to surface waters who remove small volumes are exempt from Alberta Water Act licenses for withdrawal.

Construction Stage:
<p><i>Minimize sedimentation from soils disturbed during the construction process by minimizing clearing, requiring erosion and sediment controls within the construction area and enforcing these regulations.</i></p> <ul style="list-style-type: none"> • The City of Calgary’s Wetland Policy contains excellent suggestions for development standards designed to minimize the amount of sediment carried in run-off to local waterbodies.
<p><i>Prevent the establishment of noxious, invasive or weedy species within riparian buffers through appropriate construction mitigation measures (weed control, washing of equipment prior to entering riparian areas).</i></p>
<p><i>Require rehabilitation measures as a condition of approval for projects around watercourses or wetlands where noxious, invasive or weedy vegetation has become established within a buffer.</i></p>
<p><i>Revegetate cleared areas as soon as possible with native species to prevent the establishment of noxious, invasive or weedy species and minimize potential erosion.</i></p> <ul style="list-style-type: none"> • Where construction is necessary within the 30 m riparian buffer, require revegetation of the disturbed areas adjacent watercourses and wetlands as soon as possible. Require that adequate erosion and sedimentation controls be in place for any such work, to mitigate potential release into surface waters.
<p><i>Require that appropriate erosion and sedimentation protection measures be in place for any construction works within floodplain areas to prevent potential sediment release to adjacent waterbodies.</i></p>

POTENTIAL REFERRALS FOR ACTIVITIES IMPACTING SURFACE WATERS

Activity	Legislation	Note
Where in-stream activities in fish-bearing waters are proposed	Canadian <i>Fisheries Act</i> approval; <i>Canadian Environmental Assessment Act</i>	Refer the proposal to the Canadian Department of Fisheries and Oceans and the Canadian Environmental Assessment Agency for advice.
Where construction would occur in or on the shores of navigable waters	<i>Navigable Waters Protection Act</i> approval; <i>Canadian Environmental Assessment Act</i>	Refer proposals to Transport Canada.
Where water resources, including all wetland types, could be impacted by diversion, draining or filling	Alberta <i>Water Act</i> approval	Refer such proposals to Alberta Environment and Sustainable Resource Management
Where development occurs on the bed or shores of permanent, naturally occurring waterbodies, including work within wetlands or watercourse realignments	Alberta <i>Public Lands Act</i> approval	Refer such proposals to Alberta Sustainable Resource Development, Public Lands Branch.
Where stormwater management is necessary	Alberta <i>Environmental Protection and Enhancement Act</i> and the <i>Water Act</i> Code of Practice for Outfall Structures	Refer proposals to Alberta Environment and Sustainable Resource Management.
Where road crossings over waterbodies are proposed	<i>Water Act</i> Code of Practice for Watercourse Crossings	Refer proposals to Alberta Environment and Sustainable Resource Management.
Where contamination of watercourses/wetlands may occur	Alberta <i>Environmental Protection and Enhancement Act</i>	Refer such proposals to Alberta Environment and Sustainable Resource Management for advice on appropriate design controls to prevent accidental leaks or spills.
Where intensive livestock operations are planned	<i>Agricultural Operation Practices Act</i> approval	Refer to the Natural Resource Conservation Board.

GROUNDWATER BEST MANAGEMENT PRACTICES

CONTEXT / ISSUES

Similar to surface water, important ecological goods and services are provided by a well-functioning groundwater system. As groundwater flows through surficial sediments toward underlying aquifers, it is naturally filtered. This filtering, combined with the long residence time underground, means that groundwater is usually free from disease-causing microorganisms. Other contaminants that can either be dissolved or carried in water may not always be filtered out, however, and if such contaminants reach the underlying aquifer, removal or remediation can be difficult or impossible.

Where groundwater is near or exposed to the ground surface, such as recharge or discharge zones or groundwater well shafts, the potential to encounter such contaminants is higher. Contaminants released into surface water or even onto the soil surface can leach into groundwater reservoirs. Placing fuel storage areas, septic systems or manure storage areas close to such zones further increases that risk.

Intensive withdrawal of groundwater can lead to lowered groundwater tables, affecting the ability of vegetation to persist on the surface. As the density of water wells increases, their collective demand on local groundwater resources also increases and may ultimately exhaust the source, if use is not managed. During groundwater shortages, surface waters levels may also fall as the discharge of groundwater sources to surface waterbodies may be reduced. A high density of groundwater wells also increases the risk of groundwater contamination, since direct access can allow contaminant entry.

Floodplains often have direct contact with shallow groundwater flows and facilitate groundwater recharge. Developments that reduce surface water infiltration in these zones can affect both shallow groundwater and surface water supply. Watersheds with poor groundwater storage capability will more quickly exhibit low stream flows in times of low precipitation. Stream flow may become intermittent during dry periods and water may become unavailable for livestock, wildlife and fish. Typically, water tables in well-vegetated riparian areas are higher, often within the plant-rooting zone and thus available to plants.

Groundwater falls under provincial jurisdiction and withdrawals are managed through Alberta Environment and Sustainable Resource Development. Development around groundwater wells, floodplains and recharge and discharge zones is regulated mainly by municipalities, although provincial agencies approve industrial and agricultural projects. Like surface water management, though, a landscape level approach is the best means of controlling development impacts, by designating areas appropriate for the type and intensity of development.

POLICY BMPS

Avoid contamination of groundwater by restricting activities that may release harmful substances.

- Do not allow activities associated with potentially harmful contaminants or with potential for pollutant discharge on or near groundwater recharge or discharge areas and areas draining to wetlands and other waterbodies.
- Ensure that new rural, industrial or commercial developments follow provincial guidelines for wastewater treatment and disposal. Encourage collection and treatment where feasible (e.g., tie into existing urban infrastructure).

Consider incorporating conditions to upgrade existing, non-compliant systems such as leaking underground storage tanks or older septic systems to redevelopment approvals on existing properties, or work with other jurisdictions to incite upgrades in high-risk areas through tax-benefit programs.

- Pollutant discharges from existing, older septic systems can affect surface and groundwaters. Such releases are illegal under various provincial and federal legislation

Avoid concentrating high-demand groundwater users in an area of limited supply.

- Work with the provincial government to assess the quantity of groundwater available in the community. Adjust land use zoning as necessary to minimize risk of exposure to contaminants.

During MDP and LUB planning reviews, designate areas for intensive livestock operations or heavy industries away from discharge and recharge zones, and ideally, into gross drainage areas with low surface water abundance.

- The NRCB has established manure storage guidelines for intensive livestock operations that will apply to those land uses. A reference to those guidelines may be appropriate, if not already included in relevant policies.

Identify wetlands that may lie on or near groundwater recharge areas and discourage draining, filling or other disturbance of these wetlands or their adjacent riparian buffers.

- Wetlands can serve as recharge zones for groundwater supply, providing the retention time necessary for water to soak into the soil and underlying substrate. Wetlands also function as a filtration system for water seeping through the substrate into the underlying aquifers or shallow groundwater. Lastly, wetlands may be supplied by groundwater discharge, so that groundwater is contiguous with the wetland.

PLANNING BMPS

On review of the proposed development plan, supporting air photos and the Ground Water Risk Map, implement those BMPs applicable to the site.

Development Design Stage:
<i>Encourage use of designs/landscaping that limit clearing and retain maximum vegetation within floodplain areas.</i>
<i>Avoid covering extensive areas with impervious surfaces (e.g., paving, concrete surfacing), instead, choose gravel surfacing or vegetation.</i>
<i>Design developments around natural water features to avoid impact (e.g. clustered residential developments, minimizing or avoiding water crossings by roads).</i>
<i>Maintain a minimum 30 m wide vegetated buffer around wetlands, other waterbodies and known groundwater recharge zones to protect both surface and groundwater quality.</i>
<i>Ensure septic systems are appropriate for soil and groundwater conditions. Where recharge or discharge zones are suspected, particularly in areas with coarse soils or waterbodies, septic systems that prevent potential release to surface water or subsoils should be incorporated into proposed development design.</i>
<i>Avoid developments in areas where high water table levels present a potential risk of groundwater contamination (basements may also be inappropriate in such areas).</i>
Planning Review Stage:
<i>Where wetland impacts cannot be avoided and choices are available, discourage disturbance of wetlands on or near groundwater recharge or discharge areas.</i>
<i>Do not allow land uses associated with potentially harmful contaminants on or near groundwater recharge or discharge areas.</i>
<i>Where intensive livestock operations are planned, proposals must be referred to the NRCB. The municipality can request the NRCB to address special considerations consistent with local planning objectives within approval process. Develop planning policies for ILOs that will help minimize potential conflict with other local management objectives (e.g., existing density of ILOs, proximity to locally sensitive waterbodies or groundwater recharge/discharge areas).</i>
<i>Consider other facilities associated with the proposed development, such as landfills or hazardous material storage facilities, in the proposal review. Ensure such facilities are in locations where leachates will not contaminate underlying groundwater or surface waters overlying recharge or discharge areas.</i>
<i>Confirm that sufficient groundwater supply exists to support proposals that will require large volumes of water for operation (e.g., subdivisions, industrial developments). Require the proponent to provide documentation from Alberta Environment and Sustainable Resource Management confirming that a license will be granted for the proposed development as a condition of development approval.</i>
<i>To minimize groundwater use in areas with higher groundwater demand, country residential and small holdings can be linked to municipal water systems, or use water storage systems (e.g.,</i>

<i>cisterns). Adequate sources must still be available; confirmation of a reliable and sustainable source from Alberta Environment and Sustainable Resource Management should be a condition of development approval.</i>
<i>Recommend seeking other sources of potable water, or implementing innovative approaches to water use, if there is a threat of groundwater overuse.</i>
<i>Require that any new drilled wells be reported to Alberta Environment and Sustainable Resource Management as a condition of development approval to support provincial jurisdictional requirements.</i>
Construction Stage:
<i>Revegetate floodplain areas disturbed during construction as soon as possible, as this will enhance infiltration and capture of surface run-off, and groundwater recharge.</i>
<i>Require applicants to prepare Hazardous Materials Management Plans for any large-scale construction project and for operation of industrial developments. Storage and use of hazardous materials within 100 m of any waterbody should be prohibited.</i>

POTENTIAL REFERRALS FOR ACTIVITIES AFFECTING GROUND WATER

Activity	Legislation	Note
Where water resources could be impacted by diversion, draining or filling	<i>Alberta Water Act approval; Public Lands Act</i>	Where development occurs on the bed or shores of a permanent waterbody the Alberta <i>Public Lands Act</i> approval processes also apply. Refer such proposals to Alberta Environment and Sustainable Resource Development (Water Resources & Public Lands, respectively).
Wetlands may be impacted by proposed developments by draining, filling or other disturbance	<i>Alberta Wetland Policy and Alberta Water Act approval, Public Lands Act</i>	Where permanent wetlands will be disturbed, the Alberta <i>Public Lands Act</i> may also apply. Refer proposals with such potential impacts to Alberta Environment and Sustainable Resource Management (Water Resources & Public Lands, respectively).
Contamination of groundwater (or surface water)	<i>Alberta Environmental Protection and Enhancement Act (EPEA), Canadian Environmental Protection Act (CEPA).</i>	Contamination is prohibited under <i>AEPA</i> . Depending on the contaminant, a release may also be administered under the <i>CEPA</i> . Proposals with potential to impact groundwater resources (including certain sewage treatment systems and industrial activities) should be referred to Alberta Environment and Sustainable Resource Management and Environment Canada, respectively for advice on potential for the design to contravene these regulations.
Proposals for intensive livestock operations	<i>Agricultural Operation Practices Act approval</i>	Such proposals should be referred to the Natural Resource Conservation Board.

BIODIVERSITY CORE AREA BEST MANAGEMENT PRACTICES

CONTEXT / ISSUES

In the Beaver Hills Moraine, Biodiversity Core Areas are large, contiguous patches of habitat that can support a higher diversity of plant and animal communities with abundant populations. Core Areas vary in size with respect to species, due to species-specific habitat and territory requirements. Maintaining a range of Core Areas distributed across the moraine provides multiple sources of different populations of wildlife and plant species. This avoids concentrating those resources in one, potentially vulnerable location, instead distributing them across a landscape. A network of Core Areas also allows individuals to disperse to a wider range of smaller habitat patches, thus sustaining biodiversity across the landscape

POLICY BMPS FOR MAINTAINING BIODIVERSITY CORE AREAS

Maintain large contiguous patches of native vegetation.

- Biodiversity is sustained within a landscape by maintaining pockets of high diversity that may exist, and by maintaining healthy source populations that can help repopulate other, smaller habitat patches.

Establish explicit management goals within MDP policy for Core Areas.

- The largest Core Areas should remain unfragmented by development. They should be connected to each other, and to the smaller Habitat Patches in the moraine through Linkage Habitat (Linear Corridors and Stepping Stones) and permeable forms of land use. Designating land uses and promoting land management practices that minimize impacts to the Core Areas within the lands adjacent these areas would provide an additional measure of protection for these areas.

Create explicit policy that prioritizes the types of habitat to be retained through the planning process and that identifies the means for conservation action.

- Portions of the largest Core Areas not currently contained within a federally or provincially protected area, and other medium-sized Core Areas and Linkage Habitats associated with the protected areas should be identified as conservation priorities.
- Policy should promote land uses that require minimal clearing (e.g., through low density development or agricultural land uses).

Ensure that locations identified for development in MDP and LUB plans attempt to retain critical habitat.

- This can be achieved by taking the following actions:
 - Define critical natural areas (i.e., Core Areas and Linkage Habitat) in policy and provide some measure of conservation for these areas (e.g., the policy tools suggested above).
 - Direct future development, particularly intensive industrial and commercial land uses, high density residential areas, to already developed areas with supporting infrastructure and less critical habitat.

- Zone lower density of development in areas with abundant greenspace and provide policies that encourage retention of natural vegetation, or restore natural vegetation.
- Set urban growth boundaries to focus development on lands without critical habitat, or on lands already cleared of natural habitat (e.g., the White LMAs).
- Relieve development pressures on all natural areas at the urban fringe by promoting infill development and urban redevelopment.
- Consider developing a Tree Policy that encourages retention of treed habitat for aesthetic purposes, in addition to the protection offered to critical habitat. Incentive programs that compensate or reward tree retention may be possible, and may ultimately be more successful.
- Consider amendments to MDPs and LUBs for the protection of environmentally sensitive and significant natural areas through the application of a natural areas designation.

Identify specific planning tools, including the full range of options permitted under the MGA, to manage these conservation priorities.

- A variety of tools has been developed in recent years to expand the ‘conservation toolbox’. Some municipalities have protected key natural areas under an innovative conservation land use zone (e.g., City of Edmonton). Consider also, covenants on the land title that would limit the extent of clearing of naturally vegetated lands, limit building footprints or provide other development conditions that could manage natural habitat in perpetuity. In the longer term, municipalities may wish to apply market-based approaches to compensate landowners for protection of priority lands (e.g., the Transfer of Development Credits program piloted by the BHI).
- Conservation easements provide explicit protection of parcels, or portions of parcels with natural areas from future development, but landowner consent is required to establish the agreement. Interested landowners could arrange such protective measures through the various ENGOs active in the moraine, with assistance of municipal staff.
- Environmental and municipal reserve can be used to conserve smaller areas within a developed parcel. They cannot be used to protect larger Core Areas, given constraints on their use implicit in their definition in the MGA.

Consider establishing in policy a restricted construction period to avoid the critical nesting period for migratory birds, and to avoid possible contravention of the federal Migratory Birds Convention Act and the Alberta Wildlife Act.

- Environment Canada and Strathcona County recommend that constructors avoid clearing between 15 April and 31 July. Alberta Environment and Sustainable Resource Development promote a slightly different period (15 April to 15 July) and suggest that clearing avoid disturbance of nesting owls and raptors. These timing restrictions recommend avoidance first, but if construction cannot be avoided during that period, they require a survey for nesting birds be completed by a qualified wildlife biologist. Note that Environment Canada recently suggested that survey be limited to sites of one ha or less, since larger areas can be difficult to survey completely.

Establish monitoring programs for species of management concern to determine appropriate goals for core area size.

- Collaborative programs with provincial or federal agencies, ENGOs or adjacent municipalities would provide a cost-effective alternative for monitoring, and offer access to the necessary professional expertise. Consider developing citizen science programs where possible to involve residents in local management planning, and to provide volunteer support.

Identify important natural areas and areas for restoration before development pressures grow.

- Linkage habitat in particular may have small gaps that if restored, would help maintain connection between key habitats. Restoration work could be linked to development conditions, or natural areas may be allowed to mature naturally to later successional stages over time, by leaving them undeveloped. Such restoration could be most readily incorporated into rural residential planning, particularly in low density zones.

ENVIRONMENTAL BMPS FOR MAINTAINING BIODIVERSITY CORE AREAS

BMPs relevant to development design, planning review and construction stages are listed below. On review of the proposed development plan, supporting air photos and the Core Areas Map, implement those BMPs applicable to the resources present at the site. The review should also consider adjacent lands (within a minimum radius of 5 km).

Development Design BMPs:
<p><i>Encourage development that avoids or minimizes loss of naturally-vegetated areas.</i></p> <ul style="list-style-type: none"> • In particular, avoid clearing within identified Moderate Biodiversity Core Areas, associated Linkage Habitat and Key Corridor Segments.
<p><i>In parcels containing Low and Moderate Biodiversity Core Areas, locate development along the perimeter of the habitat patch and avoid clearing with the naturally-vegetated areas themselves.</i></p> <ul style="list-style-type: none"> • If development within such areas cannot be avoided, locate infrastructure within the edge of the area, rather than its interior, and cluster development to limit impacts to specific areas.
<p><i>Use conservation tools offered by the MGA where possible to protect these areas (i.e., Environmental or Municipal Reserve dedication, Conservation Easements).</i></p> <ul style="list-style-type: none"> • Use the full allotment for Environmental and Municipal Reserves to protect Low and moderate Biodiversity Core Areas as much as possible. • Consider Conservation Easements or limitations on development (e.g., lot clearing restrictions) if these tools cannot protect the entire Core Area.
<p><i>Avoid access that will cross Core Areas, associated Linkage Habitat or Key Corridor Segments.</i></p> <ul style="list-style-type: none"> • Locate such infrastructure along the disturbed edge of such areas. For higher volume roads, locate within adjacent lands that will provide some separation from Core Areas by a buffer of low vegetation (e.g., grass or low shrubs) to discourage crossings. • The buffer could be enhanced in locations where bare soils exist, by encouraging naturalized landscaping of road rights-of-way with low-growing vegetation.
<p><i>Promote proposals that provide a buffer of lower intensity land use (e.g., low density housing, non-intensive agricultural operations) adjacent to Core Areas to minimize human disturbance impacts in these areas.</i></p>
<p><i>Avoid sensitive or critical habitat of species of federal or provincial concern.</i></p> <ul style="list-style-type: none"> • Where such species may be present, developers should be required to provide mitigation to ensure the species or their critical habitat is not harmed by construction or operation of the development. Because the risk to these species can vary with the species and the type of development, mitigation should be developed on a situation-specific basis. Seek advice from qualified biologists to incorporate appropriate mitigation into the proposed design. Appropriate experts within the BHI could be requested to evaluate the proposal for municipalities lacking such specialist expertise.

Planning Review BMP:
<i>Ensure that Environmental Reserve, Municipal Reserve, conservation easements and other tools permitted under the MGA and the Subdivision and Development Regulation have been used to maximize protection of Core Areas within a proposed development parcel.</i>
<i>Provide incentives such as lot bonusing for other innovative approaches to protect Core Areas (e.g., cluster or conservation planning design, land title covenants, resident stewardship programs, habitat enhancements).</i>
<i>Encourage innovative designs that trade off high density development in other less sensitive areas, to avoid development in Core Areas (e.g., cluster development).</i>
<i>Consider establishing a Transfer Development Credit system, which would grant development rights in other, less sensitive areas in order to protect areas with significant environmental function, including Core Areas.</i>
<p><i>Determine if any species at risk are known to occur in any proposed development area.</i></p> <ul style="list-style-type: none"> • This will require the developer to undertake an inventory, which at a minimum, should include a search for past records from the Fish and Wildlife Information Management System (FWMIS) and the Alberta Natural Heritage Information Center's (ANHIC) databases. Such requirements can be incorporated within a Biophysical Review or Environmental Impact Assessment, if the municipality has established such reviews within the planning process.
<i>Where species considered Endangered or Threatened federally, or At Risk or May Be At Risk provincially have been identified within the development area, work with Environment Canada and Alberta Environment and Sustainable Resource Development to ensure that all applicable legislative requirements are fulfilled by the developer.</i>
Construction Conditions BMPS:
<i>Minimize vegetation clearing within and adjacent Core Areas as much as possible. Mark the limits of the area to be cleared before construction begins to avoid accidental removal of additional vegetation.</i>
<p><i>Implement measures to limit the spread of noxious, invasive or weedy species when working near Core Areas, as required under the provincial Weed Control Act.</i></p> <ul style="list-style-type: none"> • This should include washing equipment before moving to new sites to remove seeds captured in soil or grease; providing weed control for soils stockpiled over long periods to limit establishment of undesirable species; and revegetating disturbed areas with suitable native seed mix as soon as possible with follow-up to ensure sufficient establishment of new vegetation.

POTENTIAL REFERRALS

Activity	Legislation	Note
Mortality to migratory birds	Federal <i>Migratory Birds Convention Act</i> and Alberta's <i>Wildlife Act</i>	In the Edmonton area, AESRD recommends avoiding clearing activities in vegetated areas between 15 April and 15 July to avoid mortality to migratory birds. Environment Canada and Strathcona County recommend an extended clearing restriction between 15 April and 31 July. While Environment Canada suggests bird surveys can be used to confirm a lack of nesting activity, it also recommends that surveys will not adequately confirm nesting in areas larger than 1 ha, and should not be accepted by regulators.
Disturbing a rare species, nesting birds, or dens or hibernation sites of certain wildlife species	Prohibitions under Alberta's <i>Wildlife Act</i> , the federal <i>Migratory Birds Convention Act</i> and the federal <i>Species at Risk Act</i>	Ensure construction plans will avoid disturbance or mortality to these species. Proposals could be referred to Alberta Environment and Sustainable Resource Management and Environment Canada for comment, if uncertainty exists regarding potential impact.
If rare species will be impacted by a proposed development	Under the federal <i>Species At Risk Act</i> , disturbance or harm to the species is prohibited and an environmental assessment may be required to meet the <i>Canadian Environmental Assessment Act (CEAA)</i> .	Consult with Environment Canada and the Canadian Environmental Assessment Agency if such potential exists.
Where wetlands may be drained, filled or otherwise disturbed	Alberta <i>Wetland Policy</i> , Alberta <i>Water Act</i> (approval), Alberta <i>Public Lands Act</i>	Refer proposals with such potential impacts to Alberta Environment and Sustainable Resource Development (Water Resources and Public Lands Branch).

HABITAT CONNECTIVITY BEST MANAGEMENT PRACTICES

CONTEXT / ISSUES

In a developed landscape, patches of suitable habitat are located in a matrix of other land uses that may discourage wildlife movement or habitat use. Species wary of predators will avoid crossing open areas separating adjacent habitat patches, with gap tolerance decreasing for smaller species. In such a landscape, wildlife “corridors”, terrain or vegetation offering security cover and food and shelter resources allow animals to move between patches of suitable habitat. Although corridors may not provide sufficient resources to sustain species for long periods, they can support them for the duration of travel, thus facilitating access to potential breeding mates and new habitat. They also allow for plant and animal dispersal across the landscape, important for maintaining biodiversity. Connective habitat also allows for populations from core areas to disperse to other smaller habitat patches, thus sustaining a species across the broader landscape.

POLICY BMPS FOR LANDSCAPE CONNECTIVITY

Identify species of management concern to determine appropriate habitat goals.

- Different species have different gap tolerance. Small species like chickadees will cross only short gaps between larger habitat patches, while larger, less secretive species like deer will cross much wider gaps. To maximize biodiversity within a landscape, consider the requirements of the smallest, least gap tolerant species.
- In general, multiple connections with only short gaps will sustain biodiversity better than fewer connective habitat links or larger gaps. Retaining good connective habitat links around core areas will be particularly important to sustain regional biodiversity.

Ensure MDPs and LUBs provide an appropriate level of habitat protection.

- Identify the habitat surrounding protected areas as key conservation areas. Use zoning to encourage lower density, more permeable development and to maximize retention natural habitat in these areas.

Maintain corridors between habitat patches by establishing explicit management goals within MDP policy for habitat connectivity.

- Determine the key natural areas (including protected areas and other large habitat patches) between which each municipality wishes to retain or enhance connections. At a minimum, connections should be retained between the four main protected areas of the moraine, and with broader regional features (e.g., with the North Saskatchewan River valley) in order to sustain the biodiversity that now exists within these areas and the rest of the moraine.

Encourage sensitive development in areas identified for habitat connectivity.

A “permeable” landscape can be readily negotiated by a broad suite of species. A highway is not permeable, a pasture might be and forested or aquatic habitat within a country residential area would be more permeable.

- Ensure a minimum level of functional connectivity between key conservation areas:
 - Through sensitive development (e.g., permitting larger, clustered lots with limited clearing within the developed footprint, retention of hedgerows, and minimizing gaps of between habitat patches to 50 to 100 m), and
 - By encouraging restoration of natural habitats and retention of existing natural vegetation.
- Consider providing policy incentives to limit lot clearing or to restore previously cleared areas or degraded, weedy habitat, particularly near core areas within these areas.

Encourage the use of conservation easements to protect habitat, particularly where such habitat links or buffers protected areas.

- Consider development bonuses, marketing assistance or other mechanisms as incentives for conservation easements.
- Seek partnerships with conservation land trusts and other conservation organizations to provide expertise in managing conservation easements.

Establish a policy for habitat retention to address natural vegetation that may not provide a connective or other habitat function, but may still be valued by area residents (e.g., a Tree Policy).

- Naturalization approaches have been used by some municipalities (e.g., Parkland County) to encourage either retention of existing natural vegetation or use of naturalized landscaping. Note that stormwater drainage can also incorporate naturalized landscaping that can provide connective habitat.

Consider providing grants to landowners who help municipalities achieve habitat connectivity goals (e.g., through habitat restoration programs).

- Such a step would require identification of key zones for habitat connection goals. Provision of links between the protective areas within the ‘spine’ of the moraine should be of particular concern.

Lobby the provincial government for an expanded definition of Environmental Reserve under the MGA to allow areas of important habitat to be retained through the development approval process.

Enforce weed control bylaws in and near Core Areas to prevent invasion of these aggressive species and elimination of native species in these critical areas.

Work with Alberta Environment and Sustainable Resource Development and/or ENGOs (e.g., Ducks Unlimited) to identify critical wetland habitats that could be conserved, enhanced or restored, particularly wetland complexes and areas where connectivity with adjacent upland habitat areas could easily be restored.

ENVIRONMENTAL BEST MANAGEMENT PRACTICES

On review of a proposed development plan, supporting air photos and the Landscape Connectivity Map, implement those BMPs applicable to the resources present at the site. Note that to address regional connectivity, review should also consider the adjacent lands (within a minimum radius of 5 km), because habitat may lay near the proposed property and may be affected by the proposed development.

Development Design Considerations:
<i>Minimize the development footprint to retain natural vegetation within lots.</i>
<i>Encourage the designation, location and management of Environmental Reserves (ER) and Municipal Reserves (MR) to establish and/or maintain connectivity between habitat patches.</i>
<p><i>Protect naturally vegetated areas on lots within new subdivisions by using the maximum Environmental Reserve and Municipal Reserve dedication and consider additional protection through conservation easements or covenants on the land title.</i></p> <ul style="list-style-type: none"> • This will be particularly important in areas that provide a buffer between human use areas and retained environmental features (e.g., wetlands, riparian areas).
<p><i>Where species at risk are known to occur within the proposed development area, ensure that connections between retained habitat within the parcel and any adjacent movement corridors are maintained.</i></p> <ul style="list-style-type: none"> • Development restrictions may also apply to habitat supporting federal Endangered and Threatened and provincial At Risk and May Be at Risk species. Because the degree of sensitivity will vary with the species and the proposed development, such mitigation measures should be applied on a situation-specific basis. Advice of a biologist is useful in evaluating the risk to the sensitive species, and in developing appropriate mitigation. Alberta Environment and Sustainable Resource Development or Environment Canada can provide such advice for species under their jurisdiction. Alternatively, the planning officer, at the developer's expense, may request professional advice from a consultant.
<i>If trails are planned as part of a subdivision, avoid bisecting otherwise intact natural areas, and instead, route trails around their perimeter.</i>
<i>Encourage developments that incorporate landowner stewardship initiatives, such as native species landscaping, or wildlife or vegetation monitoring, to engage future residents in local management.</i>
Planning Review Considerations:
<i>Encourage restoration of narrow corridors linking adjacent protected areas, or buffering protected areas as a condition of new developments that would remove vegetative cover (i.e., encourage minimal habitat loss).</i>
<p><i>Encourage conservation easements as a means of protecting connective habitat, particularly where such habitat links or buffers protected areas.</i></p> <ul style="list-style-type: none"> • Consider development bonuses as an incentive for conservation easements.
<i>Consider the relationship of the proposed parcel in the context of regional -level wildlife</i>

<p><i>corridors and ensure that development avoids blocking such corridors.</i></p> <ul style="list-style-type: none"> Corridors linking protected areas are particularly vulnerable and ideally should extend over long distances (e.g., between Blackfoot-Cooking Lake, Ministik and Miquelon protected areas). Incremental habitat loss within key corridors, particularly narrow sections of connected habitat, could cause some species to avoid travel through those areas. In such areas, maintain a threshold width of about 600 m of naturally vegetated woodland habitat within key segments of connected habitat between protected areas.
<p><i>Where development within a key corridor (e.g., within a key segment of connective habitat) cannot be avoided, require restoration or enhancement of alternative routes that would provide a detour around the disturbance area.</i></p> <ul style="list-style-type: none"> Such alternatives will require advice from a qualified biologist to identify appropriate location and landscaping.
<p>Construction Conditions:</p>
<p><i>Minimize clearing of naturally vegetated areas to the development area only by marking limits for vegetation removal prior to clearing activity.</i></p>
<p><i>Revegetate disturbed areas adjacent retained natural features using native species where possible.</i></p>

POTENTIAL REFERRALS

Activity	Legislation	Note
The activity will result in disturbance to federally or provincially listed species, nesting birds, and dens or hibernation sites of certain other wildlife species	Alberta's <i>Wildlife Act</i> , the federal <i>Migratory Birds Convention Act</i> and the federal <i>Species at Risk Act</i>	Ensure that construction plans will comply with these Acts by requiring confirmation of the absence of any rare species on the development parcel. Proposals could be referred to Alberta Environment and Sustainable Resource Management and Environment Canada for comment, if uncertainty exists regarding potential impact.
If species at risk will be impacted by a proposed development	Federal <i>Species At Risk Act</i> , and possibly the <i>Canadian Environmental Assessment Act</i>	Under the federal <i>Species At Risk Act</i> , any activity must avoid disturbance to listed species. Where a project as defined by the <i>Canadian Environmental Assessment Act (CEAA)</i> could affect a species at risk, the impact must be considered in the EIA. Consult with Environment Canada and the Canadian <i>Environmental Assessment Agency</i> if such potential is identified.

6.0 THE LMF FOR MUNICIPAL POLICY-MAKERS

APPLYING THE BHI PRINCIPLES WITHIN MUNICIPAL POLICY

To implement a framework that outlines a sustainable land use approach, the environmental goals, objectives and force of such policies should ideally be consistent and mutually reinforcing across all municipal authorities within the Beaver Hills. In the course of the review of existing municipal policy discussed in Section 2.0, we identified areas in which a minimum of consistency is required in order to set the stage for a comprehensive sustainable management approach. In the Environmental Legislation section, we identified the tools currently provided for in the MGA, and the gaps in environmental legislation that municipalities might choose to fill to maintain the key elements of the moraine. By maximizing consistency and utilizing all available tools, the BHI municipalities could best manage the natural resources of the moraine, and thus sustain its distinctive landscape character and ecological goods and services. As the experience of the past several years have shown, such efforts will serve as a model for sustainable land management for other levels of government, including the province.

In this section, we review the authority and tools provided by the MGA for management of the environment by municipal governments. We also review the limits of federal and provincial jurisdiction and the means by which municipalities can work with those government agencies to help manage their own resources more effectively. Next, we review the minimal policy changes required to achieve consistency among the municipal BHI partners. These recommendations could be considered by the member municipalities for incorporation in their MDP, LUB and other policy documents, as appropriate to their specific circumstances.

ENVIRONMENTAL TOOLS WITHIN POLICY

Currently, the MGA defines municipal jurisdiction relative to the environment as follows:

- Environmental features that pose a threat to development and should be considered in development proposals (“hazard lands”),
- Lands that should be protected by the municipality for environmental reasons, typically those same hazard lands or lands suitable as park resources (Environmental and Municipal Reserve respectively), and
- Lands of significance within the local environmental context that could be managed through land owner agreements (conservation easement provision, other management provisions within the Subdivision Regulation).

The Subdivision Regulation provides a broad clause that allows municipalities to consider any factors of concern in determining the most appropriate use of a parcel. This could include specific environmental concerns, but few municipalities have used this clause to protect critical natural features within their boundaries. As a result, most of the member municipalities have developed policies that address only the first two aspects of the environment listed in the MGA. Since the LMF was first developed, a few BHI

municipalities have taken advantage of their authority under the MGA to manage moraine lands, as Environmentally Significant Areas (ESAs), Priority Environmental Management Areas (PEMAs) or wetlands specifically. Yet a consistent approach, including a consistent definition of ‘environment’ has yet to materialize. This situation seems linked to the limited definition of ‘environment’ in the MGA, which implies that broader jurisdiction has not been delegated to municipalities.

However, the MGA does provide considerable room to manage environmental issues beyond these definitions, through the authority granted to protect the safety, health and welfare of people and community. That authority allows any resource or issue considered critical to the broader community to be managed through specific bylaws or policies, provided their justification is clear and apparent and their implementation would not be perceived as an unfair limitation. Hence, at a minimum, the BHI municipalities could consider revising policies to incorporate all three aspects of the environment defined under the MGA such that they:

- Ensure all potential environmental hazards to the development or to the environment are considered within a development proposal or broader policy area or land use zone. This may require a broader definition of environmental hazards to include threats to water resources, habitat and species of concern. Although some municipalities have begun to incorporate such definitions into policy, thus establishing precedents, confirmation of the most appropriate means of incorporating such a definition should be obtained from municipal legal counsel.
- Ensure all opportunities to protect lands defined as environmentally significant within the municipality, or the broader region, are implemented (e.g., through Municipal Reserve, Environmental Reserves or Conservation Easements). This requires a definition of what will comprise environmental significance for the municipality and related management objectives, and identification of environmentally significant lands.
- Ensure the means to secure and manage conservation easements are in place and implemented to protect lands of environmental significance. This also requires definitions of ‘environmental significance’ and related management objectives, as noted above.

In addition to utilizing these basic tools provided within the MGA to their maximum effectiveness, municipalities can also draw on the resources of provincial and federal resource managers. Federal and provincial governments are directly responsible for management of water, wildlife, fish, rare species, historical resources and air quality. The *Historical Resources Act* is particularly powerful and can be applied to a range of cultural features within the landscape, including sites with both environmental and historical relevance. The federal *Fisheries Act* and supporting policies can offer considerable support as well, where projects might affect fish habitat.

An understanding of which agencies manage which resources, and how, allows the municipality the opportunity to access expertise for review of development proposals that may not be available locally. Use of referrals also provides assurance that a proposed development will meet all applicable regulatory requirements, and that all relevant effects have been considered in the design of a proposed development.

In federal and provincial environmental legislation, the onus for referrals has been given to the developer, as part of the environmental assessment process (the “developer pays” concept). Incorporating a requirement for referrals within an environmental assessment policy would provide clear guidance to municipal administration, and better integration with the resource management processes of federal and provincial agencies. Ideally, each municipality would adopt a consistent environmental assessment process, with a mechanism for referral. This would ensure that all environmental and regulatory concerns were addressed at the initial design stage, before the developer or the municipality had invested many resources in a project.

Such a process requires the municipality to have the resources and environmental background available to support that process, however, which may not be feasible immediately. Again, awareness of the environmental legislation applicable to a given proposal would help municipal administrators ensure that review is complete. The referrals recommended for each Resource Risk Model previously discussed provide a basis for such awareness.

Provincial jurisdiction is exclusive for natural resources traded as commodities (e.g., oil, gas, aggregates and minerals) and for industries with potential to impact natural resources (e.g., agriculture, petrochemical extraction and refining). Yet municipal concerns must be considered during the approvals review process, which allows a municipality opportunity to voice concerns, if policy has identified those concerns in advance. The recommendations for base policy below will establish grounds for municipal intervention in such a process regarding moraine resources.

RECOMMENDATIONS FOR BASE POLICIES

The municipal policy review identified some areas of progress toward consistent policy but inconsistencies remain in the approach and level of detail within the MDP, LUB and non-statutory policies of the BHI partner municipalities. Specific environmental protection measures are also variable in detail and force of law (e.g., in policy, vs. MDP or LUB). Definitions of the environmental aspects of interest within the municipal context are also inconsistently addressed among the policies of the five municipalities. Filling in these gaps with consistent policy remains a key goal, as it is the definitions, objectives and goals of the MDP and LUB documents that establish the overall direction of land management.

As was the case during the first LMF, a consistent definition of the environment is still lacking within the statutory documents of all five municipalities. Although each municipality may chose to focus policy on aspects of the environment most relevant to them (and some have), sustaining the ecological goods and services derived from the moraine requires recognition of the aspects of a functional moraine environment. The moraine is a complex system, with natural features dependent on interactions and intact ecological processes that cross municipal boundaries. Recognition of the environment as an entity with both form and function, (i.e., moving away from a management approach that looks at each resource, or individual natural area, in isolation) is essential for a sustainable management approach.

A shared, broad definition of environment that would set the context for municipal management across the moraine has yet to be adopted by all BHI municipalities. The definition used in the *Canadian Environmental Assessment Act* provides a good model for ‘environment’, and if adopted, would maintain consistency with federal and provincial environmental legislation:

“Environment” means the components of the Earth, and includes:

- (a) land, water and air, including all layers of the atmosphere,
- (b) all organic and inorganic matter and living organisms, and
- (c) the interacting natural systems including components in paragraphs (a) and (b).

Identification of the specific resources considered critical, or environmentally significant to the municipality, is also essential and currently missing in most of the municipality’s policies. Establishing management goals within both the MDP and LUB of each municipality to sustain these elements will also be necessary. A broader definition of environment will help establish a context for such definitions and objectives.

With these definitions as a base, MDP policies could then consistently acknowledge the Beaver Hills moraine as a resource valued across all municipalities. Such policies should include general goals and objectives as well as policy area provisions, and any critical environmental elements that the municipality may feel are relevant. Any critical environmental resources defined in policy should be specifically addressed in policy provisions.

Full incorporation within municipal policies of the environmental management tools provided under the MGA is critical, as these tools will provide planners with the means to manage environmental concerns. A broader definition of Environmental or Municipal Reserve, to include certain critical features such as wetlands in recharge or discharge zones or Core Areas, could be helpful. Some of the BHI municipalities have already adopted such policy (e.g., Strathcona County’s Wetland Conservation Policy, which requires designation of riparian zones of wetlands as Municipal Reserve).

Incorporating in the LUB document a specific policy identifying the process for assessing potential impact in these environmentally significant or sensitive areas is required for continuity within the municipality’s statutory documents, at a minimum. Ideally, an environmental assessment process would also be listed as a requirement. As noted above, this process can be combined with a requirement for federal and provincial referrals to ensure a thorough environmental review.

A requirement for environmental review could be applied within the LUB, as Leduc has done for environmentally sensitive areas or within the MDP (as Parkland County has done to address its ESAs). Strathcona County has established a similar non-statutory policy for a biophysical assessment. However, the review can only provide guidance to development approval. A policy providing a stronger role in the approval process would give more force to the recommendations resulting from such a review. Other specific policies recommended in Section 5 could be incorporated as either LUB policy or non-statutory policy, as appropriate to the municipality’s resources, interests and political context.

CASE EXAMPLE #4 - DEVELOPING EFFECTIVE AND SUPPORTED MUNICIPAL POLICY: STRATHCONA MUNICIPAL DEVELOPMENT PLAN

The Challenge

Municipal Development Plans (MDPs) are long-range plans, a requirement introduced by the MGA in the 1980s to manage growth strategically, over the entire municipality. Under the MGA, MDPs should be updated every 5 years, an obligation difficult for most municipalities to meet. Strathcona's much overdue update was carried out from 2004-2007, with considerable effort to compile information for informed discussion of the trade-offs implicit in the planning exercise.

Strathcona residents had become very interested in sustainability and various conservation groups had begun to highlight the importance of the natural features of the moraine to the region. When the BHI started in 2002, sustainable development had already become a broader scientific concern and a local political issue in the County, and awareness of the threat to the moraine from urban development pressure was growing. The LMF project began at about the same time as the Strathcona MDP review, and the potential to use the environmental data collected for the LMF was of obvious interest to County planners. The completed LMF only confirmed the environmental value of the moraine, and in particular, Strathcona County's share of it, creating convincing arguments to adopt protective mechanisms in the updated MDP. This created both a potential policy window for conserving part of the moraine and a potential political battle over perceived land development 'rights', interests which the MDP process had to balance.

The Process

The mapping of environmental sensitivities across the moraine in the LMF led County planners to commission Countywide analyses for the new MDP (e.g., Blue and Yellow map, surface and groundwater risk analyses). The data supported an informed discussion about tradeoffs involved in developing new MDP policies, including urban growth nodes and conservation areas and resulted in substantial policy change within the moraine (i.e. the new Beaver Hills Policy Area). The BHI principles were also included in the MDP, along with other 'triple bottom line' aspects of sustainability to follow current County direction. Council requested extensive public consultation of the Draft MDP to ensure sufficient opportunity for feedback and to minimize potential resistance. Low attendance made councilors feel the public was not informed enough about the new direction, which led to an astounding 36 consultation events over 18 months.

Each presentation covered the whole MDP document, and did not always address the underlying information (e.g., environmental concerns highlighted by the LMF). Administration did this for several reasons. First, they felt that people did not understand the MDP development process, the application of the MDP to their specific situation or sustainable development principles well enough to use the information to evaluate the components of the plan appropriately. Second, given the diversity of landowner expectations regarding access to development 'rights', they felt it would be difficult to achieve consensus through the consultation process if the choice to impose restrictions could not be well defended. The MDP was eventually approved by council, despite some concerns from affected

landowners within the moraine, aided perhaps by a failed appeal by the City of Edmonton based on the new urban growth nodes and annexation potential.

How the LMF Helped

Informed decisions on policy development can be challenged by political factors, including perceptions (real or not) about public consensus on concerns. Strathcona's council recognized the moraine's natural value, which helped overcome potential resistance to change in this MDP process. Public demand for sustainable development and the work by the BHI and key champions within Strathcona County to promote awareness of the moraine as a special place likely helped, and had shifted focus to sustainable development within the administration prior to the MDP update. A large buy-out of residential properties impacted by the Industrial Heartland was another timely reminder of the benefit of sustainable planning. So a political mandate for sustainable development had already been established in Strathcona, lowering barriers to change.

Yet not all landowners were happy to forego development 'rights' to conserve the moraine. The LMF focused mainly on environmental factors, which helped identify for the public and council less obvious natural features within and beyond the moraine (e.g., sand hills in the north part of the county) and justify need for protection. Such features required more explanation to the public though and while maps could help justify conservation policy, they sometimes hindered. For example, some landowners were convinced that designation of priority habitats would sterilize their land for future development. Mapping needed an explanation of the tradeoffs involved and the implications of land use restrictions to gain public support. The new MDP had incorporated social, economic and environmental aspects of sustainability. Planners wanted to use the LMF data to support rather than lead the discussion of MDP policy change to avoid focusing debate on the environment, at the expense of the other two factors. Through extensive public consultation (and perhaps a timely threat of intervention of the City on urban development areas), public buy-in was sufficient for council to approve the MDP. The LMF certainly informed decision-making to some degree, but in concert with other political influences and clear communication.

Although the MDP update did not go as far as some would have liked, it and the LMF created enough public consensus to allow consideration of adoption of other BMPs into policy. Other supporting policies applicable to the entire County swiftly followed the adoption of the MDP (e.g., the PEMA environmental assessment process, Strathcona's Wetland Conservation Policy). The LMF has subsequently highlighted other gaps in the MDP, leading to potential consideration of adding alternative, sustainable land uses such as eco-tourism and agri-tourism during the upcoming LUB and MDP updates. The application of the LMF within the Strathcona MDP process initiated a discussion of environmental tradeoffs and possible policy options that have yet to be concluded.

7.0 THE LMF FOR PLANNERS

PLANNERS CHECKLIST

The planner's subdivision checklist, created in Phase 2 of the 2007 LMF, was intended to help guide planners through the LMF mapping and other information. The checklist drew on the BHI Land Management Principles, which identified critical components of the moraine landscape that the BHI wished to sustain. The checklist was intended to be used by a planner who understands the LMF approach to assess a proposed development application and recommend appropriate best management practices that would allow sustainable development.

The updated 2014 Planners Checklist (on page 97) outlines the steps for application review. Its use is illustrated by the subdivision example that follows. BMPs and construction advice would be listed on the back of the form, for ease of comment to potential developers, or for developers to summarize quickly concerns that should be addressed within their proposal.

Beaver Hills Initiative – Planners Checklist

Applicant Information					
Applicant Name:			Date:		
Parcel Legal Location:			Reviewer:		
Parcel Area:					
Proposed Subdivision/Development:					
Referral Check (check all that apply, refer proponent to AESRD for additional permitting advice):					
Septic system / treatment lagoon			Stormwater management systems/outfalls		
Water supply from new well or surface water source			Watercourse crossings (road or utilities pipeline)		
Ecological Function Review		Parcel Adjacent Lands (within 5 km)	Potential Referrals (see LMF for additional information)		
Air photo Review:			AESRD* (Water Resources, Public Lands)	DFO* / Nav Waters	Migratory Birds Timing Restrictions
Woodlands					x
Pasture (possibility of native grasses?)					x
Streams wetlands, other waterbodies			x	x	x
Current development					
Surface Water Risk:			Comments (Note BMPs on back):		
Gross Drainage Area SW Risk Level (Gross Drainage Area SW Risk GIS Map)					
Land Parcel SW Risk Level (SW Risk GIS Map)					
Groundwater Risk:					
Groundwater Risk Level (GW Risk GIS Map)					
Landscape Connectivity:					
Ecological Network Elements (Ecological Network GIS Map) (Any habitat patches or linkages present?)					
Protected Areas (Ecological Network GIS Map) (Any lands already protected? Any NGO activity in the area?)					
Connected Habitats (Segment GIS Map) (Part of a segment? Type?)					
Landscape Permeability (Landscape Connectivity GIS Map) (Level of regional connection present?)					
Biodiversity Core Areas:					
Biodiversity Core Areas (Core Areas GIS Map) (Core Areas present? Type?)					

* AESRD = Alberta Environment and Sustainable Resource Development, DFO = Fisheries and Oceans Canada, Nav Waters = Transport Canada

A TYPICAL DEVELOPMENT SCENARIO: SUBDIVISION EXAMPLE

Planners reviewing an application for subdivision often have limited information: an air photo of the site and perhaps a proposal. Identifying concerns before design begins is a clear benefit. Now, with the LMF's resource risk maps (available in GIS format), accompanying BMPs, and the planners checklist, planners can guide proponents through analysis of environmental sensitivities at the parcel level and request additional, site-specific information as required to mitigate potential impacts.

Development Scenario:

In this hypothetical example, the proponent submits an application for subdivision of the quarter section marked on the air photo (page 99). The site is just east of Half Moon Lake, Strathcona County. To ensure that environmental concerns have been addressed, the municipal planner or the developer's consultant would review the LMF mapping in a series of steps linked to the planners' checklist.

1. Air Photo Review

Key environmental concerns can often be identified on an aerial photograph and noted under the **air photo** interpretation section of the planner's checklist.. This parcel appears to:

- be cleared for use as pasture, removing most of the riparian buffer along a stream channel crossing the property,
- have one stream channel through it, a headwater that drains into a wetland and associated drainages southeast of the parcel and into Cooking Lake;
- be located next to Half Moon Lake, which drains to Cooking Lake through a drainage channel at the lake's south end; and
- support limited native habitat (a woodland at the northwest corner of the parcel, and a shrubby area next to a wetland at the southeast corner of the parcel).

2. Surface Water and Groundwater Risks

Using the LMF map viewer to examine the parcel online, the planner first consults the Surface Water Risk Gross Drainage Area and Parcel-level maps (reproduced on page 99 and 100) and finds that these lands have several water-related risks. The planner notes these on the Surface Water and Groundwater Risk **comments** section of the checklist:

- In the Cooking Lake Gross Drainage Area: rated as moderately low risk due to the protection offered by the Golden Ranch Conservation Area to waters within the Gross Drainage Area;
- Within a parcel that has a slightly positive impact on local surface waters, due to existing pasture and small patches of woodland;
- Next to lands that have a slightly negative rating in the Surface Water Risk Parcel level map, due to recreational development at Half Moon Lake Resort; and
- In a parcel with just one stream channel running through it, but a headwater that drains into a wetland and associated drainage southeast of the parcel linked to Cooking Lake; next to Half Moon Lake, which drains to Cooking Lake through a drainage channel at the lake's south end.

Air Photo

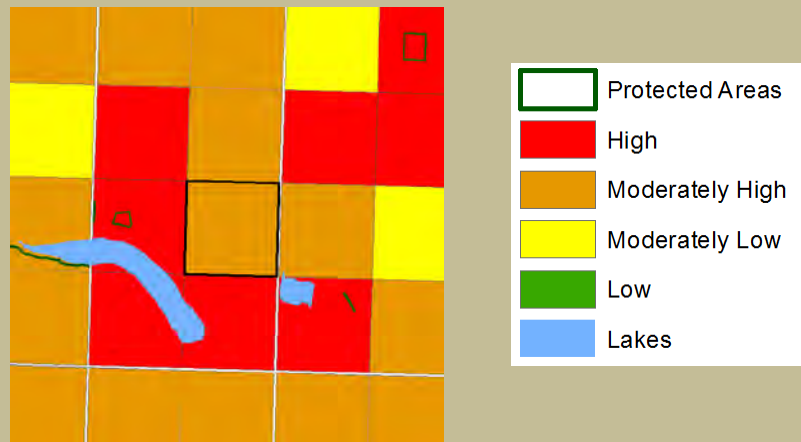


Surface Water Risk by Gross Drainage Area

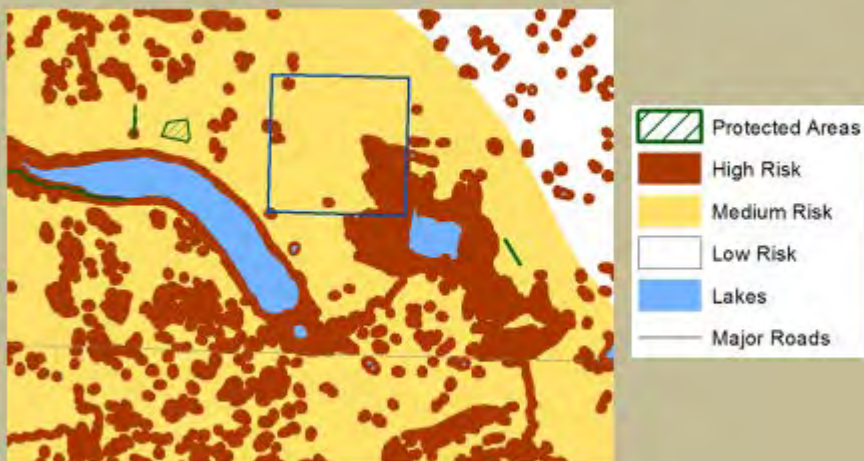


Blue	Lakes
Dark Green	Protected Areas
Red	High Risk
Orange	Moderate High Risk
Yellow	Moderate Low Risk
Light Green	Low Risk

Surface Water Risk by Land Use/Land Cover



Groundwater Risk



On examining the Groundwater Risk Map (page 100), the planner finds that:

- The parcel lies within an area of medium and high risk, which suggests a recharge or discharge area underlies the parcel, and possibly coarse surficial sediments.

With the surface waters on and near the parcel and potential for groundwater access, the planner realizes that the risk of water contamination from development is relatively high. The planner checks the associated risk boxes and suggests the following **BMPs**, drawn from Section 5.0 of the LMF for surface water and groundwater concerns:

- Maintain vegetated buffers around all waterbodies
- Maintain natural drainage as much as possible by limiting hard surfacing and development footprints within lots and directing collected roof runoff from houses overland through vegetated areas.
- Treat all stormwater prior to release to natural waterbodies.
- Where possible, avoid stream crossings, realignments or other in-stream disturbances. If a road crossing is required for access, locate such access in the upper reaches of the stream and provide adequately sized culverts to avoid back flooding.
- Ensure proposed septic system is appropriate to soils and set back sufficiently from surface waters. To confirm that the design is appropriate, the planner requests the proponent to undertake an assessment of the site that addresses potential groundwater and surface water issues (to be completed by a qualified professional).

The planner also notes requirements for **potential referrals** from federal or provincial approvals, if the municipality has a formal referral process, or if not, for **confirmation of approvals** by the proponent:

- Confirmation from Alberta Environment and Sustainable Resource Management (AESRD) that sufficient water supply is available on the property for groundwater wells, and
- Approvals from AESRD, Fisheries and Oceans Canada and/or Transport Canada for any work proposed within the stream channel or wetland.

3. *Landscape Connectivity and Core Areas*

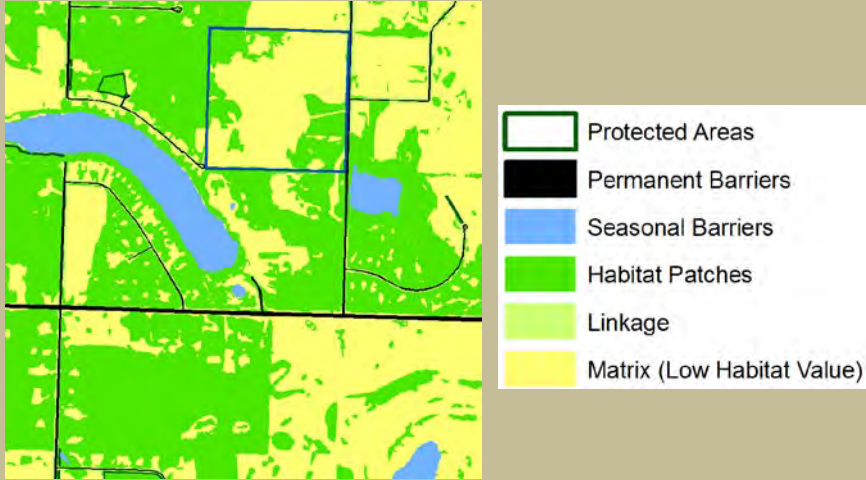
Next, the planner examines the Ecological Network, Landscape Permeability, Core Areas and Connected Habitats maps to identify concerns for animal movement or loss of important habitat.

The **Ecological Network** (page 102) map shows:

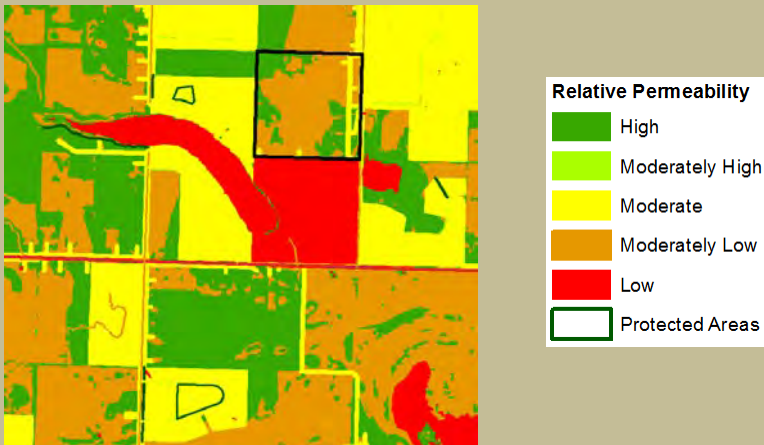
- A few Habitat Patches on the parcel that are contiguous with larger patches on the adjacent lands.
- Protection of some of the habitat around the parcel under a MR, ER or a conservation easement.

The planner notes on the **comments** section of the checklist that the proponent should consider those protected areas in their design.

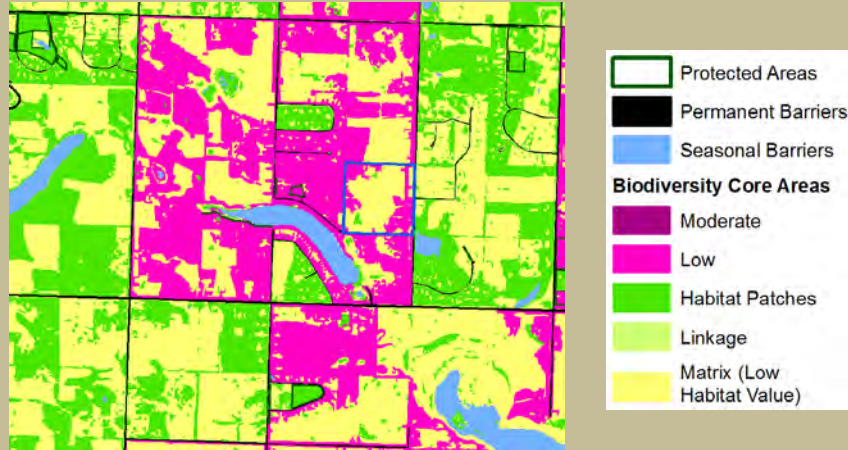
Ecological Network



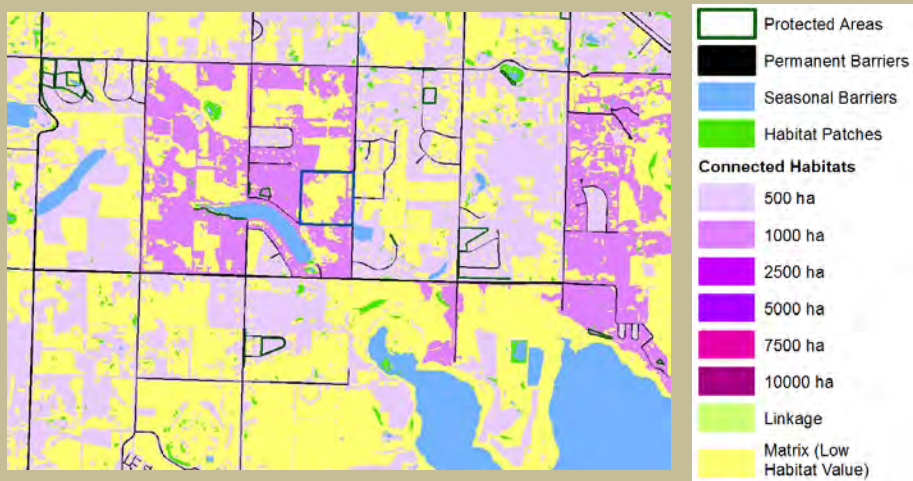
Landscape Permeability



Core Areas



Connected Habitats



Examining the **Landscape Permeability** map (page 102), the planner finds that:

- the lands in and around the parcel are Moderately Low to Highly Permeable, with Low Permeability in the south part of the parcel.

The planner notes on **comments** section of the checklist that:

- The Habitat Patches on and near the parcel are important to habitat connectivity, but some limitations to animal movement also apply.
- Maintaining habitat will sustain existing connections, but connections could be improved with restoration in the south part of the parcel, along the lake.

Next, the planner checks the **Core Areas** map (page 103) to determine whether any of the habitat patches within or adjacent the parcel are Core Areas. Many of the patches around the parcel, and those partly within it are Low Biodiversity Core Areas, areas that would support breeding populations of smaller species. The planner notes in the **comments** section that:

- Absolute protection of the Habitat Patches on the parcel is not necessary in this case, but the design should still minimize habitat loss.
- Lot bonusing or cluster (conservation planning) designs should be considered to retain as much of the natural habitat as possible.

If the Habitat Patches in or adjacent to the parcel were capable of supporting higher levels of biodiversity, lot density might be examined more closely. Development that maximized retention of habitat would be preferred to more intensive, high-density proposals.

Finally, the planner checks the **Connected Habitats** map (page 103) to ensure that the habitat patches around and partly within the parcel are not part of a larger segment. The habitat within the parcel is part of two key segments, smaller ones with a total area between 1000 and 2499 ha. The habitat patch west of the parcel is the larger of the two. The planner notes in the **BMP section** recommendations to retain habitat connectivity at the local and regional scale:

- Sensitive development that retains as much of the treed land on the property, and
- Particular attention to the larger segment.

After consulting Section 5.0 of the LMF, the planner suggests the following **BMPs** related to habitat connectivity and support of biodiversity core areas:

- Minimize building footprints as much as possible and encourage landscaping with native species to enhance connections through the parcel.
- Since ER and MR have already been claimed on this parcel, remind the proponent that their design must respect those areas. Conservation easements could also be used to protect the riparian buffer.
- Encourage cluster or conservation planning design, minimal clearing of woodland habitat and retention of riparian buffers.
- Where lots lie within naturally vegetated areas, encourage additional protection through innovative means (e.g., covenants on land titles, landowner stewardship programs or additional planting

elsewhere on the property). The currently un-vegetated sections of the stream channel might be candidate areas for replanting and naturalized landscaping, perhaps in exchange for a lot bonus.

- To confirm that no species at risk occur within the parcel, the proponent should conduct a rare plant and wildlife assessment for the property, containing at a minimum, a request of past records from provincial databases such as the Alberta Biodiversity Monitoring Institute, Alberta Natural Heritage Information Centre (ANHIC) or Fish and Wildlife Management Information System (FWMIS).
- If trails are proposed, they should be placed on the perimeter of the wooded areas and beyond a setback buffer along the stream.

No potential **referrals** for federal or provincial approvals should be required, unless development within the stream channel is proposed.

4. Construction Guidelines

If a formal review process was in place in the municipality, referrals to federal and provincial agencies could advise if any enforcement legislation is likely to be triggered and what, if any, appropriate mitigation measures are required. As a precaution, the planner could provide **additional advice** drawn from the BMPs listed in Section 5.0 to minimize potential construction impacts that would trigger enforcement. Examples of potential recommendations follow below:

- Prepare a Hazardous Materials Management Plan that addresses storage and use of hazardous materials, particularly near water, to avoid surface and groundwater contamination.
- Minimize vegetation clearing within and adjacent Core Areas as much as possible. Mark clearing limits before construction begins to avoid accidental removal of additional vegetation.
- Ensure that vegetation clearing does not occur during the breeding bird nesting period (15 April and 31 July)¹³. If that is not possible and the area is less than one hectare, conduct a nest search to confirm that no nesting birds are present before clearing.
- Minimize sedimentation from soils disturbed during the construction process by limiting clearing and installing appropriate erosion and sediment controls in the construction area.
- Require re-vegetation of disturbed areas adjacent watercourses and wetlands as soon as possible. Require that adequate erosion and sedimentation controls be in place to protect waterbodies.
- Re-vegetate disturbed areas adjacent to retained natural features using native species where possible. A naturalized landscaping plan could be required for the entire property, at the discretion of the municipality.
- Implement measures to limit the spread of noxious, invasive or weedy species when working near any natural habitat (upland or wetland) or waterbodies.

¹³ Strathcona County recommends an extended clearing restriction period for wetlands, from 15 April to 1 September, and requests surveys to confirm that no nesting owls are present.

CASE EXAMPLE #5 - SUPPORTING PLANNERS IN PLAN REVIEW AND APPROVAL: LAMONT COUNTY COUNTRY RESIDENTIAL PROPOSALS

The Challenge

Lamont County, like most of the BHI municipalities, is an agricultural landscape that has required mainly rural management by the municipality. The moraine represents only a small part of the County and although a small pocket of industrial development (the Industrial Heartland) is nearby, urban and rural residential growth in this area has been low in the past. As a result, long-range land use planning and related support services (e.g., environmental or open space management) associated with growth management have been only a small part of Lamont's municipal experience. Environmental management, for example, has been limited to public works issues (e.g., water drainage, septic systems), despite growing awareness within the County council and administration of the value of the moraine as a natural asset.

Lamont County has not yet updated its Municipal Development Plan (MDP) or its Land Use Bylaw (LUB), but is planning to incorporate the LMF during upcoming reviews. In part, this is due to recognition of growth pressures related to the Industrial Heartland and of the future need for policy specific to subdivision and growth management. The moraine lands lie close enough to Edmonton for rural development interest, particularly with the continued growth of the Industrial Heartland. The current MDP and LUB are mainly focused on agricultural land controls - they provide limited guidance for subdivision planning. Two subdivision proposals have come up since the LMF was completed in 2007, creating opportunity to apply the LMF. However, in the absence of policy to guide a LMF-based review process, and a lack of experience with the process among planners, councilors and local developers, application of the principles and BMPS in LMF to subdivision review presented a challenge to planning staff.

The Process

The two subdivision applications were brought forward at different times, and each provides insight into the internal processes required for a municipality to begin applying the LMF to development review. The earliest, Tranquility Estates was submitted soon after the LMF was released and was the first experience of Lamont planners with rural residential development in the moraine and with the LMF. Lacking the experience or capacity to conduct the review internally, County planners took advantage of a LMF training session offered by the BHI to review the subdivision proposal as a case study example. The BHI was later asked to review the completed application and Strathcona County's land use and environmental planners provided comments that were incorporated into the planning department's report to Council. Although the site had few environmental sensitivities, the lack of attention to the LMF BMPs and the potential for future management issues was readily apparent. That and other deficiencies in the proposal led to council denying approval for the plan.

The second, Highland Estates Area Structure Plan is a more recent proposal, which is still in progress. In this case, and for another proposal outside the moraine (Ross Creek Estates), County planners have

provided the developer and their consultants with the LMF as a background document. The BHI has again been asked to participate in the review of the proposal, to support planning staff in applying the LMF. In both cases, the developer has incorporated the BMPs and comments received from the County (and BHI) to improve the design. These have not yet gone to Council for approval, but County staff are pleased with the process and the improved quality of the proposal.

How the LMF Helped

The review of the Tranquility Estates during a LMF training session provided practical experience with the review process, as did the review by the BHI and Strathcona County staff. That exposure highlighted the value of an environmental review to Council, but more importantly to County planning staff. Although Council has since changed, the experience created a cultural shift across the County: planning staff and the new Council are working toward new subdivision requirements that will demand more stringent environmental controls than are currently in place in Strathcona, the acknowledged leader in rural residential development.

When new proposals were received, planners immediately provided BHI data and the LMF to the applicants with the expectation that environmental concerns would be identified and addressed using the appropriate BMPs. In both cases, the proponent was supported by a consultant team, which likely facilitated the efficient and effective outcome. Despite its location outside the moraine, the Ross Creek proposal incorporated many of the LMF BMPs, which built confidence in the proposal and simplified review by County staff. Most land use consultants work with environmental firms who are familiar with the BMPs outlined in the LMF. Consequently, planning staff did not need to provide as much guidance to the developer on the application of the LMF to their specific proposal. With less sophisticated developers, planners would need to have a more detailed understanding of the BMPs, or have access to others who could provide such support. Strathcona environmental planners were happy to review the two proposals within the moraine, a service accessible through the BHI, and Lamont planners were relieved to have the additional assurance of expert comment on which to base their recommendations to Council. The role of ‘translators’ in these three examples highlights the need for experts that are able to interpret the LMF and help others in its application, whether developers, planners or councilors.



8.0 THE LMF FOR LANDOWNERS

The third partner in sustainable land management of the Beaver Hills Moraine is the individual landowner. Municipal policy-makers and planners can guide development, but land management is largely under the control of individual landowners (including acreage owners, agricultural producers and land trust conservation agencies). In that sense, landowners arguably play a critical role in managing the environmental resource of the moraine, and should have specific interest in sustaining the ecological goods and services it provides.

Most municipalities promote initiatives related to the health and well-being of the community. Municipal staff can help landowners familiarize themselves with and adopt the BHI principles by providing information and resources related to sustainable land management practices. Such a process need not require substantial effort. With increasing interest in sustainable land management, various government and non-government organizations have developed resources and information that promote sustainable practices. Various municipalities in the province have begun posting such links to their own websites, to provide ready access to resources and implicit support for sustainable practices. Others will keep paper copies of relevant resources and will distribute them to interested landowners.

The following sections identify some resources relevant to different landowners, to facilitate referral of interested landowners to information consistent with the principles and land management objectives promoted by the LMF. These lists are not, however, exhaustive. As well, new products are being developed all the time. Hence, landowners are encouraged to conduct their own search online or by contacting provincial, municipal and conservation agencies from time to time.



ACREAGE OWNERS

The Green Acreages Guide Primer: Stewardship for Small Acreages. Published in 2012 by the Land Stewardship Centre of Canada. Also available is the Green Acreages Guide Workbook. See <http://www.landstewardship.org/green-acreages-guide/>.

The Land Stewardship Centre lists various resources of interest to acreage owners and rural residents, from ‘nature-scaping’ landscapes to ecological gardening approaches. See <http://www.landstewardship.org/resources/explore/>.

On the Living Edge: Your Handbook for Waterfront Living, Rideau Valley Conservation Authority. See <http://www.livingbywater.ca/>.

Herbicide and Pesticide Guide for Acreage Owners and Hobby Greenhouse Operators. Fact Sheet prepared by Alberta Environment and Sustainable Resource Development. See <http://www.environment.alberta.ca/01931.html>.



AGRICULTURAL PRODUCERS

Alberta Environmental Farm Plan Program. Provides information on workshops and other support for developing an Environmental Farm Plan. See <http://www.albertaefp.com/>.

Cows and Fish (Alberta Riparian Habitat Management Society) produces a variety of resources to assist agricultural producers to understand, assess and manage the health of riparian areas. See <http://www.cowsandfish.org/>.

The Land Stewardship Centre of Canada lists various resources of interest to agricultural producers, from forage management to energy conservation measures, community gardening and enhancing wildlife habitat. See <http://www.landstewardship.org/resources/explore/>.

Watershed Groups: The North Saskatchewan Watershed Alliance (north moraine) and the Battle River Watershed Alliance (south moraine) are locally based ENGOS that provide information, resources and support to improve watershed, and aquatic health. These groups monitor watershed health and promote awareness and BMPs related to watershed management. See <https://www.nswa.ab.ca/> or <http://www.battleriverwatershed.ca/>.

Environmental Stewardship Programs. Alberta Agriculture and Rural Development provide a variety of links to resources relevant to agricultural operators on its website at

(<http://www.agriculture.alberta.ca/app52/programsservices>) including the following:

- [Agricultural Research and Extension Council of Alberta - Sustainable Grazing Mentorship Program](#) (Agricultural Research and Extension Council of Alberta)
- [Confined Feeding Operation \(CFO\) Stewardship Program](#) (Growing Forward 2)
- [Confined Feeding Operations \(CFO\) Extension Services](#) (Alberta Agriculture and Rural Development)
- [EcoAction Community Funding Program](#) (Environment Canada)
- [Landowner Recognition Habitat Programs](#) (Alberta Fish and Game Association)
- [Operation Grassland Community](#) (Alberta Fish and Game Association)
- [Partners in Habitat Development](#) (Eastern Irrigation Association)
- [On-Farm Water Management](#) (Growing Forward 2)

Woodlot Management Plan. Alberta Agriculture also provides support for development of a sustainable woodlot. See [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/apa7779](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/apa7779).

NEW RESIDENTS

Municipal Resources. Some municipalities within the province have consolidated information about municipal services, planning and development and conservation activities supported by the municipality into a single fact sheet. Such an approach has the benefit of communicating simply and clearly the management priorities of the municipality, as well as some of the partnerships and resources they have invested in to support those objectives. For an example, see <http://www.wheatlandcounty.ca/DocumentCenter/View/13>.

COMMUNITY GROUPS AND SMALL COMMUNITIES

The Green Communities Guide. Published by the Land Stewardship Centre, provides information on sustainable practices relevant to administrators of small communities and community groups. A CD copy is also available. See from <http://www.landstewardship.org/green-communities-guide/>.

ASVA Lake Stewardship Guide. For those communities situated on or near a lake, the Alberta Summer Villages Association has put together a guide aimed at local councils. See <http://www.asva.ca/lake-stewardship-guide.html>.

Municipal Guide: Planning for a healthy and sustainable North Saskatchewan River Watershed.
Published 2006 by the North Saskatchewan Watershed Alliance. Edmonton, AB See
<https://www.nswa.ab.ca/sites/default/files/documents/NSWA%20Municipal%20Guide.pdf>.

CONSERVATION ORGANIZATIONS AND LAND TRUSTS OPERATING IN THE BH MORAINÉ

Alberta Conservation Association. See <http://www.ab-conservation.com/go/default/>.

Alberta Fish and Game Association. See <http://www.afga.org/>.

Ducks Unlimited Canada. See <http://www.ducks.ca/> /

Edmonton and Area Land Trust. See <http://www.ealt.ca/>.

Environment Canada Ecological Gifts Program. See <http://www.ec.gc.ca/pde-egp/>.

Miistakis Institute. See http://www.rockies.ca/project_info.php?id=91 for Private Land Conservation Fundamentals Certificate and <http://www.rockies.ca/projects.php> for project descriptions.

Nature Conservancy Canada. See <http://www.natureconservancy.ca/>.

9.0 LMF IMPLEMENTATION

The BHI Land Management Framework provides a comprehensive evidence-based foundation for land use decision-making that, ideally, will result in sustainable development across the Beaver Hills Moraine. The LMF provides a practical aid for taking a consistent, systematic approach to planning and decision-making to achieve regional coordination of land use planning. It is based on BHI principles, operationalizing development decisions by providing the details necessary for practical application. This can however, be achieved only if the LMF is incorporated into land management decision-making processes on an on-going and consistent basis. Hence, the LMF requires a focused and clear implementation strategy backed by performance monitoring and communication.

The LMF is a ‘living’ document and its implementation is a process that will take time to be effectively incorporated into municipal function. Continued awareness-raising activities and discussion, as well as continued use by managers and planners will help to fine-tune the LMF to the specific interests and capabilities of each partner municipality. Today, the 2014 LMF document continues to be of value for councilors, municipal and other land managers, conservation organizations, planners, and other decision-makers in the Beaver Hills Moraine. To remain relevant going forward, the LMF must adapt to the changing needs and interests of the BHI partner municipalities.

RECOMMENDED IMPLEMENTATION ACTIONS

The following are recommended implementation actions that will ensure that the LMF continues to serve the objectives of the BHI and sustainable land management decisions affecting the Beaver Hills Moraine.

Adoption by the BHI Board

The BHI LMF represents a clear statement on behalf of the BHI as to how the principles and objectives of the BHI can be operationalized and realized. While the LMF offers a comprehensive range of tools, current data and best management practices that are useful independently, as a complete package, it supports and enables all members of the BHI to move in a consistent direction with common land management policies.

Over the past decade, the BHI has made considerable progress raising awareness about sustainable development. By providing members with the tools and information that they need to make environmentally responsible decisions without affecting economic growth or quality of life, they have demonstrated the potential in this concept. Adoption of the LMF by the BHI Board presents an opportunity for members to refresh their commitment to the principles and objectives of the BHI, recognize past achievements and renew their collaborative efforts toward consideration of environmental impacts in land use decisions.

Communication to BHI Member Municipalities

The planning context, priorities, processes and objectives of each member municipality are substantially different and these differences must be acknowledged and respected. In this context, there is no single prescribed method for incorporating the LMF into municipal planning, nor can there be an expectation that municipalities modify their statutory planning documents to some standardized form. The LMF does however, provide a vehicle for the harmonization of planning decisions, bringing greater consistency to the rationale behind those decisions and reducing conflicts arising from inconsistencies and inter-municipal comparisons.

Once adopted by the BHI Board, a comprehensive communication strategy should be developed and implemented to create a high-level understanding among member Councils and senior administration. An emphasis on the importance of considering the LMF in planning decisions will help ensure that the tools provided are integrated into planning decision processes.

Individual Councilors could be offered opportunities to increase their familiarity with the LMF and the value it has in identifying the ecological assets present and land management priorities for the regions that they represent. This would assist them in their work with proponents and constituents on planning initiatives.

Training for Planners and Others

A critical component of the implementation of the LMF is its use by municipal land use, environmental and open space (parks) planners in making and justifying land management decisions. Considerable effort has gone into creating GIS tools and information that can be readily integrated into the technical processes being employed by planners in assessing proposed developments or developing long-range land use plans. There is a high level of turnover among municipal planning staff in Alberta. Continuing opportunities need to be in place to ensure that both long term and new staff are familiar with these tools and their potential application to planning in each municipality.

The BHI should consider developing on-going training for planners and other land management decision-makers to help them become familiar with the LMF, how it can be used to support decisions and how the tools can be integrated into municipal planning processes. While the potential audience will depend on the particular municipality, land use, environmental and open space planners should be aware of the LMF and able to use the information it provides. If municipal staff are aware of the LMF and can readily access its information, they will ensure that the information is used for any relevant application in their organization.

Communication to Landowners and the Public

The LMF has been formatted so that individual components of the Framework can be removed and provided on paper or electronically to individuals, landowners and proponents. Shorter, relevant pieces could promote understanding of the context for planning decisions, and the means to make more environmentally responsible decisions regarding their own lands. The links provided in the preceding

section are particularly relevant to landowners and the public, and have been catalogued to allow easy posting to municipal websites, or to the newly updated BHI website. Posting of interesting facts and background about the moraine to the BHI and municipal websites will provide consistent documentation of the unique aspects of the moraine, and the ecological benefits (goods and services) it provides to local and regional residents. As part of a broader public awareness and engagement effort by the BHI, the LMF can provide a consistent resource to the public and landowners about the distinctive landscape that they live within and how it can be managed sustainably.

Regional Planning

Regional planning, as mandated under the *Alberta Land Stewardship Act* and the Land-use Framework, is progressing. Planning for all seven watersheds, including the North Saskatchewan Regional Plan, is currently underway. The BHI is a model for collaboration in land use planning highly relevant to the regional planning process. It deserves to be recognized for what it has accomplished and for its potential transferability to other regions and sub-regions regarding the structure and processes of the BHI.

As a science-based framework for decision-making, the LMF also provides a model for regional planning across the North Saskatchewan watershed, and a basis for compiling equivalent tools to assist land management decisions at the regional landscape level. Indeed, provincial agencies such as the former Tourism Parks and Recreation (now part of AESRD) developed a nature-based tourism assessment with the BHI to ensure that these special attractions were recognized in the future planning process. The BHI should be prominent in discussions at all levels in the North Saskatchewan Regional Plan, as it has much to contribute, and others have much to learn from the BHI experience.

Biosphere Reserve

As a practical guide to facilitate sustainable development in the moraine, the LMF provides tangible evidence supporting the BHI's application for designation by UNESCO as a Biosphere Reserve. This current version has demonstrated the successful application of the BHI principles in conserving the distinctive ecological features of the moraine, as well as outlining the means to maintain those features in the future.

The LMF and the BHI State of the Beaver Hills report will document how sustainable the moraine is currently, and provide the means to sustain it over the long-term. The acknowledged critical role of on-going support and communication will also help to illustrate to UNESCO reviewers how the BHI will engage all parties in sustainable land management, including landowners, developers and government and non-governmental agencies, a critical element of the nomination review process. The vision of the LMF as a 'living document', adapted and communicated as context changes and new information emerges will provide strong evidence of how the BHI intends to promote sustainable development within the proposed biosphere reserve on an on-going basis.

Regulatory Context

There are several provincial committees currently examining the need for changes to the *Municipal Government Act (MGA)*, and indeed the Act itself is currently in the process of major revision. As partners in an initiative promoting sustainable development, the municipalities and the BHI should take full advantage of this opportunity, and participate in these discussions. Provincially, there is an openness to change in the MGA and in the approach to land use in general, that could promote the flexible policy necessary for municipalities to manage local resources sustainably. Some suggested changes to the MGA that would strengthen municipal actions to support sustainability include the following:

Broaden the Definition of Environment in the MGA

Affecting change within municipal policy is one option for adopting sustainable management practices. To enhance that capacity, change is also required at the provincial level, to improve or provide new tools for management. One such change is broadening the definition of environment within the MGA. The current definition focuses mainly on geotechnical and flooding concerns: the potentially negative interactions of the environment on development. A definition of the environment that encompasses not only the specific resources but also the interactions between them (e.g., similar to the ecological definition of environment in the CEAA) would provide a definition comparable to other levels of government. That expanded scope of management would set the stage for a sustainable management approach, because it acknowledges that both resources and the interactions between them can be affected by development. Importantly, it would also fill a local-scale gap not currently addressed by higher levels of government, which necessarily must focus on concerns at the provincial or national scale. An expanded definition would allow municipalities to manage resources of local importance, in a manner consistent with the sustainable approach now taken by other levels of government.

Expand the Definition of Environmental Reserve to Include Various Natural Features

The benefit of a broader definition of the environment would help support another change currently being promoted by municipalities across the province. Presently, under the MGA, the features that can be taken as Environmental Reserve are restricted to environmental limitations to development: geo-technically unstable areas, ‘wet areas’ and floodplain lands. Expanding the definition of Environmental Reserve lands to include natural features that may serve a critical ecological function (such as wetlands on recharge zones, or Core Areas) would provide a legislative tool not currently available to municipal planners.

Adjust the Taxation Structure to Acknowledge Ecological Goods and Services from Natural Areas

Currently, the MGA delegates land taxation to municipalities, with an implied focus on developed landscapes. For municipalities that have recognized the need to protect local natural areas, the current land tax structure offers no clear guidance for tax assessment of lands conserved through either private land ownership or conservation easements. The current property tax structure provides no clear valuation for conservation lands, and instead acknowledges only agricultural and developed use of rural lands, policy developed in the early 1900s as an incentive for settlement and agricultural development. As

various policy analysts have noted since the late 1990s¹⁴, the legislation has not modernized to offer clear tax guidance for properties managed for conservation purposes, in keeping with rising public interest in conservation easements and property securement. Instead, such lands are often taxed inconsistently, either at the higher rural residential rate or at agricultural rates determined under special provision by the individual municipality. In the view of such analysts, an explicit valuation rate for conserved lands, ideally comparable to agricultural property taxes, is necessary to provide clarity and recognition of the public benefit of sustainable land management. The opening of the MGA for revision offers the opportunity to recognize the ecological goods and services provided by natural areas, and the potential to incent conservation of critical natural lands through consistent, lower land taxation.

PERFORMANCE ASSESSMENT – INDICATORS & MONITORING

To ensure that the LMF is being utilized and that it is indeed contributing to the achievement of the goals of the BHI, a system of performance monitoring and assessment should be put into place. There are numerous benefits to measuring performance, particularly for an organization like the BHI, which is responsible for an increasingly diverse range of projects and initiatives. The BHI is also required to report to funding agencies and partnering municipalities on their performance.

A comprehensive system of measurement supports the following attributes of successful organizations:

Accountability – With rising public interest in the effectiveness of publicly funded organizations, stakeholders, partners and constituents want a clear demonstration that the organization is accomplishing what it has proposed to accomplish.

Program Improvement – Measures permit organizations to identify problem areas and remedial strategies, and as corrective actions are taken, to detect the extent to which improvements have actually occurred.

Strategic Planning – Performance measures identify where strategic opportunities are present as a guide to strategic planning.

Budgeting and Resource Allocation – Within an effective evidence-based planning system, performance measures substantiate requests for the most effective allocation of resources.

Collaboration - Performance measures enable organizations to demonstrate clearly to their partners what they do best as a foundation for effective collaboration.

¹⁴ Arlene Kwasniuk (1999) *Conservation Easement Guide for Alberta*, National Round Table on the Environment and the Economy, and Unger (2007) *Conservation Easements in Alberta: Practical and Legal Reforms to Facilitate Easement Effectiveness* have all noted the disincentive imposed by inconsistent property tax law for conservation easements and properties in Alberta.

Communication with the Public - Performance measures provide information to the public about what the organization is doing, what it proposes to do, and how effective it is in doing it.

Two levels of indicators are available through the LMF.

1. **Utilization and impact of the LMF** – The case examples used throughout the LMF provide anecdotal indications of the extent to which the LMF has been incorporated into planning decisions. The BHI should, as a follow-up to communication and training efforts, monitor the degree to which the elements of the LMF have been utilized, to understand better who is using the LMF, how frequently, and for what purposes. This will provide important evidence for future improvement in communication, training and the LMF tools themselves.
2. **Environmental Indicators** – The objective of the LMF is to provide a foundation for sustainable land use decisions, which in turn, should lead to improved environmental management. The work currently being conducted by the BHI on the State of the Beaver Hills report will provide important base line data to understand how land use decisions are affecting key environmental indicators. Some attention should be applied to connecting the best practices recommended in the LMF to actual improvements in environmental indicators.

PERIODIC REVIEW OF THE LMF

Best environmental management today is understood to include three elements: adaptive management, risk assessment and dispute resolution. The LMF provides information that allows those that own or manage land to assess risk to key environmental resources. As demonstrated in the case examples, informed debate can also help resolve potential conflict in land-use policy development. The LMF is not a static tool though. It will need periodic updating to adjust to new information, and to adapt management to a changing social, economic and environmental context.

The LMF will become dated over time. To maintain relevance to the municipal and other partners involved in land management in the moraine, the document itself should be reviewed from time to time to ensure its contents, including best management practices and links to resources are up-to-date. Additionally, the data sets and models used to develop the maps associated with this document should be re-run and updated periodically to capture the changes in the landscape and its resources over time.

GLOSSARY

Aquatic organism: Fish, invertebrate animal species and microbial organisms (e.g., bacteria) that reside exclusively in and are dependent on water.

Biophysical Assessment: A form of environmental assessment that focuses on the potential impact to the biophysical features present in or adjacent to the proposed location by a proposed development. Assessed features can include, but are not limited to geology, landform (terrain), soils, surface and groundwater, vegetation, wildlife, fish and aquatic habitat. Results of the assessment may provide assurance that development follows sustainable practices and significant regulatory issues have been addressed, or it may inform other related permitting processes.

Connectivity: The concept of connectivity is used to describe how the spatial arrangement and quality of other elements in the landscape affect the movement of organisms among habitat patches (Merriam 1984, 1991; Taylor et al. 1993; Forman 1995 in Bennett 2003). In an urban context, connective landscapes are described in terms of relatively permeable habitat patches and linkages, separated by a less permeable matrix and barriers.

Core Area: A patch of habitat that contains a large, growing sub-population from which species could disperse to other smaller habitat patches, thus contributing to a sustainable population at the landscape scale (Forman 1995). Core areas vary with species, due to species-specific habitat and area requirements, thus discussion of management of Core Areas must be tied to species of management concern, or indicators representative of a more diverse suite of species.

Corridor: Any space, usually linear in shape, that improves the ability of organisms to move among patches of their habitat (Hilty *et. al* 2006). Although naturally-vegetated linear strips can also be corridors (Bennett 2002), for this assessment we identified only disturbed grass corridors, primarily transportation rights-of-way (i.e., linear greenspace, such as hedgerows, were not specifically identified as corridors in this assessment).

Ecological Goods and Services: provisioning, regulating, cultural and supporting functions supplied by a well-functioning ecosystem, difficult to replace through human means and thus, valued by humans. Examples include food, water, fibre and fuel (provisioning); climate regulation, water and disease control (regulating); spiritual; aesthetic, recreation and education (cultural); and primary production and soil formation (supporting) (Millennium Ecosystem Assessment, 2005).

Ecological Network: A means of achieving connectivity within a landscape through a linked system of habitat suitable for residence and/or movement (patches, linkages and permeable matrix types) (Forman 1995, Hilty *et al.* 2006).

Edge: The portion of an ecosystem near its perimeter, where influences of the surrounding lands prevent development of interior environmental conditions. Instead, the perimeter contains a distinctive species composition or abundance created through a process termed “edge effect” (Forman 1995).

Environment: “Environment” means the components of the Earth, and includes:

- (d) land, water and air, including all layers of the atmosphere,
- (e) all organic and inorganic matter and living organisms, and
- (f) the interacting natural systems that include components referred to in paragraphs (a) and (b).

(from the *Canadian Environmental Assessment Act*)

Environmental Assessment: A review of a proposed development to identify and quantify the potential impact on the biophysical, social and/or cultural environment. Where negative impacts may result from the project, the assessment should recommend mitigative measures that will eliminate or minimize those impacts. Such assessments are usually used by government agencies responsible for development approval to determine whether the proposal will result in sustainable development, or will reduce the quality or function of a valued component of the environment. The scope may be adjusted to focus on specific environmental resources of concern to the regulatory agency, or relevant to the type of development. Development permits are usually contingent on approval of these reviews by the regulatory agency, which in turn depends on the extent of environmental impact predicted to result from the project.

Environmental Impact Assessment: A form of environmental assessment applied as a condition of development under statutory legislation. Although these reviews may be conducted at a general or very detailed level, they always consider potential impacts to a broadly defined “environment” that includes biophysical, social and cultural elements. Federal and provincial EIA processes are legislated under the *Canadian Environmental Assessment Act* and *Alberta Environmental Protection and Enhancement Act*, respectively. They both apply to larger infrastructure projects. Some municipalities have also adopted EIA processes applicable to specific geographic areas (e.g., Leduc County, the City of Edmonton).

GIS: Geographic Information System, computer software that allows spatial analysis and display of the qualities and characteristics of a landscape.

Habitat: The ecosystem in which a given species lives, or the conditions within that ecosystem that provide resources suitable for a given species (modified from Forman 1995).

Habitat Patch: A relatively homogenous, unfragmented, nonlinear area of habitat that differs from its surroundings. Within this assessment, habitat patches are all considered capable of sustaining populations of plants and wildlife over the longer term. Such sites included naturally vegetated lands identified in an inventory by Alberta Sustainable Resource Development, provincial parks and protected areas, which included regionally significant natural areas.

Linkage: Arrangements of vegetated areas that enhance connectivity for species, communities or ecological processes. In a developed environment, linkage is typically provided by Stepping Stones or Corridors (defined elsewhere in this glossary). In the context of our assessment, we have considered Stepping Stones as Linkage habitat and Corridors as a distinct form of linkage habitat.

Landscape: An area (usually large and at a regional scale) where a grouping of local ecosystems is repeated in similar form. In the context of a developed area such as the Beaver Hills Moraine, the landscape can further be defined as a zone or area perceived as a unit by local people or visitors, with

visual features and character resulting from the action of natural and /or cultural (human-influenced) factors. In this analysis, we considered the Beaver Hills moraine to comprise a landscape, from an ecological and human perspective.

Landscape Character: The recognizable and consistent pattern of natural and cultural elements that differentiate landscapes from each other. Such patterns (for example, in geology, soils, landform, land use, vegetation, field boundaries, settlement patterns and building styles) can be described for landscapes of any scale. Landscape character reflects the combination of biophysical and cultural factors that create a distinct and unique sense of place perceived by local residents and visitors (modified from the European Landscape Character Assessment Initiative, 2005).

Landscape Protection: Measures to preserve the present character and quality of a landscape that is greatly valued because of its distinctive natural or cultural configuration. Such protection must be active and involve maintenance measures to preserve significant features of the landscape (European Landscape Convention, Article 1). Protection in the context of this document includes formal measures to control future land management, either through a change in ownership (e.g., conservation easement, Environmental Reserve, protected area designation) or through implementation of protection by jurisdictions responsible for specific environmental features (e.g., provincial control of surface waters).

Landscape Management: Any measure introduced under the principle of sustainable development to guide changes brought about by economic, social or environmental necessity. Those measures may be concerned with organization of the landscape (e.g., within a Municipal Development Plan) or its components (e.g., specific planning guidelines). The goal of those measures, however, is to sustain environmental functions and features in the context of development, such that the landscape changes to meet economic and social needs without disrupting critical ecological processes. Because the underlying ecological processes and societal needs are dynamic, the management approach must also be adaptive, seeking always to improve landscape quality based on the society's expectations and ecological need. Management in the context of this document includes measures implemented on a voluntary or statutory basis that guide activities on developed and undeveloped parts of the moraine.

Landscape Planning: The formal process of study, design and construction within a landscape, which lead to modifications that meet the goals of stakeholders. Deciding which landscapes should be modified to accommodate economic or social needs involves a balance between planning for development, conservation and on-going management that is ultimately dependant on the natural character of the area, and the agreed objectives for its future character. Planning in the context of this document includes the research and discussion of objectives guiding future development of the moraine landscape.

Matrix: The matrix is the background ecosystem or land use in which habitat patches lie on a landscape (Forman 1995, Hilty et al 2006). The matrix in a developed landscape can be quite complex given the variety of land uses present and is best thought of as comprising a gradient of permeability that can range from very permeable to a complete barrier (Hilty et al 2006). Permeability is related to the quality of the matrix and the distance separating more suitable habitat patches, and is therefore, species-specific. In this

assessment, we defined relative permeability of the matrix from the perspective of two large mammals with relatively high mobility and wide gap tolerance (deer and coyote).

Metapopulation = a population of sub-populations, or a system of local populations (demes) connected by movements of individuals (dispersal) among the population units (Hilty et al 2006).

Minimum Viable Population = population at or above which the probability of extinction is reduced to an acceptable level over a given period of time (Schaffer 1981, Samson 1983, Lemkhul 1984, Gilpin and Soule 1986, Lacy 1993/94, Henriksen 1997).

Natural Capital: The ecological goods and services provided by natural ecosystems, which sustain the ecosystems themselves as well as human populations. Those resources are in turn involved in a broad range of ecosystem processes and functions that provide tangible benefits to people, including air quality, climate moderation, maintenance of the water cycle and water quality, waste assimilation, nutrient cycling, soil regeneration, pollination and provision of foods and other useful natural products. Aesthetic and spiritual values are additional intangible benefits associated with natural capital (Folke *et al.* 1994.)

Natural Vegetation: Plant species composition and cover comprising predominantly native species not planted by humans. Human impacts and exotic species may be present, but native species are usually dominant (Forman 1995).

Riparian: Lands immediately adjacent a waterbody. Due to high soil moisture, such areas typically have more productive vegetation development and growth, which in turn support abundant and diverse wildlife communities. As the buffer between aquatic and terrestrial ecosystems, they can support other important ecological processes, including water quality protection, groundwater recharge and habitat connectivity.

Restoration: Efforts to restore or re-establish habitat in lands degraded by past land use to improve connectivity or other ecological processes. Restoration can be passive relying on succession to replace natural vegetation or active planting or managing habitat to restore natural vegetation (Hilty *et al.* 2006).

Source Population: A growing or stable population in which reproduction is greater than mortality, such that individuals must disperse to new habitat.

Stepping-stone: A vegetated area that may provide resources to sustain an organism for some time, but is generally used as a temporary stop while moving through the matrix toward more suitable habitat patches (modified from Forman 1995).

Sustainability: The ability of a site to continue to exist as a vigorous, biologically diverse site that will follow a natural trajectory of change, regulated by natural processes and dominated by native species, even when future conditions on surrounding lands have changed.

Viable Population: A population that continues to exist and function naturally so that over the long term, reproductive rates remain higher than or equal to rates of loss (Salwasser et al 1984, Newmark 1985).

Wildlife: Vertebrate and invertebrate animal species.

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APPENDIX 1. DATA, MODELS AND MAP DOCUMENTATION

The following section provides detailed information about the data and models used to produce the Environmental Sensitivity Areas and Resource Risk maps.

KEY CHANGES - 2014 UPDATE

A variety of new resource mapping data have been compiled by various agencies since the original LMF was produced. The LMF mapping models described below incorporated new data based on four criteria:

- accuracy
- currency (up to date)
- appropriate / comparable scale
- cost of access

Solstice Canada Corp. also developed new 1:5,000 scale datasets for the project based on newly available LiDAR data and SPOT imagery for:

- hydrology
- wetlands
- vegetation heights and native vegetation

Other new data sources included ABADATA, an external service that provides users with oil and gas infrastructure locations, used in analysis under existing licensing arrangement with Solstice Canada. That licence agreement did not allow base data to be used in mapping, but the individual counties each have a licence, so that they can integrate the LMF data with that from ABADATA.

The addition of the new, fine-scale wetland, hydrology and vegetation data allowed application of new GIS models to fill known data gaps. Specifically, we were able to enhance existing soil suitability mapping (based on provincial Land Suitability Index System data) to map agricultural capacity within the moraine at a finer scale. The addition of this model allowed us to integrate all of the models to identify potential land uses based on environmental constraints, the ultimate aim of the LMF.

The sections below describe the original and new models. Original and updated sources are listed for each model, with a citation indicating the organization providing the data.

BUFFERS FOR HYDROLOGICAL FEATURES

We reviewed a variety of references to identify the range of buffer widths recommended for various ecological functions (Table A1). Based on these data, and the principle that a wider buffer would provide maximum protection, we selected appropriate buffer widths for each model, according to the ecological function of interest. To a certain extent, our decisions were based on the minimum map-able unit – generally, buffers less than 50 m were not distinguishable at the map scales used for this assessment. Accordingly, a 50 m buffer was the minimum unit feasible for these analyses.

Much of the research on wildlife corridors has focused on wilderness areas (e.g., the Bow Valley system in Banff National Park). As a result, the buffer widths recommended by those studies is much wider than would be feasible in a rural environment. We selected a buffer of 200 m for the Environmental Sensitivity Area analysis, which represented a compromise between sufficient wildlife habitat and a minimum width for wildlife connectivity. For the Groundwater Risk analysis, we selected 50 m as a water quality buffer, which recognized the 30 to 36 m buffer recommended by most authors, and acknowledged our mapping limitations.

Table A1 - Comparison of Riparian Buffer Widths to Achieve Different Ecological Functions

Ecological Function	Buffer Width*	Description	Reference
Water Quality	30 m	Protect water quality in wetlands by filtering sediment, contaminants, nutrients and pesticides	Fischer et al 2000, Connecticut River Joint Commissions 2000
	36 m	Reduces the concentration of nutrients and microorganisms to acceptable levels in feed lot runoff from summer storms	Young et al 1980
Wildlife Habitat	100 m	Accommodate resident populations of all three locally common amphibian species	Spencer Environmental 2004
	100 m	Provide for increased avian diversity in natural vegetation surrounding wetlands	Fischer et al 2001
	100 m	Provides habitat for wetland and riparian species	Fischer and Fischenich 2000, Alberta Sustainable Resource Development 2001
	10-200 m	Provide habitat for all life stages of wildlife dependent on wetlands or watercourses	Connecticut River Joint Commissions 2000
Wildlife Connectivity	600 m	Minimum corridor width for white-tailed deer	Nelson and Mech 1987 <i>in</i> Meffe and Carroll 1994
	1000 m+	Corridors several kilometers in width may be necessary for use by large mammal species	Paquet et al 1994

* Buffer widths listed are *minimums*; it is widely accepted that wider buffers are more effective.

SURFACE WATER RISK MODEL

BACKGROUND

The Surface Water (SW) Risk Model identifies the sensitivity of land parcels within Gross Drainage Areas (the smaller drainage systems comprising a watershed sub-basin) to sediments and contaminants potentially introduced by existing development within the Beaver Hills Moraine. In this model, we have assumed that where certain types of development have been extensive relative to the amount of SW, the risk of contamination is higher. In those cases, natural processes that help protect water quality and quantity may potentially be approaching the limits of sustainability. Further development of operations with high potential for contaminant release may be less suitable in such areas, if water quality and quantity are to be protected.

The model is based on the relative influence of different types of land use and management on water quality and water supply, applied first within the individual parcels and then summed over each gross drainage area in the Beaver Hills Moraine. The model assigns scores to each form of land use (identified from land use mapping) in terms of positive and negative influence on SW. The areas of positive and negative land covers within the Gross Drainage Area are then weighted using the model scores and standardized by dividing by the area of SW represented in the Gross Drainage Area. This index represents the proportional contribution of land cover to overall SW health relative to water coverage in the Gross Drainage Area. The indices of positive and negative land covers for a given Gross Drainage Area are next summed to derive a single net estimate of the positive and negative land cover impact on SW within the Gross Drainage Area.

DATA SCORING AND MODEL MECHANICS

SW Risk rating was originally (2007) calculated by dividing (respectively) the weighted areas of 'healthy' land cover and the unhealthy (potentially polluting) land cover by the area of the Gross Drainage Area (i.e., proportion of healthy to unhealthy land cover relative to the Gross Drainage Area in the analysis area). Proportions were then summed to determine the SW risk for the Gross Drainage Area. We continued this analysis at the quarter section level analysis, such that the land covers were simply rated according to Table 4, then displayed. For the Gross Drainage Area though, this approach could be expanded to assess risk relative to the area of SW present, and thus accessible to potential contaminants.

As in the original model, in 2014 we again developed two scales of SW Risk assessments. The largest assessed the risk at a sub-watershed level, using portions of Gross Drainage Areas (as a sub-unit of the watershed) that lie within the moraine. This large-scale assessment was intended for use in long-range (MDP and LUB) planning. We also assessed risk in terms of the relative proportion of healthy to unhealthy development at the quarter section level, to allow planners and developers to identify risk relevant to a specific development proposal. Working within the Gross

Drainage Areas or quarter sections, the model assigned a score for each land cover type present based on their influence on water quality and supply. The ratio of the total area of healthy or unhealthy land covers (for water protection) within the analysis unit provided an indicator of the relative health of uplands. For the Gross Drainage Area analysis, this ratio could then be combined with the ratio of waterbodies present within the analysis unit to calculate the risk to SW within a given analysis area. Thus, the model was based on GIS reclassification of land covers and analysis of the land covers present within a Gross Drainage Area or quarter section, rather than an additive approach.

Initially, vegetated land covers and waterbodies were combined (dissolved) in the GIS to form a comprehensive land cover map. These land covers were explicit (i.e., they did not overlap). The land cover polygons were classified as either Positive or Negative Land Cover Types as outlined in Table A2. Assigned scores reflected the direction and magnitude of a land cover class's potential influence on water quality or water volume retained on the landscape. Each land cover type within the SW Risk Model was scored according to the following system:

<u>Score</u>	<u>Influence</u>
-2	Highly negative
-1	Moderately negative
0	Neutral
1	Moderately positive
2	Highly positive

For each land cover within the given analysis unit, a Healthy and Unhealthy Land Cover Index was calculated according to the following calculation:

Healthy (Positive) Land Covers = (Score_{*i*} x Land Use Area_{*i*})

Where *i* = positive land cover.

Unhealthy (Negative) Land Cover Index = (Score_{*i*} x Land Use Area_{*i*})

Where *i* = negative land cover.

Next, those indexed values were summed to calculate the relative amount of healthy to unhealthy land covers within the given area of analysis (i.e., at the Gross Drainage Area or quarter section):

Healthy Land Covers = Σ (land area x healthy cover type score)

Unhealthy Land Covers = Σ (land area x unhealthy cover type score)

To determine the extent of healthy to unhealthy land covers in the area of analysis, we calculated the ratio of the two land cover totals:

Healthy Land Cover Ratio = Healthy land covers / unhealthy land covers

Finally, the healthy land cover ratio was used to assess overall risk within the Gross Drainage Area, by modifying (multiplying) the net score by the proportion of surface water relative to the respective area of the analysis unit (the specific Gross Drainage Area). This effectively created a risk index based on the extent of SW within the given area and the impact of existing upland use:

$$\text{SW Risk Index} = \frac{\text{SW Area}}{\text{Analysis Unit Area}} \times [\text{Net Healthy Land Cover}]$$

The resulting risk indices were mapped for each Gross Drainage Area or quarter section, to illustrate landscape level and site-specific SW risk.

FINAL MAPPING

Mapping was provided in two forms:

- Quarter section level to show distribution at local scale across the moraine
- Gross Drainage Area level to show risk at the watershed (landscape level)

The first map is applicable to assessment of individual land development proposals, while the second is applicable to broader scale planning (e.g., MDP review). The mapped scores were not normally distributed. To map the Gross Drainage Area and quarter sections, we divided the resulting risk data into four classes, based on the median and quartile distribution of scores (i.e., quartile method). The classes were identified as low to high levels risk to surface water based on the break point at each quartile. These risk categories were then color-coded and used to map the relative risk of SW contamination across the moraine at the quarter section and Gross Drainage Area scale.

Variable Assumptions

Each land cover category used as a variable in the analysis was scored relative to its potential contribution (positive or negative) to either SW quality or volume. Scoring was somewhat generalized, given the combined examination of these two aspects of surface water, but the individual scores were based on documented functional relationships of land cover on surface water run-off, soil percolation, contaminant filtering, and evapotranspiration.

Accurate and current forage and cropland data for the moraine were lacking for the original LMF modelling and an up-to-date inventory at a scale compatible with land use planning (e.g., 1:20,000 or less) remains a data gap. We developed a layer that estimated current crop and forage/pasture areas using the new Solstice vegetation dataset (based on 3 m LiDAR and 1.5 m 2013 SPOT data) and Agriculture Canada's (2012) Crop Type Land Cover dataset, an inventory developed from remote sensing. Overlays with aerial photographs confirmed that this method had generally identified these lands correctly.

Land use data were also used to identify the various other land uses considered in this analysis. The original land use data provided by the municipalities were reclassified to identify industrial, country residential, commercial and urban residential areas. Protected areas considered in the analysis included federal and provincial protected areas and the smaller conservation easements and conservation properties owned and managed by environmental non-government organizations. Native vegetation and croplands were dissolved into the land use layer to create the explicit data layer used to develop scores for SW risk.

Buffers for Roads and Right-of-Ways:

Buffers were required for line features (roads, pipelines, small streams) based on average widths derived from measurements from aerial photography. Pipeline widths and well sites were difficult to distinguish on aerial photography and were instead assigned a typical buffer size based on completed infrastructure. Because this analysis is based on the Gross Drainage Area and provides an assessment of risk level due to previous development within that broad unit, accurate road and rail widths can be used (i.e., the buffers do not need to be scaled up to ensure they can be displayed).

Variable	Element	Buffer (m)
Transportation	Expressway/ Highway	35
	Ramp	40
	Collector	15
	Local/ Street	20
	Service	20
	Rail Line	25
	Park roads	15
Oil and Gas Infrastructure	Oil & gas well sites	20
	Pipelines	5
Hydrology	Streams	10

Table A2. Surface Water Risk Model Variables

Land cover Type	Variable	Element	Score	Influence	Datasets	
Positive	<i>Land cover</i>	Natural vegetation (forest, shrub or grassland)	2	High positive	Solstice vegetation	
		Protected Areas (where not overlapping native vegetation)	2	High positive	AB Parks Protected Areas	
		Forage and cropland	1	Moderately positive	Ag Canada Crop Type Land Cover (2012)	
		Rural residential	0	Neutral	Land use zones	
		Commercial	-2	High negative	Land use zones	
Negative	<i>Land cover</i>	Industrial	-2	High negative	Land use zones	
		Urban residential	-2	High negative	Land use zones	
		Developed urban areas	-2	High negative	Built-up areas analysis (town limits)	
		<i>Transportation</i>	Roads	-1	Moderate negative	NRCAN Roads
		Rail lines	-2	High negative	NRCAN Roads	
	<i>Oil & Gas Infrastructure</i>	Oil & Gas wells and pipelines	-2	High negative	ABADATA	
	<i>Water</i>	Hydrology			Solstice hydrology	
Gross Drainage Area				PFRA Gross Drainage Areas		

GROUNDWATER RISK MODEL

BACKGROUND

The Groundwater Contamination Risk Model was designed to identify areas of high sensitivity to water-borne contamination. The model scored soil texture, surface water sites and groundwater recharge and discharge sites relative to the risk of a contaminant release spreading through that feature and into groundwater. Because these data can overlap in space, this is an additive model. The scores assigned to each feature are summed for all overlapping polygons to produce a final summed score. A higher summed score reflects the overlap of permeable soils, surface water and discharge or recharge zones, where risk of potential contamination would be highest.

DATA SCORING AND MODEL MECHANICS

Waterbodies were buffered by 50 m to consider the risk of a release within that zone to enter the waterbody itself. The buffer was slightly wider than the minimum 30 m buffer often recommended as a water quality protection measure to provide a conservative estimate of the risk zone. All buffer distances used in the analysis are listed in the column beside the variable scores.

After buffering of features, all data were reclassified to reflect the relative permeability of the natural feature to water-borne contaminants. The relative permeability to water was assumed to indicate the potential speed and extent of spread of a contaminant accidentally released at the feature. Scores assigned to the various features followed the range listed below:

<u>Score</u>	<u>Permeability</u>
-2	High permeability
-1	Medium permeability
0	Limited permeability

The Groundwater Contamination Risk Model is additive and, therefore, the scores representing natural resource sensitivity (Table A3) overlapping at any given location were summed to indicate the risk due to simultaneous occurrence of highly permeable features at a given site. The resulting final summed scores were grouped into three classes: low, medium and high sensitivity as follows:

<u>Final Summed Score</u>	<u>Mapped Sensitivity Class</u>
0	Low sensitivity
-1 to -2	Medium sensitivity
-3	High sensitivity

FINAL MAPPING

Variable Assumptions

The model assumed that groundwater sensitivity is higher where the surface lands and underlying groundwater are relatively well connected. A contaminant released to surface water or on porous soils would encounter few barriers to movement. Where such features lie near a discharge or recharge zone, the potential for a contaminant to reach groundwater is likely high.

The model assumes that at least two components must exist within a short distance of each other in order for a contaminant to reach an aquifer: porous soils and groundwater near the ground surface. The presence of waterbodies further increases the risk, as the groundwater table may be linked directly with the wetland in a discharge or recharge situation. For that reason, we have identified surface waterbodies as having higher sensitivity (a lower score), due mainly to the speed at which contaminants could diffuse through water, versus soils. Coarse soils would allow a faster rate of contaminant spread than more finely textured soils, and these were also considered to be of higher sensitivity (lower score).

Although the direction of groundwater flow at a recharge and discharge location may influence the speed of contaminant spread within these groundwater zones, for the purposes of this assessment, we have assumed that the difference is minor relative to speed of spread through the various soil types and waterbodies. Thus, the juxtaposition of surface water, porous soils and a groundwater recharge or discharge site presents the worst-case scenario for contamination. Where these features overlap, the combined score would be lowest, indicating that risk is highest at that location.

Table A3. Groundwater Contamination Risk Model Variables

Variable	Score	Buffer Distance	Permeability to Contamination	Datasets
<i>Wetlands</i>	-2	50 meters	High permeability	Solstice vegetation
<i>Hydrology</i>	-2	50 meters	High permeability	Solstice hydrology
<i>Groundwater Discharge</i>	-1	None	Medium permeability	PFRA groundwater discharge
<i>Groundwater Recharge</i>	-1	None	Medium permeability	PFRA groundwater recharge
<i>Groundwater Transition</i>	0	None	Limited permeability	PFRA groundwater transition zone
<i>Fine Soils</i>	0	None	Limited permeability	AGRASID soils
<i>Moderately Fine Soils</i>	0	None	Limited permeability	
<i>Medium Soils</i>	0	None	Limited permeability	
<i>Moderately Coarse Soils</i>	-1	None	Medium permeability	
<i>Coarse Soils</i>	-2	None	High permeability	
<i>Organic Soils</i>	-1	None	Medium permeability	

LANDSCAPE CONNECTIVITY MODEL

BACKGROUND

Connectivity of habitat in a developed landscape depends on several factors including:

- the distribution of **habitat patches** and potential **linkages**,
- the **matrix** in which they are located,
- the 'friction' to movement that organisms face within various parts of the matrix, and
- **barriers** relative to patches and linkages.

This model identifies those landscape features in the Beaver Hills Moraine that contribute to a connected ecological network system. By classifying the landscape in terms of habitat patches, linkages, barriers and the remaining matrix (the ecological network), we can identify critical components that require management. By rating the degree of resistance to movement by organisms presented by each of those components, we can also map the level of connectivity across that landscape (landscape permeability). Lastly, by examining the combined areas resulting from habitat patches contiguous with linkages, we can identify the largest segments of the network, where movement would theoretically be unimpeded (key segments). Together, these data identify the most sensitive ecological features within this landscape.

Movement across a landscape by an animal is not random: the choice of a travel route depends on the animal's requirements for secure cover to avoid perceived threats (human or predators) and the energy required to negotiate that landscape. These behavioral responses are predictable and species-specific, which allows identification of likely movement paths. Ideally, most species would travel through parts of the landscape offering secure cover (i.e., habitat patches, linkages and permeable forms of matrix) and no barriers. In the best case, habitat patches and linkages would be contiguous.

Where less hospitable lands (e.g., sparsely vegetated lands) separate desirable habitat patches, many animals have been shown to adapt their path of travel to avoid crossing the intervening gap. Reluctance increases with gap width and so movement at the landscape level is best provided by a densely distributed network of habitat patches and linkages that are “functionally connected” by tolerable gaps. Gap-crossing tolerance varies with the species, and thus, functional connectivity is scale dependent. Generally, smaller animals that are less mobile or more vulnerable to predators seem to avoid crossing broad gaps. Larger, more mobile species will cross wider gaps but still have a limit beyond which they will rarely travel. For this analysis, we assumed a minimal gap distance of 20 m, the limit applicable to the smallest animals.

Plants also require connected habitat in order to propagate across the landscape. Plant seeds are carried by wildlife in some cases, and by wind. Ensuring that wildlife connectivity is maintained within a landscape will also help sustain those species that are carried by wildlife. Wind-borne seed dispersal is less readily modeled but is addressed at least partially through the various scales of functional connectivity. As gap distance increases, fewer species are likely to be dispersed to adjacent habitat. We assumed a minimum 20 m gap between habitat patches would be passable, thus the habitat patches would be contiguous.

In essence, the connectivity model examines two different types of connection: structural connection and functional connection. Structurally connected habitat is contiguous naturally vegetated habitat that would provide security cover and potential resources to animals as they move through the area. Functionally connected habitats are those separated by a gap that an animal will attempt to cross in most cases. For this analysis, we assessed only the smallest scale of connectivity, which would support movement of the broadest range of animals. Both structural and functional connectivity are important to land managers. Areas where structural connection exists and creates large areas of accessible habitat are critical for sustainability of a diverse plant and animal community. Functional connections may link adjacent, large areas, further enhancing the sustainability of biologically diverse communities on the landscape. The mapping resulting from these two analyses will allow planners to identify critical linkages within the moraine that will help sustain its biodiversity.

The analysis focuses on native habitat rather than human-modified habitats such as agricultural areas. Native habitat tends to support higher biodiversity, and therefore, best provides the means to address the BHI principle of conservation of biodiversity.

DATA SCORING AND MODEL MECHANICS

Scores reflecting the direction and magnitude of friction associated with each land use/cover element within the connectivity model are listed in the column beside the model element in Table A4. Individual friction scores reflect the degree to which a forest-dwelling animal would perceive a given feature as facilitating or resisting movement, as outlined below:

<u>Score</u>	<u>Friction Level</u>
-2	High
-1	Moderately high
0	Moderate
1	Moderately low
2	Low

We selected deer and coyote as representative forest-dwelling species to score the friction level for various landscape features. These species offered several advantages for this modeling exercise. First, they both have large home ranges and must move through the landscape to access suitable habitat on a daily basis. Suitable habitat includes, for at least some life requirements, woodland habitat. Finally, their movement habitat requirements and preferences are relatively well studied and although they will cross open areas, they prefer to move through forested lands offering security cover.

As mentioned above, connectivity reflects the ease of potential travel over terrain, and the spatial distribution of vegetative cover that provides security cover and possible habitat. Terrain in the Beaver Hills moraine is rolling to undulating. It lacks steeply sloped areas that would discourage movement. Accordingly, the model identified habitat that would facilitate movement (**linkages**) between **habitat patches** with sufficient resources to sustain plants or wildlife for some time. Habitat patches are considered to have minimal resistance to movement, and so have the highest, positive scores. Linkages may not be as permeable, due to human use or narrow width, and had scores of variable magnitude, but

were still positive. Land use of the **matrix** also had varied potential friction, ranging from positive to negative values. Differences were dependant on the degree to which natural vegetation is retained in the land use zone, the level of human use and the extent of infrastructure development within such areas. **Barriers** (roads and rail lines) had negative or neutral scores that ranged in magnitude according to their width and the volume and frequency of traffic, which in turn determine the extent of deterrence to animal movement. We recognized lakes and large waterbodies as barriers in summer, but also acknowledged their potential permeability in winter, particularly for our reference species (deer and coyote).

Landscape Connectivity – Structure and Friction

The model first classifies data contributing to each of the connected landscape elements (patches, linkages, matrix and barriers) to identify where they occur on the landscape (Table A4). Those elements are mapped to illustrate where habitat patches and linkages are structurally connected (Ecological Network map). The connected elements of the landscape represent the backbone of the ecological network - the main routes linking habitat inside and potentially, outside the moraine. The longest of those connected segments are identified as part of a separate analysis, to locate the key segments of contributing to habitat connection within the network (Connected Habitats Map).

Lastly, the relative degree of friction presented by those features is assigned as outlined in Table A4 and summed to provide a total (additive) score reflecting the level of connectivity of all overlapping landscape features. The total scores are then mapped to illustrate landscape permeability (Landscape Permeability Map). Friction in this model reflects the degree to which our reference forest-dwelling animal would perceive a given feature as facilitating or resisting movement. This animal will avoid crossing lands with high friction levels, but may cross other areas with a smaller or more positive friction level.

FINAL MAPPING

Variable Scoring Assumptions

ROWS for roads and pipelines were all assumed moderately effective as a linkage (Table A5). ROWs often have grassland cover, at a minimum, but limited tree cover and human disturbance that could discourage animal use.

Patches and Linkage Connections: Connected habitat can be considered in terms of structural and functional connections. Contiguous patches and linkages are structurally connected. Patches and linkages separated by 20 m or less were assumed to have a Good Functional Connection (i.e., the small gap was not sufficient to isolate the patches/linkages for most animals, Rudd et al 2002). Larger gaps discourage some animals from crossing: 100 m is an effective limit for large animals like deer to cross open areas (Thomas et al 1979, DeNicola et al 2000, Gehring and Swihart 2002). Smaller animals such as birds and amphibians tend to avoid gaps wider than 50 m (Roberts and Lewin 1979, St. Clair et al 1998, Rothermel and Semlitsch 2002, St. Clair 2003). For mapping, we considered only the 20 m gap tolerance, since this gap would allow most animals to cross, accessing adjacent habitat patches.

Matrix of Land Use: We assumed that the more intensive the land use, the higher the level of resistance to movement through that matrix. Rural residential lands tend to be more extensively landscaped. Thus, they offer moderate levels of friction to movement. Habitat alienation due to human activity will still influence animal use of these areas, another factor contributing to the moderate score for this landscape class. Rural recreational facilities are also often more landscaped than other intensively developed lands, and were given a moderate connectivity score based on that and habitat alienation potential. Industrial, commercial and urban residential lands, in contrast, tend to support more infrastructure, space that is more open and more human activity. This deters animals from moving through them. Agricultural lands fall between these more intensive land uses and less developed land uses. Although human activity is typically lower than in more developed areas, vegetative cover is typically also limited at certain times of the year, providing little secure cover and habitat diversity to support movement or species requirements.

Roads: Traffic and road width both influence road crossing behavior of animals ranging from deer to amphibians. Generally, smaller roads are crossed more easily and larger highways are almost a complete barrier for most species. Although the right-of-way is typically converted to non-vegetated (or non-naturally vegetated) cover and trains travel at speeds that would cause mortality to crossing animals, trains are generally much less frequent than road traffic. Hence, rail lines act as only a moderate barrier.

Dataset Manipulation: Land use datasets of each municipality were reclassified into the land use categories as indicated above.

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Table A4. - Landscape Connectivity Model Variables

Connection Component Type	Variable	Element	Score	Friction Level	Buffer (m)	Datasets
Habitat Patch	<i>Vegetation</i>	All native vegetation	3	Low		Solstice vegetation
	<i>Protected Areas</i>	Federal or provincial protected area or ER/MR/CE	3	Low		GOA Protected Areas + Municipal and ENGO conservation data
	<i>Wetlands</i>	Wetlands	3	Low		Solstice hydrology
Linkage	<i>Road Rights of Way</i>	Expressway/ Highway	0	Moderate	50	NRCAN Roads
		Ramp	0	Moderate	50	
		Collector	0	Moderate	50	
		Local/ Street	1	Moderately Low	35	
		Service	1	Moderately Low	35	
		Park Roads	1	Moderately Low	35	
		Rail Line	1	Moderately Low	35	
	<i>Oil & Gas Infrastructure</i>	Pipelines	1	Moderately Low	35	ABADATA
Matrix	<i>Land Use Zones</i>	Commercial	-2	High		Municipal Land Use Zoning for all 5 partner municipalities
		Industrial	-2	High		
		Agricultural	-1	Moderately High		
		Rural Residential	0	Moderate		
		Rural Recreation	1	Moderately Low		
		Urban Residential	-2	High		
		Conservation	3	Low		
Barriers	<i>Roads</i>	Highway/Freeway	-2	High	20	NRCAN Roads
		Ramp	-1	Moderately High	20	
		Collector	-1	Moderately High	10	
		Local/Street	0	Moderate	5	
		Service	0	Moderate	5	
		Park Roads	-1	Moderately High	15	
		Rail Line	0	Moderate	5	
Hydrology	<i>Large Waterbodies</i>	Rivers, lakes	-2	High		Solstice hydrology
	<i>Streams</i>	Streams	-1	Moderately High	10	

Table A5. Landscape Connectivity Model Buffers for Roads and Right-of-Ways

Connection Component Type	Element	Buffer Distance (m)	Rationale
Linkage	Expressway/ Highway	50	Average ROW (and adjacent lands)
	Ramp	50	
	Collector	50	
	Local/ Street	35	
	Service	35	
	Rail Line	35	
	Park roads	35	
	Pipelines	35	
Barrier	Highway/Freeway	20	Typical lane width
	Arterial	20	
	Ramp	20	
	Collector	10	
	Local/Street	5	
	Service	5	
	Rail line	5	
	Park roads	10	
Hydrology	Streams	10	Must buffer as this is a line feature: data is not in polygon form

BHI CORE AREA ASSESSMENT

BACKGROUND

Biodiversity plays a critical role in many ecosystem processes, and as a result, is responsible for the ecological goods and services on which human populations rely (Hilty et al. 2006). Water quality, soil fertility, air quality, climate moderation, pollination and the range of plant and animals that are used as foods and medicines provide tangible benefits of biodiverse, functional ecosystems. The spiritual and aesthetic value of healthy, functional and biodiverse natural systems are an intangible, but no less valuable benefit. Protecting biodiversity and managing landscapes (even developed ones) to sustain the highest level of biodiversity possible is not simply an ethical matter: our quality of life and in the extreme, our survival, depends on it.

Biodiversity centers on several fundamental ecological factors: a sustainable meta-population, genetic flow and redundancy. Core Areas support all of those fundamental factors, and ultimately, ensure a well-functioning ecological landscape. Core Areas are larger patches of habitat that can support high biodiversity and abundance of species, and whose populations are growing or stable (Forman 1995). As a result, they can serve as a source to repopulate areas more susceptible to local extinction (generally smaller, more fragmented areas), thus sustaining regional meta-populations. When Core Areas are distributed at several locations across a connected landscape, they can provide genetic flow and redundancy, which helps sustain populations across the landscape. Maximizing biodiversity helps ensure that key ecological processes continue to function throughout that landscape. The relationship between Core Areas and these fundamental ecological factors, and the relevance of that relationship to the Beaver Hills moraine is summarized in the sections below.

Role of Metapopulation, Genetic Flow and Redundancy in Conserving Biodiversity

The meta-population is a key concept in discussions on biodiversity conservation. Simply put, the meta-population is the collection of smaller populations of a species across a landscape. For a species to be sustained within a given area, the meta-population must be sufficiently large to persist through stochastic changes in size of its constituent populations (Meffe and Carroll 1997, Akçakaya *et al.* 1999, Hilty *et al.* 2006). Population size is not static and typically fluctuates over time (Akçakaya *et al.* 1999). There may be periods of high mortality due to unpredictable climatic conditions, food shortages or other disturbances. Small populations do not have the capacity to recover from such downturns, and very small populations run the risk of local extinction (Meffe and Carroll 1997, Akçakaya *et al.* 1999, Hilty *et al.* 2006). To sustain a species across a landscape, the meta-population must be sufficiently large to persist through and recover from stochastic events that cause higher than normal mortality.

Although substantial populations provide a good buffer against stochastic events and associated mortality, genetic flow among the populations must also be maintained to ensure that populations continue to adapt through evolutionary change (Meffe and Carroll 1997, Hilty *et al.* 2006). Genetic flow, in this sense,

provides the resilience required for the meta-population to compensate for a dynamic environment, in which resource availability and environmental conditions continually change.

Core Areas

For the purpose of this analysis, we defined core areas as patches of contiguous native woodland, grassland and wetland habitats large enough to support both interior and edge species. Although agricultural areas may also support wildlife species, the moraine's natural habitats, and particularly patches containing a variety of habitat types, will have much higher biodiversity. Our analysis also assumes the moraine is an ecologically distinct area with better connectivity within its boundaries than with other natural features beyond the moraine. That is, the populations in the habitat patches within the moraine function as a meta-population. Because the moraine contains several large protected areas, it was reasonable to expect that the protected areas and possibly other contiguous natural habitat could serve as core areas. The question is "what other core areas may exist and what level of biodiversity might they (and the protected areas) support?"

Core areas ideally would be large enough to support a minimum viable population for a given species (the population size sufficient to persist through periodic population declines caused by unexpected events). For many species, an effective breeding population of 50 individuals allows a species to persist in the short term; 500 to 5000 individuals provide long term persistence (Franklin 1980, Soule 1980, Shaffer 1981, 1983; Samson 1983, Brussard 1985, Samson et al 1985, Lande 1987, Berger 1990, Thomas 1990, Henriksen 1997, Belovsky et al 1999; reviewed by Snaith and Beazley 2002). In this analysis, we compared the size of habitat patches (contiguous native habitat, comprising combinations of native woodlands, grasslands and wetlands) in the moraine to the area required for a minimum viable population of 500 individuals for selected species (the Minimum Critical Area, Snaith and Beasley (2002)). In this way, we could identify habitat patches likely to support a group of species with similar habitat requirements, and thus identify relative abundance of species (biodiversity) across the landscape.

Given the differences in range requirements among species, the area required to support a minimum viable population varies by species. For this assessment, we selected a group of 'umbrella species' representing a range of territory/home range size requirements shared by a broader group of species. The assessment assumed that the habitat area required by a given umbrella species would also satisfy a suite of other species with similar habitat and area requirements. These "umbrella species" thus represent the level of biodiversity that can be sustained within the habitat available in a given landscape. The species requiring the largest area would, by default, also sustain viable populations of species with smaller area requirements, and thus indicate areas with the highest level of biodiversity. This analysis assumed that diverse habitat was likely present in sufficiently large habitat patches, given the density of wetlands in this landscape, and associated grassland and shrub zones.

Analysis Objectives

The Core Areas Analysis was designed to identify habitat patches sufficiently large to sustain a range of levels of biodiversity and species abundance. This abundance in turn could then sustain other adjacent habitat patches. This assessment used as umbrella species those that require native woodlands and wetlands for a significant part of their life history. Some of them may also use native grasslands and agricultural lands to some extent, but would not use those areas exclusively. This focused the assessment on native habitat, a key aspect of biodiversity implied within the BHI principles.

Umbrella Species Selection

In addition to representing a range of area requirements indicative of certain levels of biodiversity, we applied several additional criteria to selecting umbrella species for this analysis:

- relatively common distribution within the moraine,
- well documented habitat and life history requirements;
- availability of density or territory size data from the same ecoregion and ideally, the BH moraine area; and
- relatively abundant populations within the BH moraine.

Where possible, we used keystone species, those species known to regulate a broad plant and wildlife community, provided they met the other criteria. We also tried to include species of public concern or interest, to allow the assessment to be more readily understood and accepted by the public. Based on these criteria, we selected the umbrella species in Table A6 for our analysis, and calculated a Minimum Critical Area based on their documented density or territory size (see density sources provided below).

Moose, white-tailed deer and mule deer are common throughout the moraine, and elk occur across the area, although at lower density. Coyotes are the largest predator and are common throughout the moraine. Together, these species have the largest home range size of the suite of species regularly occurring in the BH moraine. Thus, they require the largest Core Area to sustain their minimum viable populations. The Minimum Critical Area required for moose, deer and coyote, as the most common of these species, set the upper limit (representing high biodiversity) for the core area analysis.

We selected several other species with smaller area requirements as additional umbrellas species representing moderate and low levels of biodiversity. Unlike the species representing high biodiversity, these other species depend primarily on woodland or wetland habitat. They would typically remain entirely within such habitat patches, except during migration or dispersal.

Where possible, we used density data from Elk Island National Park (EINP) and the Cooking Lake - Blackfoot Recreation Area. EINP is the largest protected area in the BH moraine and supports a variety of large mammal species including moose, deer, elk and bison and a variety of medium sized carnivores,

including coyote. The park is entirely fenced, however, and most of these large ungulates are confined to the park area. The Cooking Lake-Blackfoot Recreation Area is also fenced, and supports the same large mammal species as EINP, except bison. Ungulate populations in both parks are managed to maintain them within ecological capacity of the landbase, and thus, are likely representative of the rest of the moraine. More importantly, both parks conduct annual censuses of their wildlife populations, which provided local and recent estimates of population densities for the analysis.

DATA SCORING AND MODEL MECHANICS

The Minimum Critical Area for each umbrella species was derived from the density (animals per unit area) or home range/territory requirement of the species. For some animals, individual territory/home ranges can overlap, so in these cases, density is the better estimate of the required area (Snaith and Beazley 2002). The Minimum Critical Areas of the umbrella species were next averaged to provide a single value representative of Low, Moderate and High Biodiversity patch areas.

Habitat Patches (larger than the Average Minimum Critical Area for a given level of biodiversity) were identified as Core Areas for that level of biodiversity (see Table A6 for Minimum Critical Areas and Table A7 for data variables used in the analysis). The High Biodiversity Core Areas are those most likely to contain most diverse populations of woodland/wetland dependent species. Moderately Biodiverse Core Areas would contain mainly small and medium-sized species, and Low Biodiversity Core Areas would support only those species with smaller area requirements. Ideally, these areas would also support growing populations. Because we do not have population statistics for these specific areas in most cases, we do not know if these species are increasing (reproduction outweighs mortality). The analysis assumes only that based on area, these sites could provide a source population for other, adjacent habitat patches.

All types of Core Areas are identified in the final mapped output (the Core Areas map and on the Ecological Network map). Together, Core Areas and other elements of a connected system comprise the 'backbone' of the BH moraine, those components most critical to the ecological function of the area.

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Umbrella Density References

Coyote:

- Pruss, S.D. 2002. Reported coyote densities of between 0.87 and 1.05 coyotes/sq km

Ungulates:

- EINP aerial survey spring 2006: Moose $321 \text{ animals}/196 \text{ km}^2 = 1.64 \text{ moose}/\text{km}^2$; Deer = $0.93 \text{ deer}/\text{km}^2$
- Moose density elsewhere: AB Parkland Region, 1996 surveys average density of $0.18 \text{ moose}/\text{km}^2$, Rochester (ctrl AB) = $0.64 \text{ moose}/\text{km}^2$
- Moose density used for analysis = average of Ctrl AB Parkland ($0.18/\text{km}^2$) and current EINP density ($1.64/\text{km}^2$) = $0.91/\text{km}^2$. EINP density is apparently quite high, and with no hunting or predators, it would not be consistent with typical populations. The Central Parkland data likely represents a landscape most consistent with the Beaver Hills moraine.

Beaver:

- EINP has conducted annual surveys to estimate beaver populations within the park since the 1950s. The 2005 data indicate a stable to declining population, at lower density than in past years due to drought and prescribed fire (G. Hood, EINP). This data may be similar to density in the surrounding agricultural lands, which have also been subject to drought.
- 153 active lodges in EINP (194 sq. km), each lodge typically supports six individuals, for a total estimate of 918 beaver in the park, or 4.73 beaver/km².
- Blackfoot – Cooking Lake conducted a beaver occupancy survey in the fall of 2006, which found 249 lodges within the 94 km² protected area (G. Hood, EINP). Based on the same average lodge occupancy, the park likely supports about 1494 beaver, or 15.9 beaver/km².
- Given the broad range of densities within the moraine, we used the average of these two current population estimates in our assessment (10.3 beaver/km²).

Great horned owl:

- Data from EINP point count survey data collected between 2000 through 2004. Average density over that period was 0.01/ha, or 1 bird/km².

Yellow warbler:

- Data from Forrest (2001) study of breeding bird densities in Edmonton's river valley parks. Density in that study was 0.54/ha, or 156.4/km².

Red-backed vole:

- Data for local densities of red-backed vole were not available. Westworth et al. (1984) and Boutin et al (1996) both reported densities of 20 voles/ha in aspen forest of Alberta and the Yukon (respectively)

Porcupine:

- Banfield (1974) reported densities ranging from 7.7-10.8/km² in Maine and 2.3-3.0/km² in New Brunswick. More recent or local data was not available; however this species represents a common animal of the moraine, known to be abundant in EINP and the Blackfoot.
- We used the lower density estimate from Maine for the purposes of this analysis, although its accuracy for our area is less certain than others.

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Table A6. Minimum Critical Areas Required by the Selected Core Area Analysis Umbrella Species

Core Area Type	Umbrella Species	Density/Territory Size	Minimum Critical Area Required (sq. km.)	Level of Biodiversity Implied	Area Requirement Source	Rationale for Umbrella Species
Lower Biodiversity	Red-backed vole	20 voles/ha (200 voles/sq. km)	2.5	Low	Westworth et al (1984) and Boutin et al (1996)	Common woodland rodent, represents smallest level of mammalian biodiversity.
	Yellow warbler	156.4 birds/sq. km	3.2	Low	EINP 2000-2004 Roadside Count data	Common woodland species; density data available from EINP
		Average	2.85			
Moderate Biodiversity	Porcupine	7 porcupine/sq. km.	71	Moderate	Banfield (1974) published densities in North America	Common species in EINP and Blackfoot, dependant on woodlands for winter habitat, representative of mid-range area requirement
	Beaver	10.3 beavers/sq. km.	48.5	Moderate	EINP 2005 and Cooking Lake - Blackfoot 2006 beaver census data	Keystone wetland species, densities and population trends known for EINP and can be estimated for outside park
		Average	59.8			
High Biodiversity	Great horned owl	1 bird/ sq km	500	High	EINP 2000-2004 Roadside Count data	Woodland specialist; density data available from EINP
	Moose	0.91 moose/sq. km	549	High	EINP 2005 census data	Common species in BH moraine woodland & wetlands; has large home range requirement
	Deer	0.91 moose/sq. km	549	High	EINP 2005 census data	Ubiquitous species found across BH moraine, with large home range size. EINP population can move outside park
	Coyote	0.87 coyotes/sq. km.	575	High	Pruss(2002)	Common species in BH moraine, uses woodlands for denning and hunting; EINP population contiguous with outside lands
		Average	543			

Table A7. Core Area Analysis Variables

Connection Component Type	Variable	Element	Score	Datasets
Habitat Patch	<i>Vegetation</i>	All native vegetation	1	Solstice vegetation
	<i>Lakes, Rivers and Wetlands</i>	Lakes, manmade, reservoir, river, streams, wetlands	1	Solstice hydrology

BACKGROUND

During discussions to inform the update of the LMF, several land use planners noted that loss of agricultural land is a seldom-addressed concern in municipalities, despite rising concern with urban development of such lands. This is presumably because an assessment of agricultural capability (based on soil qualities and climatic, terrain and other impediments to crop growth) or suitability (based on similar factors but emphasizing soil qualities) is not available at a suitable scale. A dataset that might identify higher capability (or suitability) lands, at a locally relevant scale, would help support conservation of prime agricultural land, a management objective of all five BHI municipalities.

To date, municipalities have used the Canada Land Inventory (CLI) Agricultural Capability map mainly to identify high value agricultural lands for seed and forage crops. The CLI used climate, terrain and soil quality data to determine capability for cereal crop production. The scale of CLI mapping (1:250K) limits differentiation of good agricultural lands within the municipality because it identifies very broad areas as higher capacity (Class 1-3) soils. Further, those areas do not necessarily reflect the local variation in agricultural capacity understood by local land managers, because wetland and terrain constraints were mapped from broad scale data that lacked resolution at the local planning scale. To address this concern, Alberta Agriculture published an on-line tool based on the Land Suitability Rating System for small-grained cereal crops (LSRS; Agriculture and Agri-foods Canada, 1995) and AGRASID data (1:50K scale), but this mapping has not been readily adopted at the municipal level.

One factor limiting adoption of the LSRS may be access: it is available online, but not easily downloaded for municipal use. Mainly though, it too is limited by scale. The model is constrained by the scale, accuracy and date of its input data, particularly that for wetlands and other hydrological features (1:50,000 or 1:20,000 scale, based on 1972 analysis). By differentiating agricultural capability at a level of detail suitable for land use planning (e.g., 1:5,000 scale), land use policy could be developed to conserve lands most suitable for large agricultural production, and inform discussion about alternative land uses for other, less productive lands.

Because we have new, fine-scale data describing landscape limitations relevant to agricultural suitability (terrain roughness, wetlands and hydrology), we could enhance the Alberta Agriculture LSRS ratings to reflect more accurately the local conditions within the moraine. The resulting model output retains the suitability ratings for cereal crops to pasture uses (i.e., Class 1 suitability reflects lack of limitations for annual cereal crops while lower classes are more suitable for forage and pasture) but the output is at a finer resolution than previous LSRS mapping.

The Land Suitability Rating System considers three main factors relevant to agricultural production: soil quality, climate and landscape constraints. Soil quality is well addressed in the AGRASID database, outlining soil fertility and chemical constraints such as alkalinity. It has some limitations imposed by mapping scale (1:50,000), but has the advantage of field

confirmation. The AGRASID database was developed from field surveys of soil class, chemical parameters, soil fertility and impediments to vegetation growth (e.g., stoniness). Climatic factors were assumed consistent within the moraine area, and thus not likely to influence agricultural production. Terrain constraints, however, included terrain ‘roughness’ (steep slopes) and density of wetlands or larger waterbodies within a given area. Because both of these factors were based on relatively coarse scale data, the LSRS rating would not reflect the range of variation apparent locally. Adjusting the rating based on the 1:5,000 scale hydrology and terrain-mapping data would help document that variation and allow planners to better substantiate planning decisions about conservation of agricultural lands.

DATA SCORING AND MODEL MECHANICS

The AgCap© model revised the provincial Land Suitability Rating System score by deducting scores for terrain roughness (median slope gradient) and waterbody density (percent area), based on the scores identified in the LSRS (Agriculture and Agri-foods Canada, 1995). We automatically designated areas covered by permanent water or built-up areas as Class 7, no suitability, since these lands would have obvious limitations for agriculture. The resulting polygons for the remainder of the landscape were assigned to the LSRS Classes 1 through 7 based on the classification system of the original LSRS (Agriculture and Agri-foods Canada, 1995).

Agricultural suitability was determined with the following formula, based first on the original LSRS rating, and deductions based on new fine-scale hydrology, wetlands and terrain data:

$$\text{LSRS Score} - \text{Total deductions (terrain roughness + hydrology)}$$

The specific approach included some modifications of the original scoring system, to acknowledge the possible ‘double-counting effect’ of applying these deductions a second time.

The original LSRS was calculated based on climate, soils and landscape variables: the score for the parcel was based on the comparison of the rating for each category, such that the final classification reflected the most significant constraint. To update this rating, we used the deduction scores for terrain and waterbody density from the original LSRS system, but wetland scores in particular were reduced by approximately 1/3 to 1/2 to acknowledge the potential previous application of these factors to original LSRS rating (Table A8.). The resulting polygons were assigned to one of seven agricultural suitability classes, following the original LSRS system, but based on the modified scores (Table A9.).

Final mapping represents summarized ratings at the quarter section level, based on the average of the land suitability ratings (excluding Class 7) within the quarter section. This method follows the LSRS approach for assessing a land parcel (Agriculture and Agri-foods Canada, 1995). As a result, this method does not represent the continuous soil conditions across the landscape and will often not capture the smaller scale transition zones between wet areas and upland soils (e.g., a Class 7 area will have no transition zone of lower suitability soils between it and adjacent upland zones). These smaller zones, while a more accurate depiction of the spatial variation in suitability,

would not necessarily affect the overall suitability of the quarter section, the typical operational scale for agricultural land use. The averaged value does, however provide a reasonable assessment of agricultural suitability for cereal to pasture agricultural uses at a scale relevant to land use planning, thus satisfying the objectives of the Land Management Framework.

Table A8. Scoring for Enhanced LSRS Variables

Variable	Element	Score	Description	Datasets
AB Land Suitability Rating System Score (Alberta Agriculture)	Class 1 (no to slight limitations for crops)	100	Very good crop soil	Alberta Agriculture Soils Information Viewer (AGRASID)
	Class 2 (slight limitations for crops)	79	Good crop soil	
	Class 3 (moderate limitations for crops)	59	Moderate crop soil, very good to good forage soil	
	Class 4 (severe limitations for crops)	44	Low suitability crop soil, good forage / pasture soil	
	Class 5 (Very severe limitations for crops)	29	Low suitability for forage and pasture	
	Class 6 (Extremely severe limitations for crops)	19	Low forage and pasture soil	
	Class 7 (Not suitable for production of crops)	9	No agricultural value	
Terrain Roughness (based on slope deductions for complex slopes, AAFC, 1995)	Median slope deduction for quarter section based on LSRS slope gradient formula, AAFC, 1995)		As slope gradient increases, erosion, drivability and irregular soil moisture occurs	LiDAR (1:5,000)
Developed / Water Areas	Permanent lakes and their inundated shorelines and developed areas	0	Precludes agricultural cultivation	Solstice hydrology (1:5000)
Water Density	Few waterbodies present (<5% of quarter section) (based on LSRS Inundation scoring, rare event, very long duration)	3	Highly suitable for large-scale crop production, forage or pasture	Solstice hydrology (1:5000) DUC wetlands (or Solstice new wetlands)
	Moderate number of waterbodies present (5 – 15% of quarter section) (based on LSRS Inundation scoring, occasional event, very long duration)	25	Unsuitable for large-scale crop equipment, small-scale crop operations possible. Good potential for forage or graze use	
	Many waterbodies present (>15% of quarter section) (based on LSRS Inundation scoring, common event, very long duration)	33	Severe limitations for large-scale crop equipment, moderate limitations for small-scale crop. Forage and graze may be possible	

Table A9. Assignment of Final Scores to Enhanced LSRS Classifications

Final score	Enhanced Land Suitability Class	Agricultural Suitability *(Note that successive classes indicate limitations for spring-seeded cereal crops, but do not imply that land could not be used for other crops or uses)
80 - 100	1	High Suitability – no to slight limitations for spring-seeded, annual crops
60 – 79	2	Soils with slight limitations for spring-seeded, annual crops
45 – 59	3	Soils with moderate limitations for spring-seeded, annual crops
30 – 44	4	Soils with severe limitations for spring-seeded, annual crops
20 – 29	5	Soils with very severe limitations for spring-seeded, annual crops
10 - 19	6	Soils with extremely severe limitations for spring-seeded, annual crops
0 - 9	7	Unsuitable soils (i.e., wet or organic) with no agricultural capability, built-up lands

Waterbody Buffers

Waterbodies were buffered to acknowledge agricultural limitations due to wet soils. We based buffer widths on AESRD (2012) and Wenger, S. (1999).

Stream Order	Stream Type	Buffer (m)
1	Intermittent	15
2		
3	Small Permanent Stream	15
4		
5	Large Permanent Stream	15
6	River	30
Wetland, Lake	N/A	15

REFERENCES

- AESRD. 2012. Stepping back from water. Edmonton, AB: Alberta Environment and Sustainable Resource Development.
- Agriculture and Agri-foods Canada. 1995. Land suitability-rating system for agricultural crops. 1. Spring-seeded small grains. Technical Bulletin 1995-6E. W. W. Pettapiece (Ed.). Ottawa, ON: Centre for Land and Biological Resources Research.
- Wenger, S. 1999. A review of the scientific literature on riparian buffer width, extent and vegetation. Athens, Georgia: University of Georgia Institute of Ecology.

APPENDIX 2 RELEVANT FEDERAL AND PROVINCIAL ENVIRONMENTAL LEGISLATION

GOVERNMENT OF CANADA

FEDERAL ENVIRONMENTAL MANAGEMENT LEGISLATION

CANADA WILDLIFE ACT

The *Canada Wildlife Act* empowers Environment Canada to create, manage and protect Wildlife Areas (or National Wildlife Areas) for wildlife research activities, conservation or interpretation of wildlife. National Wildlife Areas created under the Act are managed under the *Wildlife Area Regulation*. No National Wildlife Areas exist within the moraine currently. The Act also allows Environment Canada to protect wildlife and habitats on other federal lands, and in cooperation with provincial agencies, particularly for species at risk. The Act and its regulations would apply to federal lands within the moraine, including Elk Island National Park, and potentially any joint management activity with the province regarding wildlife species.

Relevant to: activities on federal lands and cooperative activities on other lands supporting species in danger of extinction and species at risk

Web Resources:

Act: <http://laws-lois.justice.gc.ca/eng/acts/W-9/FullText.html>

Wildlife Area Regulations: http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1609/index.html

CANADIAN NATIONAL WETLAND POLICY

This federal policy promotes the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future. In support of this objective, the federal government strives to achieve numerous goals including no-net loss of wetland functions on all federal lands and waters and recognition of wetland functions in resource planning, management and economic decision-making with regard to all federal programs, policies and activities.

Although the federal government only has jurisdiction of wetlands situated on federally owned lands, their policy and associated guidelines must be respected when a federally funded project has potential to affect wetlands. Like the province, the National Wetland Policy requires a mitigation sequence of impact avoidance and minimization, followed by compensation for unavoidable residual impacts.

Relevant to: all projects receiving federal funding that have potential to affect wetlands

Web Resources:

Policy: <http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=BBAAE735-EF0D-4F0B-87B7-768745600AE8>

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA 2012)

CEPA is intended to foster sustainable development through the control of pollutants and to protect the environment, human life and health from toxic substances. It establishes comprehensive pollution control by identifying and classifying toxic materials, appropriate management strategies and outright prohibition and enforcement capacity. Management actions range from national standards for vehicle emissions to management of waste material. Toxic substances are defined as those posing a risk to ecosystems and biodiversity and can include chemicals and more recently, living products of biotechnology (including genetically modified plants). Health Canada works with Environment Canada to identify toxic materials and appropriate management strategies. Environment Canada has sole enforcement responsibility.

CEPA also authorizes Environment Canada to undertake research to develop appropriate standards and limits for the management of toxic substances. The Canadian Council of Ministers of Environment (CCME) is the main body responsible for this part of the Act. They and Environment Canada have developed industry and material specific regulations, Guidelines and Codes of Practice that outline specific requirements, including guidelines for water and air quality. Schedule 1: Toxic Substances List identifies those materials addressed under the Act, and the list is regularly reviewed and updated by Environment Canada. Guidelines and Codes of Practice relevant to municipalities include those for environmental management of road salts, above and below ground fuel storage tanks and contaminated sites.

Relevant to: any activity that requires use, handling, storage or trade of chemicals, hazardous materials or genetically modified organisms (including agriculture)

Web Resources:

CEPA Environmental Registry: <http://www.ec.gc.ca/lcpe-cepa/>

Environment Canada: <http://www.ec.gc.ca/default.asp?lang=en>

Health Canada: <http://www.hc-sc.gc.ca/index-eng.php>

Regulations: Numerous regulations are enforced through the *Canadian Environmental Protection Act*. A complete list of current and proposed regulations can be found at <http://www.ec.gc.ca/lcpe-cepa/eng/regulations/?n=54FE5535-1>

Guidelines

Several guidelines have been developed by Health Canada and Environment Canada, dealing with contaminated sites, emissions, monitoring, waste and environmental quality:

<http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=E9DBBC31-1>

Codes of Practice

Codes of practice developed by Health Canada and Environment Canada regarding contaminated sites, emissions, waste and pollution prevention:

<http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=E034D992-1>

FISHERIES ACT (2012)

The *Fisheries Act* was revised as part of federal omnibus legislation in 2011 and 2012. The changes have narrowed the focus of management only to species of economic value, although impacts to prey species that support harvested fish populations can also be addressed. Pursuant to Section 35(1) of the new federal *Fisheries Act*, any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery is prohibited, unless authorized by the Department of Fisheries and Oceans (DFO). Section 36 prohibits the deposition of substances harmful to fish into waters used by fish, unless authorized under the Act (or other federal legislation). A corresponding change in the *Canadian Environmental Assessment Act (CEAA)* has removed the triggering function linked to other federal approvals, including the *Fisheries Act*. A project now requires Environmental Assessment under the *CEAA* only if the project is considered a designated activity.

Section 35, the habitat provision, addresses activities resulting in the death of fish, any permanent alteration to or destruction of fish habitat, and impacts to prey fish populations that could subsequently affect the harvested populations. Impediments to fish passage and water flow are also prohibited, since these would constitute serious harm to fish. Thus, Section 35 has retained much of the Harmful Alteration, Disturbance and Destruction (HADD) restriction of the previous Act, but may potentially exclude species that have no economic value. As previously noted, potential to cause habitat loss should be resolved using the mitigation cascade (avoid, minimize, compensate). Under current terminology, compensation is framed as an ‘off-set’, meaning some form of replacement within the same or another waterbody.

When proposing to carry out an activity that has the potential to affect relevant fish species or their habitat, a project description must be submitted to DFO as part of the application for authorization. During the review process, DFO will determine whether the project activities are likely to result in serious harm to fish or fish habitat. Prey species are not defined under the Act, and were only generally defined in a subsequent Fisheries Protection Policy Statement (2013) as “*fish that support commercial, recreational or Aboriginal fisheries*” within in the same waterbody or through a connected watercourse. The Policy Statement further explains that most waterbodies in Canada contain fish or habitat that supports commercial, recreational or Aboriginal fisheries, and thus exceptions would be few. However, exceptions would require scientific assessment to confirm the presence or absence of regulated species and proponents should assume that the *Fisheries Act* applies, until applicability has been confirmed with DFO through their case-by-case review process.

Environment Canada is the agency responsible for administering Section 36 of the *Fisheries Act*, the pollution provision regarding the deposition of deleterious substances in fish habitat. Proposals submitted to DFO for authorizations for release of deleterious substances will be reviewed by Environment Canada. In certain situations, release can be authorized under Section 36(4) of the Act. Unauthorized releases can be investigated by Environment Canada and penalized through fines and/or criminal charges.

The new Act also addresses overlap in jurisdiction. If there is a provincial provision in force that is deemed equivalent to a federal provision, the provincial regulations will supersede the federal regulations. However, if the provincial provision is no longer equivalent or is not being adequately administered or enforced, Cabinet can revoke this order.

Relevant to: Any development in Canadian waters that has the potential to result in serious harm to fish that are part of a commercial, recreational, or aboriginal fishery, or prey species supporting those fisheries. In addition, any activities that involve the release of deleterious substances into fish habitats.

Web Resources:

Act and Regulations: <http://laws-lois.justice.gc.ca/eng/acts/F-14/>

Fisheries Act, Sec. 35, Fisheries Protection Policy Statement: <http://www.dfo-mpo.gc.ca/pnw-ppe/pol/index-eng.html>

Fisheries Act, Sec. 36: <http://www.ec.gc.ca/pollution/default.asp?lang=En&n=072416B9-1>

Does my project need review? <http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>

Federal Fisheries Act Regulations

Alberta Fishery Regulations

Aboriginal Communal Fishing License Regulations

Applications for Authorization under Paragraph 35(2) of the Fisheries Act Regulations (SOR/2013-191)

Chlor-Alkali Mercury Liquid Effluent Regulations

Deposit Out of the Normal Course of Events Notification Regulations

Fish Health Protection Regulations

Fish Toxicant Regulations

Fishery (General) Regulations

Management of Contaminated Fisheries Regulations

Meat and Poultry Products Plant Liquid Effluent Regulations

Metal Mining Effluent Regulations

Petroleum Refinery Liquid Effluent Regulations

Potato Processing Plant Liquid Effluent Regulations

Pulp and Paper Effluent Regulations

Wastewater Systems Effluent Regulations

MIGRATORY BIRDS CONVENTION ACT (MBCA)

The *MBCA* prohibits damage, destruction, removal or disturbance of prescribed migratory bird species, including waterfowl and songbirds, or of active migratory bird nests during breeding season. An amendment to the Act also prohibits the release of deleterious substances in waters or areas frequented by migratory birds.

The Act, administered by Environment Canada, is an enforcement Act. Contravention is not permitted and violation of the *MBCA* may result in penalties. The best means to ensure compliance is to avoid activities with potential to disturb nests, such as vegetation clearing during the spring breeding period. Birds will even nest in freshly cut woody debris that has been left in situ during the height of the breeding period. For this region of Alberta, Environment Canada suggests avoiding such activity during the period 01 May to 31 July. If potentially disturbing activities must occur within this period, Environment Canada recommends a survey for active nests to confirm absence of nesting birds. Because such nests can be difficult to detect in dense brush, this technique is recommended only within relatively small areas (i.e., < 1 ha).

The Migratory Bird Sanctuary Regulations under the Act similarly prohibit hunting or disturbance of migratory birds within a federal Migratory Bird Sanctuary. Two Migratory Bird Sanctuaries exist within the moraine: Miquelon Lake and Ministik Game Bird Sanctuaries. Both areas are now managed by the province.

Relevant to: all proposed development that will require vegetation manipulation/ clearing during bird breeding season

Web Resources:

Act: <http://laws-lois.justice.gc.ca/eng/acts/M-7.01/index.html>

Migratory Birds Sanctuary Regulations:

http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1036/index.html

Migratory Birds Regulations:

http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1035/index.html

Guidelines:

Incidental Take of Migratory Birds

<http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1>

NAVIGATION PROTECTION ACT (2012)

The previous *Navigable Waters Protection Act* was repealed in 2012 and replaced with the *Navigation Protection Act* (NPA). The primary change was in the size of waterbody addressed by the legislation. The new Act narrowed focus to designated large lakes and rivers considered important for navigation, from a previous comprehensive definition of navigable waterway. Designated navigable waters are listed in Schedule 2 of the Act. Within Alberta, these include the North Saskatchewan, Athabasca, Peace and Bow rivers.

Under the new Act, any proposed development in, on, over, under or through designated waters is subject to a formal approval by Transport Canada, with certain exceptions. The NPA identifies under the *Minor Works Order* smaller projects that require only notification, provided proponents incorporate into design mitigation measures recommended for the given activity:

- erosion-protection works,
- docks and boathouses,
- boat ramps, slipways and launch ramps,
- aerial and submarine cables for power and telecommunication,
- pipelines buried under the bed of navigable water,
- pipelines and power or communication cables attached to existing works,
- works within a boomed-off area upstream or downstream of an existing work for water control,
- outfalls and water intakes,
- dredging, and
- mooring systems.

The new Act introduces some grey areas in terms of regulation of navigable waters by replacing a definition of ‘navigable waters’ with designation. For example, deposition of material that could interfere with navigation in navigable waters continues to be a prohibited activity under the NPA, as is dewatering of navigable water. Implicit in retention of these prohibitions is an assumption of navigability for any a waterway could be used by boating traffic, which is consistent with past court rulings. In fact, Transport Canada acknowledges that the “public right of navigation – the right to use navigable waters as a highway” is still protected in Canada under common law, whether the waterway is designated or not.

The new NPA allows proponents to ‘opt-in’ voluntarily for review of a project in non-designated water, or for submission under the Minor Works Order, as a best management practice. This suggests opportunity for court challenge of this law, since the designation process places considerable weight on the good judgment of industry and the public, and assumes information about use of waterways by boaters that may not necessarily be available. Since navigation has been addressed only at the federal level in Canada, this leaves a considerable gap in terms of local concerns, and potential confusion in applicability of the law.

Lastly, the requirement for an environmental assessment under CEAA has also been removed, since the ‘trigger’ of assessment through requirement for a federal approval has been changed in the CEAA. Today, only a designated project would undergo a federal assessment - smaller projects such as bridge crossings are excluded from review. This ambiguity suggests an area in which municipalities could set their own assessment requirements, should local navigation concerns exist.

Relevant to: All structures, except Minor Works, proposed within navigable waters designated in Schedule 2 of the NPA

Web Resources:

Act and Regulations: <http://www.tc.gc.ca/eng/programs-632.html>

Regulations

Ferry Cable Regulations

Navigable Waters Bridges Regulations

Navigable Waters Works Regulations

Orders

Minor Works and Waters Order

SPECIES AT RISK ACT (2012)

The federal *Species at Risk Act (SARA)*, administered by Environment Canada, prohibits harm to extirpated, endangered or threatened species and disturbance of their critical habitat (once identified). The Act also requires management action for species of special concern. For the most part, the prohibitions apply to species occurring on federal lands, except for those species protected under other federal legislation (migratory birds and aquatic species).

The Act does allow cabinet to extend protection to species under provincial control under an Order of Cabinet, if the federal Minister of the Environment feels habitats and individuals are not sufficiently protected under provincial law. Although full protection is not explicitly provided by the Act, the risk of triggering federal intervention has driven most provinces to implement appropriate protections for species under their jurisdiction. Similarly, many developers (particularly large industries and government infrastructure departments) chose to comply voluntarily with the prohibitions to avoid public censure, or triggering of stricter government controls.

Species are listed by the federal cabinet, under the recommendation of the Environment Minister and the Committee on the Status of Endangered Wildlife (COSEWIC). COSEWIC investigates population trends of Canadian wildlife and plant species on a continual basis and categorizes them according to the level of extinction risk (Extinct, Extirpated, Endangered, Threatened, Vulnerable, Data Deficient). They recommend to cabinet species that require protection under the SARA and recommendations accepted by Cabinet are then listed in Schedule 1 (extirpated, endangered, threatened and special concern species). Species recommended, but not listed are compiled in Schedule 2 (extirpated, endangered or threatened species) or in Schedule 3 (species of special concern) of the Act. The Act's prohibitions regarding direct harm and critical habitat apply to species in Schedule 1.

The Act also requires development of recovery strategies within certain timeframes after listing of an extirpated, endangered or threatened species, followed by action plans to implement the strategy's recommendations. All strategies and plans must be developed in cooperation with other management jurisdictions and affected stakeholders, particularly groups involved in land claims. Critical habitat identified in recovery strategies must be protected on federal lands, and additional protection can be implemented by Order of Cabinet for populations of a species in a national park, sanctuary or wildlife area, or on provincial or territorial lands. Compensation to landowners affected by such Orders is also allowed under the Act. Critical habitat for migratory bird species is protected under the MBCA, according to its definition of habitat.

Species of special concern also require management plans to be completed within three years of designation. The plans can address several species, or take an ecosystem approach, but as with recovery strategies and action plans, must be developed in cooperation with other management jurisdictions and affected stakeholders. Information on Canada's species at risk, including all

associated recovery strategies, action plans and status reports is available on the SARA Public Registry, an internet resource enabled through the Act.

Agreements and permits may be issued by the relevant minister to authorize activities that have the potential to affect listed species. In these cases, Environment Canada requests project information to be submitted for an assessment. Activities likely to be permitted include research activities and population management projects. Most development projects would be unlikely to gain approval for disturbance to listed species and violations of the Act can result in penalties. If any special status species are encountered in the course of a project development, work should be halted immediately and Environment Canada should be contacted for advice.

Relevant to: all proposed development on lands that support endangered, threatened or vulnerable species; projects that require federal approval or funding

Regulations

- Exemption Order for Certain Licenses, Authorizations and Documents (White Sturgeon)
- List of Wildlife Species at Risk (Decisions Not to Add Certain Species) Order
- Order Acknowledging Receipt of the Assessment Done Pursuant to Subsection 23(1) of the Act
- Order Extending the Time for the Assessment of the Status of Wildlife Species
- Order Giving Notice of Decisions not to add Certain Species to the List of Endangered Species

Guidelines

- Activity Set-back Distance Guidelines for Prairie Plant Species at Risk (2011)
- Addressing Species at Risk Act Considerations Under the Canadian Environmental Assessment Act for Species Under the Responsibility of the Minister Responsible for Environment Canada and Parks Canada (2010)
- The Species at Risk Act Environmental Assessment Checklists for Species Under the Responsibility of the Minister Responsible for Environment Canada and Parks Canada (2010)
- Species at Risk Act Policies (Draft) (2009)
- Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada

Web Resources:

COSEWIC: http://www.cosewic.gc.ca/eng/sct5/index_e.cfm

Environment Canada: <http://www.ec.gc.ca/nature/default.asp?lang=En&n=FB5A4CA8-1>

SARA Public Registry: http://www.sararegistry.gc.ca/default_e.cfm

Alberta Sustainable Resource Development: <http://www.srd.alberta.ca/>

WATER ACT AND WATER POLICY (FEDERAL)

The federal *Water Act* outlines the framework for cooperation between federal government and the provinces and territories with respect to conservation, development and use of Canada's water resources. It, and the federal *Water Policy*, promotes sustainable use of freshwater within Canada.

The *Water Act* delegates control of waters within provincial boundaries to the provinces, but identifies a role in joint management for regulation, sharing and monitoring of water resources, including the establishment of water quality guidelines. Where surface waters cross federal lands (including national parks, first nation reserves, wildlife sanctuaries and military areas), the Act empowers the federal government to manage them and regulate their use.

Several associated pieces of legislation administered by Environment Canada are used to manage water-related activities:

- the [*Canada Water Act*](#), which contains provisions for formal consultation and agreements with the provinces;
- the [*International River Improvements Act*](#), which provides for licensing of activities that may alter the flow of rivers flowing into the United States; and,
- the [*Department of the Environment Act*](#), which assigns the national leadership for water management to the Minister of the Environment.

Other federal legislation affects water management within Alberta, and includes:

- [*International Boundary Waters Treaty Act*](#) (R.S. 1985, c. I-17); [*Bill C-6*](#) (Assented to 18 December 2001)
- [*Canadian Environmental Protection Act*](#) (1999)
- [*Fisheries Act*](#)
- [*Navigable Waters Protection Act*](#)
- [*Northwest Territories Waters Act*](#)
- [*Mackenzie Valley Resource Management Act*](#)
- [*Dominion Water Power Act*](#)

Relevant to: international management of surface waters, water management near national parks

Web Resources:

General information: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=E05A7F81-1>

FEDERAL ENVIRONMENTAL ASSESSMENT LEGISLATION

CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA, 2012)

Under the Canadian Environmental Assessment Act (CEAA, 2012), only projects that are designated under the Act or on federal lands will require an environmental assessment (*EA*). Designated projects are listed in the *Regulations Designating Physical Activities* under the *CEAA*. This includes all projects formerly listed in the Comprehensive Projects List of the previous *CEAA*, except for activities in national parks. According to *CEAA* (2012), any activity on federal lands must receive an assessment to ensure that impacts have been minimized and projects in national parks are to be addressed through that provision. Parks has decided to revert to their past policy of EIA for projects on park lands; effectively a discretionary based system in which certain projects would be assessed upon review of the project description by a park representative.

Designated projects are divided into three categories based on the responsible authority. Those administered by the Canadian Environmental Assessment Agency include mainly large industrial or mining projects; some energy projects; dams and large water diversions; changes to military bases and training programs; certain airport, road or railway projects and certain projects on wildlife reserves. Those administered by the National Energy Board and Canadian Nuclear Safety Commission include large electrical or petroleum energy projects, nuclear facilities and mines, respectively. Designated projects have the potential to cause significant environmental effects, and therefore are automatically subject to the federal environmental assessment process. Small or routine projects were considered unlikely to generate impacts or were assumed to be addressed under provincial legislation, and so have been removed from the *CEAA* process. Undesignated projects that are likely to cause significant effects can also be directed to an assessment or panel review by the Minister, a discretionary power.

The definition of environment has not changed from previous versions of the Act: environment includes land, water and air, organic and inorganic material and living organisms, and the interactions of these components. The definition of environmental effects has changed to differentiate between impacts to the components of the environment as defined above, plus those specific aspects of the environment under federal jurisdiction. Environmental effects that must be taken into account in relation to designated projects, projects, or any associated activity or thing are:

- Changes that affect components of the environment within the government's legislative authority (this includes specific species outlined in the *Fisheries Act*, the *Species at Risk Act* and the *Migratory Birds Convention Act*).
- Changes to the environment occurring internationally, between provinces, or on federal land.
- Effects on aboriginal people in regards to health, heritage, traditional land use, or historically significant structures or sites.
- Changes to the environment that are directly linked to or necessarily incidental to any federal decisions about a project.

Designated projects can fall under the jurisdiction of one of the three responsible authorities, who are responsible for preparing the EA as outlined above. The *Canadian Nuclear Safety Commission (CNSC)* is responsible for all nuclear projects, the *National Energy Board (NEB)* has jurisdiction over international/interprovincial pipelines and transmission lines and the *Canadian Environmental Assessment Agency (the Agency)* is responsible for all other designated projects. Once a project is proposed, proponents must provide the *Agency* or responsible authority with a project description with enough information to determine whether a federal Environmental Assessment is required. Projects under the *CNSC* and the *NEB* automatically require an EA, and so no project description must be submitted. Environmental assessments, if required, must consider cumulative effects of the activity, possible mitigation methods and alternatives, and public comments. The new *CEAA* has established firm timelines for each stage of the assessment process. Once the description has been received, the Agency has 45 days to determine if an assessment is necessary. This period includes 20 days for public consultation.

If there is sufficient public concern over a project, or if it appears as though the environmental effects will be significant, the Minister may refer a project to a review panel. This must be done within the first 60 days of the EA process. Review panels are required to hold public hearings, and submit their report and recommendations to the Minister, who makes the final decision for both EAs and Review Panels. Public participation guidelines have been tightened such that only stakeholders directly affected by the project can participate in the EA and participant funding will be provided only for those projects on the designated projects list.

Under the *CEAA*, responsible authorities (RAs) with relevant expertise must be consulted. They also must complete their analysis of a project within strict timelines. The overall decision process must be completed within a relatively short time, which includes the review time by RAs. For a regular EA, the Agency has 365 days from the commencement of the assessment to their final decision. A review panel has 24 months from the date of referral to their final decision. If more time is required, the Minister may extend this period up to three months, and the federal Cabinet may extend beyond the three months. These limits do not include the time required by proponents to gather information regarding the project.

Relevant to: all designated physical activities, as listed in federal regulations

Web Resources:

Canadian Environmental Assessment Agency - <http://www.ceaa-acee.gc.ca/default.asp?lang=En>

Canadian Nuclear Safety Commission - <http://nuclearsafety.gc.ca/eng/>

National Energy Board - <http://www.neb-one.gc.ca/clf-nsi/rcmmn/hm-eng.html>

Regulations Applicable to this Act

Regulations Designating Physical Activities (with background on changes to project triggers)

Prescribed Information for the Description of a Designated Project Regulations

Cost Recovery Regulations

OTHER FEDERAL EIA AGENCIES

As noted above, the National Energy Board administers the EIA process for large energy projects, guided by the *CEAA*. Designated projects include those that cross international or provincial boundaries. The potential for such projects to occur within the moraine are limited, but nonetheless, there are examples. Continental pipelines have been constructed across broad areas of the province in the past: many of these have been routed through the Industrial Heartland. Municipalities are granted affected stakeholder status in the public consultation process for such projects, their only means of influence within this EIA process.

Web Resources:

Environmental Assessment at the NEB:

<http://www.neb-one.gc.ca/clf-nsi/rsftyndthnvrnmnt/nvrnmnt/lfcclpprch/lfcclpprch-eng.html#s2>

AGRICULTURAL OPERATION PRACTICES ACT (AOPA)

AOPA divides responsibilities between Alberta Agriculture and Rural Development (ARD) and the NRCB. ARD is responsible for resolution of nuisance and disturbance conflicts that may arise between the public and agricultural producers. ARD also develops technical standards for management of new and expanding confined feeding operations (CFOs), manure storage facilities and manure handling practices. The Act addresses requirements for sustainable practices regarding siting, managing run-on and –off water and soil and groundwater protection. The NRCB issues approvals, registrations, authorizations and amendments for confined feeding operations (CFOs) under the Act, depending on the type and size of operation:

- **Approval** – for larger scale new/expanded CFOs (based on # of animals and manure production)
- **Registration** – for medium sized new/expanded CFOs (based on # of animals and manure production)
- **Authorization** – for new/expanded manure collection areas or manure storage facilities
- **Amendment** – for changes to existing permits issued by the NRCB, a municipal district or a health authority (where there is no change in # of animals and manure production).

Technical information regarding local surface and groundwater conditions and soils is required for the application but no formal EIA is required. The application process is meant to function as a one-window process, so that the applicant can also apply for other required approvals. Other approvals that can be addressed in this application (at the proponent’s discretion) include:

- A **licence** under the *Water Act* for water diversion (for ground or surface water supply),
- An **approval** under the *Water Act* to change a natural drainage or for any activity within a waterbody (including wetlands),
- A **licence** or **approval** under the *EPEA*,
- An **authorization** under the *Public Lands Act* for activities and/or structures on public lands (including the bed and shores of waterbodies), and/or
- A **permit** under the *Public Highways Act* to construct a development within 300 m of a highway right-of-way boundary or 800 m of the center point of an intersection of the highway with another public road.

Web Resources:

Act: http://www.qp.alberta.ca/1266.cfm?page=A07.cfm&leg_type=Acts&isbncln=9780779770588

Regulations: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/acts5986](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/acts5986)

- Agricultural Operations, Part 2 Matters Regulation - AR 257/2001
- Board Administrative Procedures Regulation - AR 268/2001
- Standards and Administration Regulation - AR 267/2001

ALBERTA ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT 2010

Alberta's *Environmental Protection and Enhancement Act (EPEA)* was developed to provide comprehensive environmental management of any activity throughout the project's life cycle, from the proposal stage through to operation and finally, decommissioning. It established several key principles in the provincial approach to environmental management (bold emphasizes points important for the Land Management Framework):

- (a) "the protection of the environment is essential to the integrity of ecosystems and human health and to the well-being of society;
- (b) the need for Alberta's economic growth and prosperity in an **environmentally responsible manner** and the need to integrate environmental protection and economic decisions **in the earliest stages of planning**;
- (c) the principle of **sustainable development**, which ensures that the use of resources and the environment today does not impair prospects for their use by future generations;
- (d) the importance of preventing and mitigating the **environmental impact** of development and of government policies, programs and decisions;
- (e) the need for Government leadership in areas of environmental research, technology and protection standards;
- (f) the **shared responsibility** of all Alberta citizens for ensuring the protection, enhancement and wise use of the environment through individual actions;
- (g) the opportunities made available through this Act for **citizens to provide advice** on decisions affecting the environment;
- (h) the responsibility **to work co-operatively** with governments of other jurisdictions to prevent and minimize transboundary environmental impacts;
- (i) the responsibility of **polluters to pay** for the costs of their actions;
- (j) the important role of **comprehensive and responsive action** in administering this Act".

Administered by Alberta Environment and Sustainable Resource Development, the Act and its regulations control a variety of activities including:

- Hazardous material and pesticide handling, sales and use;
- Conservation and reclamation of land;
- Authorization for municipalities and other select agencies to hold conservation easements;
- Potable water quality;
- Substance release (including permitting of effluent release and management of contaminated sites);
- Waste minimization, recycling, and waste management;
- Wastewater and stormwater management and drainage; and
- Enforcement.

The *EPEA* has some overlap with other legislation that requires approvals for activities. For example, construction of proposed stormwater management facilities, including outfalls, requires an approval pursuant to the *EPEA* as well as a *Water Act* approval. In decreasing order of

application process complexity and potential for environmental impact, the Act requires an **approval, registration** or filing of a **notice** in order for certain activities to proceed. The *Activities Designation Regulation* lists those activities that require such authorizations. The *EPEA* also establishes a legislated process for environmental assessments (EA) of prescribed proposed developments (see Environmental Assessment Section below). Many of the approvals required under the Act can trigger assessment, depending on the size and type of project, ensuring thorough environmental review.

Once approvals under the Act are issued, compliance is monitored and enforced by AENV. Some approvals must be periodically renewed, providing an opportunity to check those operators in non-compliance, and apply the enforcement options allowed by the Act. The *EPEA* is an extensive piece of legislation, detailed review of which is beyond the scope of this document. A comprehensive review of the Act can be found in Alberta Environmental Law Center (2003).

Relevant to: all proposed development or activities requiring stormwater or waste water management, effluent or other material releases (including air-borne releases), land disturbance, waste handling, and hazardous materials or pesticides

Web Resources:

- *AEPEA* regulations, codes of practice, and guidelines:
<http://environment.alberta.ca/03147.html>
- The provincial *EPEA* is intended to provide sustainable development through a comprehensive system of management for natural resources. There are a number of regulations supporting the Act, which cover a broad range of environmental issues:
 - [Beverage Container Recycling Regulation \(AR 128/93\)](#)
 - [Conservation and Reclamation Regulation \(AR 115/93\)](#)
 - [Environmental Appeal Board \(AR 114/93\)](#)
 - [Environmental Protection and Enhancement \(Miscellaneous\) Regulation \(AR 118/93\)](#)
 - [Ozone-Depleting Substances Regulation \(AR 125/93\)](#)
 - [Amendments to the Ozone-Depleting Substances Regulation \(AR 125/93\)](#)
 - [Pesticide \(Ministerial\) Regulation \(AR 43/97\)](#)
 - [Pesticide Sales, Handling, Use and Application Regulation \(AR 24/97\)](#)
 - [Potable Water Regulation \(AR 122/93\)](#)
 - [Release Reporting Regulation \(AR 117/93\)](#)
 - [Substance Release Regulation \(AR 124/93\)](#)
 - [Waste Control Regulation \(AR 129/93\)](#)
 - [Wastewater and Storm Drainage Regulation \(AR 119/93\)](#)
 - [Wastewater and Storm Drainage \(Ministerial\) Regulation \(AR 120/93\)](#)

ALBERTA LAND STEWARDSHIP ACT (ALSA) (2009)

ALSA was created to direct development of provincial policy for sustainable development, addressing economic, environmental and social objectives. Specifically, it provides a legislative framework for regional planning, coordination of decision-making regarding land, biodiversity, human settlement, natural resources and the environment and consideration of cumulative effects of development and natural processes (e.g., fire, floods, insect pests). The Act includes:

1. Regional planning
2. Nature and effect of Regional Plans and Compliance Declarations
3. Conservation and Stewardship Tools
4. Regional Planning process and administration
5. Transitional provisions

Regional plans are intended to be landscape level policy directing future growth within specific land units. They are statutory documents and municipal land use policies must be consistent with them. Past examples have shown that existing municipal policies were often considered in the development of the regional plan, such that any changes required for compliance have been minor. The legislation also requires review and updating, at least once every five years.

ALSA allows for certain land use restrictions to be imposed through conservation directives to conserve high value environmental or agricultural lands, or to create new public lands for similar purpose. Affected landowners have the right to appeal decisions they feel will affect them negatively, and can apply for compensation when their land may be taken for public purpose.

The Act also provides stewardship tools that allow the province or municipalities to work with landowners interested in such conservation action. Tools allow municipalities to establish conservation easements or to use market-based instruments to compensate loss of development on lands voluntarily left for conservation purpose, and for a market of conservation offsets to be established.

The Act was amended in 2011 to state clearly that property and other rights of the individual will be respected in the planning process, especially with regard to regional planning actions and mineral rights or land titles. In particular, the creation of a conservation directive that would allow the province to declare permanent protection of private land for environmental or agricultural values was perceived by some as a 'land grab' by the province. The Province has since attempted to clarify that the conservation directive imposes a restriction on the land title, similar to a conservation easement, but does not affect land ownership in any other way.

Relevant to: municipal land use planning, conservation planning with or without non-government organization partners

Web Resources:

Act and Regulation: <https://landuse.alberta.ca/Governance/ALSA/Pages/default.aspx>

ALSA Fact Sheet: <https://landuse.alberta.ca/Governance/ALSAFACTS/Pages/default.aspx>

ALBERTA PUBLIC LANDS ACT

Pursuant to Alberta's *Public Lands Act*, the Province owns the bed and shore of all permanent and naturally occurring waterbodies, including wetlands, unless the waterbody is specifically exempted in land parcel titles. The *Public Lands Act* defines a permanent waterbody as one that exhibits persistent evidence of a bank, bed and shore and a tendency to return to normal water levels under ordinary circumstances after periods of drought or flood. Development within a crown-owned waterbody resulting in occupation or alteration of a watercourse or waterbody, and/or infilling or draining of a permanent, naturally occurring wetland requires **approval** from Alberta Environment and Sustainable Resource Development, Public Lands Division. Compensation for any loss would be required and any compensatory waterbodies created as an approval condition must be transferred to Crown ownership.

The province also owns lands within the White Area that are managed for agriculture, recreation and some resource extraction. The most relevant example in the moraine is the Cooking Lake/Blackfoot Recreational Area (and Grazing Reserve), which is used for both agricultural and recreational purposes. Dispositions for use are also authorized under the *Public Lands Act* and its regulations, in the form of leases, permits, licences, quotas and sales.

Relevant to: all proposed development that will encroach on permanent and naturally occurring watercourses and waterbodies, including wetlands, or development on provincial lands

Web Resources:

Public Lands Act and Regulations:

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779756162&search_by=link

Public Lands guidelines:

<http://www.srd.alberta.ca/LandsForests/PublicLandsAdministrationRegulation/Default.aspx>

ALBERTA'S WETLAND POLICY

The Province first began to recognize the extent of loss of Alberta's wetlands in the early 1990s. A formal *Wetland Policy* that would establish a process for wetland conservation has been a priority of the province since that time. The *Water Act* (Section 36) provides a regulatory means for wetland management, through the approval requirement for water diversion. Under the Act, the Province released an *Interim Draft Wetland Policy* in 1993 that outlined principles and a process to limit future wetland losses to development. Alberta's *Water for Life Strategy* (2003) included wetland management as part of its action plan for healthy aquatic systems in the province. Adoption of a new *Wetland Policy* by Cabinet in 2014 was the culmination of decades of collaboration with government, non-government organizations and industry to develop an approach to wetland conservation accepted by all parties. The new policy will be phased in from September 2014 to May 2015 in the White Area, and after 2015 in the Green Area. The Interim Policy and the current wetland compensation process will apply through the White Area transition period. By May 2015, all applications will follow the new 'value-based' process.

The goal of the *Wetland Policy* is to conserve, restore, protect and manage Alberta's wetlands to sustain the services they provide to the environment, society and the economy. The policy focuses on wetland value and four key outcomes:

- Protection of the highest value wetlands for the long-term benefit of Albertans
- Conservation and restoration of wetlands in areas where losses have been high
- Management of wetland loss by avoiding, minimizing and if necessary, replacing lost wetland value
- Management with consideration of the regional context of past wetland loss and present wetland value

The new policy will provide a process for determination of wetland value, its ecological, social and economic contributions to the overall aquatic resource in the province. It will also provide tools for management and a framework for education and incentive programs to enhance stewardship. Process, tools and programs will be developed and released over the White Area and Green Area implementation periods.

Provincial wetland mapping, a critical management tool and the first comprehensive inventory in the province, is now available. It will continue to be refined and updated over time. A range of initiatives are being developed under the new policy to encourage wetland stewardship, including various support programs for protection, conservation and restoration through non-profit organizations, municipalities and local groups and organizations. Voluntary programs and incentives will be promoted through government and non-government organizations including the Land Stewardship Centre of Canada, the Emerald Awards Foundation and the Alberta Growing Forward program through Alberta Agriculture and Rural Development. Finally, a change in awareness of the value of wetlands to Albertans will be fostered through partnerships with

agencies (e.g., Ducks Unlimited Canada and the Alberta Tomorrow Foundation) and through ESRD wetlands programs.

Until the transition is complete, the Interim Policy will apply. This system was based on a concept of no-net loss of wetland area or function and compensation for sites where loss was unavoidable. Proponents must demonstrate that they have attempted to avoid and minimize impacts to wetlands before proposing compensation. Compensation could be within the project area, or by financial contribution to other projects (mitigation banking). *A Guide to Using Wetland Restoration as Compensation for Wetland Loss in Alberta* (2004) outlines the process and acceptable forms of compensation. This is an area-based system that requires replacement at a minimum 3:1 ratio (created/restored to lost), or more depending on site-specific issues (e.g., presence of rare species, sensitive or significant wetlands). Off-site compensation must be by an approved Wetland Restoration Agency (WRA). Ducks Unlimited is the primary WRA in the province, although several municipalities in the province have sought WRA status (e.g., Edmonton, Calgary and Strathcona County).

As the province shifts to a value-based system, the compensation process will likely also change to specify the means to replace equivalent value of wetland. The details are not yet clear, but various possibilities are under discussion. The proposed incentives for conservation within municipalities could expand on the role of WRAs, to incent avoidance of wetland impact within their jurisdictions. The new **conservation offsets** allowed under the new *Alberta Land Stewardship Act* have been proposed to enhance the mitigation banking process and encourage incorporation of wetland conservation into development projects.

Applications to AESRD for wetlands approvals under the *Water Act* are circulated to Alberta Fish and Wildlife for input regarding impacts to aquatic habitat and wildlife. Some wetlands are considered permanent, which means that their bed and shores are Crown Land. Infilling activities would require a separate license application under the *Public Lands Act* in this case. The compensation plan for such cases becomes quite complicated, because the disturbed bed and shores must be physically replaced and ownership transferred to Public Lands.

As noted under the discussion of the *Water Act*, an approval for wetland disturbance cannot be granted until an environmental assessment under *EPEA* is completed, if the project triggers such an assessment. Most small development projects (e.g., subdivision development) do not require an assessment, however, and the *Water Act* approval process is the sole environmental review.

Relevant to: all proposed development with potential to disturb any natural wetland, even those not claimed by the province as permanent waterbodies

Web Resources:

Interim policy: <http://environment.alberta.ca/01125.html>

Compensation guide: <http://environment.alberta.ca/01126.html>

Wetland Policy Implementation Plan: <http://www.waterforlife.alberta.ca/03356.html>

ALBERTA UTILITIES COMMISSION ACT

The Alberta Utilities Commission (AUC) is governed under the *Alberta Utilities Commission Act*, which consolidates regulatory jurisdiction from more than 10 pieces of legislation regulating Alberta's energy resource and utility sectors. The commission regulates Alberta's investor-owned electric, gas, water utilities, and certain municipally owned electric utilities, as well as associated natural gas and utility markets to protect the public's interests. The AUC has responsibility for siting of facilities, such as transmission facilities, electric power plants and natural gas transmission lines. Renewable energy projects are now also included under the AUC jurisdiction, as electrical generation projects. Lastly, the AUC also oversees routes, tolls, tariffs and service regulations regarding energy transmission (electric transmission lines and natural gas pipelines). AUC does not regulate rural electric associations (REAs), municipally owned utilities (except EPCOR in Edmonton and ENMAX in Calgary), natural gas co-ops and competitive retailers. Applications for new development are expected to follow various Rules developed for specific types of projects.

Relevant to: investor owned electric, gas and water utilities (production, transmission, distribution, retail), and certain municipally owned electric utilities, including renewable energy projects

Web Resources:

AUC Act and Regulations: <http://www.auc.ab.ca/acts-regulations-and-auc-rules/acts-and-regulations/Pages/default.aspx>

AUC Rules - <http://www.auc.ab.ca/acts-regulations-and-auc-rules/rules/Pages/default.aspx>

AUC Regulations:

AR 230/2012 Security Management Regulation

AR 266/2007 Market Surveillance Regulation

AR 159/2009 Fair, Efficient and Open Competition Regulation

Associated Acts and Regulations:

Electric Utilities Act and Regulations (Ch. E-5.1, 2003)

Gas Utilities Act and Regulations (Ch. G-5, RSA 2000)

Hydro and Electric Energy Act and Regulations (Ch. H-16, RSA 2000)

Pipeline Act and Regulations (Ch. P-15, RSA 2000)

Public Utilities Act and Regulations (Ch. P-45, RSA 2000)

ALBERTA WATER ACT

The Province owns all surface and groundwater resources. Alberta's *Water Act*, administered by Alberta Environment and Sustainable Resource Development, is one of two pieces of legislation governing the use and management of Alberta's water resources. The *Act* creates a regulatory process for the allocation and use of surface and groundwater resources. It also charges the province with regional management of both surface and groundwater systems through water management plans. Water quality is addressed under the *Environmental Protection and Enhancement Act (EPEA)*, discussed above.

The *Act* controls use of water resources through **licences** and activities that could affect water resources through **approvals**. For the purposes of the *Act*, surface water is defined as all waterbodies, watercourses and their floodplains, and permanent and temporary wetlands. Under Section 36 of the *Act*, an **approval** is required for all activities that may affect surface water and the aquatic environment, including permanent and temporary redirection of surface drainage, permanent and temporary water withdrawal, and, disturbing, draining or infilling of a wetland.

Licences apply to withdrawal or diversion of surface or groundwater. With respect to both surface and groundwater use, the *Act* controls withdrawal rates and establishes priority of use. Section 49 requires any water diversion or water works to be licensed, with exceptions for household and agricultural use. Household use has highest priority for use of water resources and does not require a licence if use volume is below 6250 m³/year (or within limits of an approved water management plan). Agricultural users are also exempt from requirements for a licence, approval or well registration, if their withdrawal is below either the volume or the management plan limits. Should another application compete for water use though, agricultural users do not have priority under the *Act*. Agricultural users can only establish priority for use by applying for a diversion licence or registering a well.

Although registration of groundwater wells is not required, it is encouraged. All new groundwater wells must be reported to AENV through a drilling report that documents the location and discharge (flow) rate of the well. Registration allows the province to track the number of users accessing aquifers and the volume of withdrawal.

Residents within a subdivision are a special case of household use. They can divert groundwater for household use only after requesting an assessment of impact on groundwater supply by a professional engineer or geologist (Section 23(3)). The volume of withdrawal for subdivision residences must also fall within the limits of an approved water management plan or the volume limit, in the absence of such a plan. AENV must also approve the withdrawal, based on submission of the technical engineering report.

Under Section 16(1), permits under the *Water Act* cannot be issued if the project triggers an environmental assessment under *EPEA* and has not yet undergone such a review. Although

preliminary approvals can be provided, the actual licence or approval cannot be granted until the assessment process is complete (Section 16(2)).

Relevant to: all proposed development activities with potential to affect surface or ground water

Web Resources:

Act and regulations: <http://www.environment.alberta.ca/02206.html>

Standards and guidelines: <http://environment.alberta.ca/01316.html>

Alberta Water Act Codes of Practice

Alberta's *Water Act* allows construction of certain standard structures at, in or under watercourses under three **codes of practice**, exempting requirement for formal approval:

- *Code of Practice for Watercourse Crossings;*
- *Code of Practice for Pipelines and Telecommunications Lines Crossing a Waterbody;* and
- *Code of Practice for Outfall Structures on Waterbodies.*

Proponents of developments involving these activities must follow the design and construction practices and information requirements set out in the codes. They must also submit a **Notice** with the required supporting information to the Director of Alberta Environment and Sustainable Resource Development (for the BHI area this would be the Manager Regional Support – Northeast Boreal Region). Importantly, the codes recognize that rivers and streams provide different types of aquatic habitat that may require specific mitigation to minimize impacts related to construction and operation of the relevant structures. Most streams and rivers within the moraine have been mapped into one of four Classes: generally, larger rivers are considered Class A or B, while smaller streams are Class C or D.

No approval or official acknowledgement is provided after submission of a Notice under the relevant Code of Practice, other than acknowledgement of its receipt and satisfactory compliance with Code requirements. If an environmental assessment is completed, the supporting document may be used as background for the Notice, but no assessment is triggered by the Code of Practice process.

Relevant to: all bridges, culverts and utilities that will cross rivers or creeks within the moraine, all new stormwater outfalls

Web Resources:

Codes of Practice: <http://environment.alberta.ca/02514.html>

NATURAL RESOURCE CONSERVATION BOARD (NRCB) ACT

The *Alberta Natural Resources Conservation Board (NRCB) Act* outlines the purpose, structure and responsibilities of the NRCB. Under the Act, the board is responsible for regulation of intensive livestock (confined feeding) operations and the approval of large, non-energy natural resource development projects. The two distinct regulatory functions expand on functions delegated to other provincial departments and thus coordination amongst agencies.

The technical requirements of agricultural operations are managed by Alberta Agriculture and Rural Development under the *Agricultural Operation Practices Act* (see below). In 2002, the Act was changed to assign NRCB licensing responsibilities for confined feeding operations, a function previously managed by individual municipalities. Accordingly, the NRCB approves new and expanding operations and is responsible for inspection and enforcement of the AOPA regulations and any conditions associated with approvals. Finally, it administers an appeal process for approval and compliance decisions.

Relevant to: confined feeding operations and large non-energy projects.

Web Resources:

Confined Feeding Operations: <https://cfo.nrcb.ca/CFOHome.aspx>

Large non-energy projects: <https://nrcb.ca/>

RESPONSIBLE ENERGY DEVELOPMENT ACT (REDA, 2013)

Until 2013, energy projects in the province were managed by the Energy Resources Conservation Board under the *Energy Resources Conservation Act* and Alberta Environment and Sustainable Resource Development, under the various Acts described above. The *Responsible Energy Development Act* (REDA) has transferred responsibilities for management of upstream energy resources (oil, natural gas, oil sands and coal) from the ERCB to a new crown corporation, the Alberta Energy Regulator (AER). The AER is intended to consolidate regulatory powers to manage energy projects throughout their lifetime, to improve the efficiency of the regulatory and management process. This transition has involved the transfer of jurisdiction to AER of various energy development acts:

- *Coal Conservation Act*
- *Coal Conservation Rules*
- *Agent Exemption Regulation*
- *Gas Resources Preservation Act*
- *Approval of Short Term Permits Regulation*
- *Gas Resources Preservation Regulation*
- *Oil and Gas Conservation Act*
- *Oil and Gas Conservation Rules*
- *Orphan Fund Delegated Administration Regulation*
- *Oil Sands Conservation Act*
- *Oil Sands Conservation Rules*
- *Pipeline Act*
- *Pipeline Rules*
- *Turner Valley Unit Operations Act*

A series of regulations under REDA outline the legislative framework of AER, a necessity not only because of the transition of resource selling, authorization, inspection and enforcement powers away from the NRCB, but also because the AER is intended to administer various other environmental permitting functions applicable to energy projects. Specifically, AER has regulatory control over approvals and licenses under the *Water Act*, *Public Lands Act* and the *EPEA*, for construction, operation and closure/reclamation phases of the project. The REDA regulations also allow AER to set new policies for energy resource development and all of these other functions, including consultation requirements. This particular change poses a potential risk to environmental management, because of the potential to create different standards for energy and types of other development in the province. At a minimum, it has potential to cause confusion among proponents, since the *REDA* has effectively created two regulators for all provincial environmental legislation. Confusion could also occur among regulators, for example, where jurisdictional boundaries are not clear, or where federal jurisdiction might also apply. The *Jurisdiction Regulation* of the *REDA* has attempted clarification, but grey areas will undoubtedly emerge.

REDA regulations also transferred responsibility for stakeholder consultation, another key function of the ERCB process. This function has also been transferred to AER, but importantly, AER is explicitly exempt from the requirement to engage in Aboriginal Consultation for proposed projects. This responsibility has instead been transferred to the individual proponents under *Directive 056: Energy Development Applications*. Large projects for which a hearing is required under other legislation, projects with significant stakeholder interest or environmental implications, or projects in which the Crown has requested a hearing to address potential impacts on Aboriginal peoples can be referred to a hearing process. This process is quite different from that formerly convened through ERCB. It can take a variety of forms, written, electronic, oral or combination and is heard and decided by one or more hearing commissioners under the AER *Rules of Practice*. Stakeholders can participate in the hearing process, but at AER's discretion, based on direct influence of the project on them and their substantive contribution to the process. In the case of a municipality, it must show that a substantive part of its constituency is affected by the project. An appeals process allows for internal review of some of AER's decisions: the decision to hold a hearing and granting of an approval under the various energy acts. Stakeholder designation and decisions from a hearing process cannot be appealed through this process and must proceed through the courts.

Creation of the AER is an ambitious shift in the regulatory system of the province, effectively creating a separate regulator for a primary industry. To aid in transition, the province created an Interim Regulatory Guide intended to explain how the new system is intended to work, for the public as well as businesses operating in the province. At this point, many new regulatory processes are still being coordinated with their respective provincial agencies, a process that will likely continue through 2014-15.

Relevant to: any energy-related project

Web Resources:

Act and Regulations: <http://www.aer.ca/rules-and-regulations/acts-and-rules>

Regulations:

- Responsible Energy Development Act General Regulation
- Responsible Energy Development Act General Amendment Regulation
- Responsible Energy Development Act
- Specified Enactments (Jurisdiction) Regulation
- Responsible Energy Development Act
- Responsible Energy Development Act Transition Regulation
- Security Management for Critical Upstream Petroleum and Coal Infrastructure Regulation

Rules:

- Alberta Energy Regulator Rules of Practice
- Alberta Energy Regulator Administration Fees Rules
- Enforcement of Private Surface Agreement Rules

SOIL CONSERVATION ACT

The *Soil Conservation Act* is intended to manage soil quality and quantity, particularly with respect to topsoil. Administered by Alberta Agriculture and Rural Development (ARD), the Act delegates enforcement to municipal authorities, who must provide at least one officer responsible for soil conservation (s.3). Provincial officers can also be identified. The Act requires every landowner to prevent soil loss or deterioration or, where it is already occurring, to stop such impacts (s.21 (1)). Where topsoil may be removed or stubble burned, the municipality and province are authorized to issue a **permit** for the activity. The permit will identify terms and conditions applicable to the activity. The *EPEA* also addresses soil conservation with respect to proposed developments but in terms of the requirement to plan for soil salvage and replacement.

Relevant to: developments that will disturb topsoils or cannot use topsoil within the completed project and must dispose of it off-site; agricultural landowners

Web Resources:

Weed Control Act and Regulation (272/98): <http://www.qp.alberta.ca/570.cfm>

WEED CONTROL ACT

Alberta's *Weed Control Act* provides the legal authority to deal with native or introduced weed species that affect agricultural production. The Act applies to control of weeds in all environments. It and its supporting Regulation designates prohibited noxious or noxious weeds, empowers municipalities to do the same using bylaws and delegates power to local authorities to destroy or control designated weeds. The Province is actively involved in activities to manage invasive plant species. Development proponents are required to control weeds during project construction and as part of subsequent maintenance activities, for example by cleaning equipment before transport between construction sites. Landowners are similarly required to manage problem species on their properties, through weed management or eradication.

Relevant to: construction and maintenance activities that could disturb soils; any lands with suitable growing conditions

Web Resources:

Act: <http://www.qp.alberta.ca/570.cfm>

Weed Control Regulation (19/2010):

http://www.qp.alberta.ca/1266.cfm?page=2010_019.cfm&leg_type=Regs&isbncln=9780779748150

WILDLIFE ACT

Alberta's *Wildlife Act* places all wildlife in the province under Crown ownership. The Act prohibits disturbance of prescribed species or their habitat (typically nests and dens) during certain times of the year, a consideration for scheduling of new development or for land management activities. Unlike the other Acts discussed to this point, this is enforcement legislation. Further, some species are also addressed by federal legislation (e.g., *Migratory Birds Convention Act (MBCA)*, *Species At Risk Act (SARA)*). Under most circumstances, approvals cannot be granted for activities affecting species managed under the *Act* and violations may result in fines. Exceptions include game species; the *Wildlife Act* permits licences for hunting purposes, within harvest limits set by provincial wildlife managers.

Section 36 is relevant to proposals for development, because it prohibits disturbance to species, including species at risk, and their critical habitats (e.g., active snake hibernacula). Proposed development that requires vegetation clearing or earthworks, which could disturb sensitive habitat, could be in contravention of this Act. Clearing impacts to breeding birds (including waterfowl) are a common example, in part because of the overlapping jurisdiction through the *MBCA*, but impacts to snake hibernacula and sensitive raptor species are also increasingly of concern. Any species at risk listed under both the *Wildlife Act* and the *SARA* would also require attention.

AESRD has developed geographically relevant timing restrictions in coordination with their federal counterparts to facilitate scheduling of construction activities outside sensitive periods for these species. For example, in central Alberta, AESRD recommends that vegetation clearing and wetland disturbance be avoided from 15 April to 15 July to avoid impact to breeding birds. If those dates cannot be respected, breeding bird surveys should be performed prior to any construction activity, to ensure that no active nests are disturbed. Often, AESRD, Environment Canada and some municipalities will recommend that developers conduct wildlife surveys to identify raptor nests, snake hibernacula and other sensitive habitats in advance of planning development and construction.

Relevant to: all proposed development that requires vegetation clearing during breeding bird and raptor nesting seasons or earthworks in well-drained soils that could support potential dens or hibernacula.

Web Resources:

Wildlife Act and Regulations:

http://www.qp.alberta.ca/570.cfm?frm_isbn=9780779765362&search_by=link

Wildlife Land Use Guidelines: <http://www.srd.alberta.ca/FishWildlife/WildlifeLandUseGuidelines/>

PROVINCIAL ENVIRONMENTAL ASSESSMENT LEGISLATION

ALBERTA ENERGY REGULATOR

The *Responsible Energy Development Act (REDA)* has transferred all regulatory powers to the Alberta Energy Regulator (AER), including those requiring environmental assessment for large projects. The details of this process are not yet confirmed but general guidelines have been established. Authority over the EIA process itself has been retained by AESRD, under the *EPEA* and AESRD's Environmental Assessment Section will lead the development of the new energy EIA policy, in cooperation with AER.

At this point, the scale of project triggering review remains consistent, but the differentiation between AESRD and AER jurisdiction requires clarification. AESRD will continue to manage assessment of oil refinery projects, which are delegated to them by the *EPEA* Mandatory Projects List. Authority remains unclear for the various other upstream works pertaining to energy development and previously assigned to the former Energy Resource Conservation Board (ERCB) for review including:

- oil sands mines,
- commercial oil sands, heavy oil extraction and upgrading or processing plants “located within the site of an energy resource activity”,
- surface coal mines,
- sour gas processing plants,
- coal processing plants, and
- large tailings dams.

Similarly, the means by which the stakeholder consultation process outlined in the *REDA* will be applied to an EIA has not yet been confirmed. While most of these types of projects are currently proposed in areas outside the moraine, surface coalmines and sour gas processing plants can and have been proposed within the moraine.

Relevant to: large energy development projects

Web Resources:

Act and Regulations: <http://www.aer.ca/rules-and-regulations/acts-and-rules>

ALBERTA ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT (EPEA)

The *EPEA*, in addition to outlining permitting requirements relevant to certain resources and industries, also provides a legislated process for an EIA of certain proposed developments. *EPEA* outlines the assessment and EIA approval process and identifies AESRD as the responsible agency to coordinate such reviews. For certain projects, the AUC, AER or NRCB are designated as the EIA coordinating agency. For projects triggering both provincial and federal review, joint review is permitted under the Federal-Provincial Harmonization Agreement. The agency with highest-level jurisdiction leads the assessment but must solicit and coordinate input from all other interested agencies.

For some larger, more complex projects such as dams or mines, an EIA is mandatory under *EPEA*; other minor developments are exempt from an EA. The *Environmental Assessment (Mandatory and Exempted Activities) Regulation* identifies those projects requiring a mandatory EIA. The *Act* also provides for Ministerial discretion to ask for an EIA, based on the location, nature and scale of the project or potential for public concern. This allows the province the discretion to assess any proposed project on a case-by-case basis. Discretionary review is typically triggered by application for an approval under *EPEA* or the *Water Act*.

Public consultation is a key provision in the *EPEA* process and the act provides several opportunities for public comment. Municipalities are often considered an affected party in the assessment process, which confers priority status in the consultation process. For NRCB and AUC projects, this may be the only avenue for a municipality to provide input to the EIA, as there is no formal involvement of the municipality under those reviews. If public concern is high enough, or at the discretion of the Minister, a public hearing may be convened to review the results and conclusions of an EIA. A hearing can extend over a long period, as both the EIA study and hearing review period can be lengthy. Approval of the EIA is by the Minister and is not the same as authorizations required under *EPEA* or other provincial acts. Such approvals, licences and registrations can only be issued by the responsible department after EIA approval.

Relevant to: any proposed development with potential for significant environmental impact

ALBERTA UTILITY COMMISSION (AUC)

The AUC has been delegated management of the EIA process for power generation and transmission projects. Applications for upgrades to transmission and utility facilities (including new developments) are submitted in two parts to AUC. The Alberta Electrical System Operator (AESO) requests approval for the upgrade based on identifying the need for the new development (Need Identification Document, NID). The respective energy operator submits a more specific proposal showing routing and engineering details. The two applications can be submitted concurrently and reviewed in one proceeding. Other applications address the construction, operation, alteration and decommissioning of power generation and gas utility pipeline facilities.

Public consultation is held by the AUC when developing its Rules for approving projects but only locally affected stakeholders can participate. Interveners can comment to AUC on the NID but only when they can show that the application is technically deficient or contrary to public interest. Under Rules 007 and 020, the proponent must conduct a public consultation process that considers the input of directly affected stakeholders (anyone within 800 m) of the proposed project. For larger projects, public notification in local newspapers is also required. Stakeholders with unresolved concerns can also register to participate in the AUC application review process. The final decision on new developments must consider social and environmental impacts provided by the proponent and interveners, as well as economic implications for ratepayers.

Relevant to: power generation and transmission, as well as projects relating to water, energy or natural gas utilities

HISTORICAL RESOURCES ACT

Historical resources, as defined under the *Historical Resources Act*, are recognized in the Province of Alberta as nonrenewable cultural resources subject to protective measures. Management and protection of historical resources is the responsibility of Alberta Culture and Tourism (ACT). Any development with the potential to disturb historical resources (typically indicated by potential for surface disturbance) requires assessment and then clearance by ACT. Assessment of potential for disturbance to historical resources is accomplished through a two-stage review: a Historical Resources Overview and, where warranted, a more comprehensive Historical Resources Impact Assessment.

Relevant to: all proposed development with potential to disturb the terrain's surface

Web Resources:

Act:

http://www.qp.alberta.ca/1266.cfm?page=h09.cfm&leg_type=Acts&isbncln=9780779744879&display=html

Ministry:

<http://culture.alberta.ca/heritage/resourcemanagement/archaeologyhistory/resourcesimpactassessments.aspx>

NATURAL RESOURCES CONSERVATION BOARD (NRCB)

The NRCB administers an EIA review process for non-energy projects such as forestry pulp mills, metallic and industrial mineral mines, water management projects and large recreation and tourism developments. The Board is responsible for a quasi-judicial EIA review of development proposals. This includes getting input from public interveners and addressing the social, environmental and economic effects of the project. These projects may also trigger an environmental assessment under the *EPEA*. The NRCB coordinates such processes with AESRD and the federal government, if required.

The assessment and EIA approval process are administered by the NRCB under the guidelines in the *NRCB Act*. Once the Board approves the EIA and allows the project to proceed, AESRD can issue approvals for activities covered under the *EPEA*. Important from a municipal perspective, the *MGA* clearly grants authority for regulation of these projects to the NRCB. An approval by the NRCB will prevail over the municipal planning and development approval process, thus the municipality must issue a subdivision or development permit to an approved project (Environmental Law Centre 2003).

Relevant to: pulp mills, metallic and industrial mineral mines including large scale aggregate extraction, water management works and large recreation and tourism projects

