

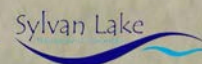
Sylvan Lake Watershed CEMS Phase 2: Implementation Plan

April 17 2015

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Prepared for
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Executive Summary

The cumulative effects of development and other land uses in the Sylvan Lake Watershed can be likened to Ravel's Bolero: slowly, almost imperceptively building until they reach a mighty crescendo. This analogy is particularly fitting in the case of Sylvan Lake because the signatures of various land uses, as indicated by concentrations of total phosphorus and total nitrogen, are not readily apparent in samples of lake water quality. Despite three decades of monitoring, the relationship between land use and lake water quality remain largely a mystery. Nonetheless, it is recognized that additional nutrient loading may cause the lake to "tip" from mesotrophic to eutrophic status without much warning. This is the crescendo the Cumulative Effects Management System (CEMS) was designed to prevent. The challenge therefore is to collaboratively move forward with actions to protect and preserve the Sylvan Lake Watershed, even in the absence of water quality triggers warning that the lake is in trouble.

This implementation plan represents Phase 2 of the CEMS project, which builds upon the desired outcomes and related water quality objectives of the CEMS Phase 1 background technical report adopted in 2014. The purpose of this implementation plan is to propose actions required to achieve the short-term objectives related to water quality as outlined in the CEMS Phase 1 report. The plan provides a comprehensive set of strategies and recommendations complete with associated estimates for the resources, budget, and monitoring mechanisms required to achieve these objectives.

The CEMS Phase 2 Implementation Plan consists of three parts: 1) an overview of the current conditions in the watershed, 2) a gap analysis of existing watershed initiatives currently being undertaken by each municipality in the watershed, and 3) implementation actions for cumulative effects management. The overview of the watershed provides a contextual understanding of current watershed ecological health and risks to lake health, effectively establishing a defensible need for the proposed implementation actions. The gap analysis is an important tool for understanding key strengths and missing links in watershed management, and was therefore instrumental in the development of implementation actions tailored to specific needs and gaps.

Outcome of the Engagement Workshop

The content and structure of this plan have evolved based on feedback from the Sylvan Lake Management Committee (SLMC) and stakeholders, as well as guidance from the SLMC Technical Advisory Team (TAT). Following a workshop with the SLMC in late November 2014, the document was restructured to include a comprehensive gap analysis of existing watershed stewardship programs in place across the eight municipalities of the Sylvan Lake Watershed. This component was not in the original scope of the project, but was added to enhance the usability and relevance of the implementation plan. The gap analysis complemented the background technical information gleaned from the CEMS Phase 1 report, resulting in a series of implementation actions that respond not only the biophysical needs of the watershed, but also to the practical management needs of individual municipalities. A detailed description of the feedback obtained from this meeting, as well as the decision to alter the scope of the original project to include a gap analysis, are provided in a companion report: Sylvan Lake CEMS Phase 2 Implementation Plan: Report on Community and Municipal Engagement.



Acknowledgements

The Sylvan Lake Watershed CEMS Phase 2: Implementation Plan evolved in a positive direction thanks to support and guidance from the members of the Sylvan Lake Management Committee (SLMC) and the Technical Advisory Committee (TAT). The project team would like to acknowledge the special contributions made by members of the SLMC and the TAT, as well as other individuals who provided knowledge and support in the development of this implementation plan:

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- Michael Wells – Summer Village of Birchcliff
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1.0 Introduction





Since the development of the first Sylvan Lake Management Plan in 1977, the cumulative effects of development in the Sylvan Lake Watershed have mounted, placing increasing pressure on the carrying capacity of the lake. Cumulative effects are the combined impacts that occur over time from a series of individual impacts from previous, current, and reasonably foreseeable future actions (Sylvan Lake Management Committee, 2014). In response to mounting concern over the long-term ecological health of the lake and watershed, the Sylvan Lake Management Committee (SLMC) was established to help facilitate coordinated land use decision making amongst the eight municipalities of the Sylvan Lake Watershed. The SLMC includes the five Summer Villages on the shore of Sylvan Lake (Norglenwold, Half Moon Bay, Sunbreaker Cove, Birchcliff, and Jarvis Bay), the Town of Sylvan Lake, Lacombe County and Red Deer County. Together, this body strives to leverage its resources and efforts for the overall benefit of the lake and watershed. In 2011, the SLMC asked representatives of Alberta Environment and Sustainable Resource Development, Fisheries and Oceans Canada and the Sylvan Lake Watershed Stewardship Society (SLWSS) to become resource members of the committee to provide technical expertise and guidance on SLMC projects. This sub-committee became known as the Technical Advisory Team (TAT).

The Cumulative Effects Management System (CEMS) Plan for the Sylvan Lake Watershed recognizes that land uses must be more consciously managed in order to maintain lake water quality and overall watershed health into the future. The CEMS concept was formally proposed by the Government of Alberta to address cumulative effects in the Sylvan Lake Watershed, and was subsequently embraced by the SLMC. Shortly thereafter, the TAT developed the Sylvan Lake Cumulative Effects Management System (CEMS) Plan Phase 1 report. The CEMS Phase 1 report was developed to examine the consequences of decision making on all aspects of the watershed including the economic, environmental and social consequences of our decisions. In particular, the CEMS Phase 1 report provided a specific vision, objectives and outcomes for the Sylvan Lake watershed as decided upon by all governing bodies and interested stakeholders in the watershed.

While the CEMS Phase 1 report examined the overarching framework for the cumulative effects management in the Sylvan Lake Watershed, the CEMS Phase 2 Implementation Plan is intended to outline feasible actions to set the objectives of Phase 1 in motion. More specifically, this implementation plan is focused on achieving the short-term water quality objectives outlined in Phase 1, with an understanding that water quality is the litmus test for overall watershed health.

1.1 Purpose

The purpose of this implementation plan is to propose actions required to achieve the short-term objectives related to water quality as outlined in the CEMS Phase 1 report. The plan provides a comprehensive set of strategies and recommendations complete with associated estimates for the resources, budget, and monitoring mechanisms required to achieve these objectives.

1.2 Plan Structure

The CEMS Phase 2 Implementation Plan consists of three parts: 1) an overview of the current conditions in the watershed, 2) a gap analysis of existing watershed initiatives currently being undertaken by each municipality in the watershed, and 3) implementation actions for cumulative effects management.

The overview of the watershed provides a contextual understanding of current watershed ecological health and risks to watershed health, effectively establishing a defensible need for the proposed implementation actions. The gap analysis is an important tool for understanding key strengths and missing links in watershed management, and was therefore instrumental in the development of implementation actions tailored to specific needs and gaps.

1.3 Goals and Objectives

As the implementation phase of the CEMS project, the goals and objectives of this implementation plan carry forward the vision, mission, outcomes, and objectives of the CEMS Phase 1 report. The vision and mission of the CEMS project are to be realized through established outcomes, which were defined in the CEMS Phase 1 report as 1) collaborative planning, 2) environmentally healthy watershed and lake, and 3) planned diverse recreation. In an effort to establish a clear link between these outcomes and the proposed implementation actions and strategies put forward in this plan, icons representing each outcome will appear next to relevant implementation actions:

- Collaborative Planning
- Environmentally Healthy Watershed and Lake
- Planned Diverse Recreation

Short, medium, and long-term objectives were developed for each outcome as a means of providing step-wise guidance for achieving successful cumulative effects management in the watershed. The scope of this implementation plan is to address only the short-term objectives related to water quality for each outcome.



Collaborative Planning



**Environmentally Healthy
Watershed + Lake**



Planned Diverse Recreation¹

The following tables list the short-term objectives related to water quality for the Collaborative Planning and Environmentally Healthy Watershed and Lake Outcomes as cited in the CEMS Phase 1 report, along with the associated actions proposed in this implementation plan. For the purposes of this report, which focuses on the water quality related objectives of Phase 1, the Planned Diverse Recreation Outcome will not be addressed¹. Short term objectives related to this outcome were too indirectly related to water quality, and were therefore considered out of scope. However, certain water quality issues related to recreation, such as invasive species and safe boat fueling procedures, will be covered in this report.

Collaborative Planning

PHASE 1 WATER QUALITY OBJECTIVES	PHASE 2 IMPLEMENTATION ACTIONS
Identify alignments and possible policy discrepancies or gaps among Municipal and Provincial and Federal governments	<ul style="list-style-type: none"> - Gap Analysis² - Subregional Plan for the Sylvan Lake Watershed

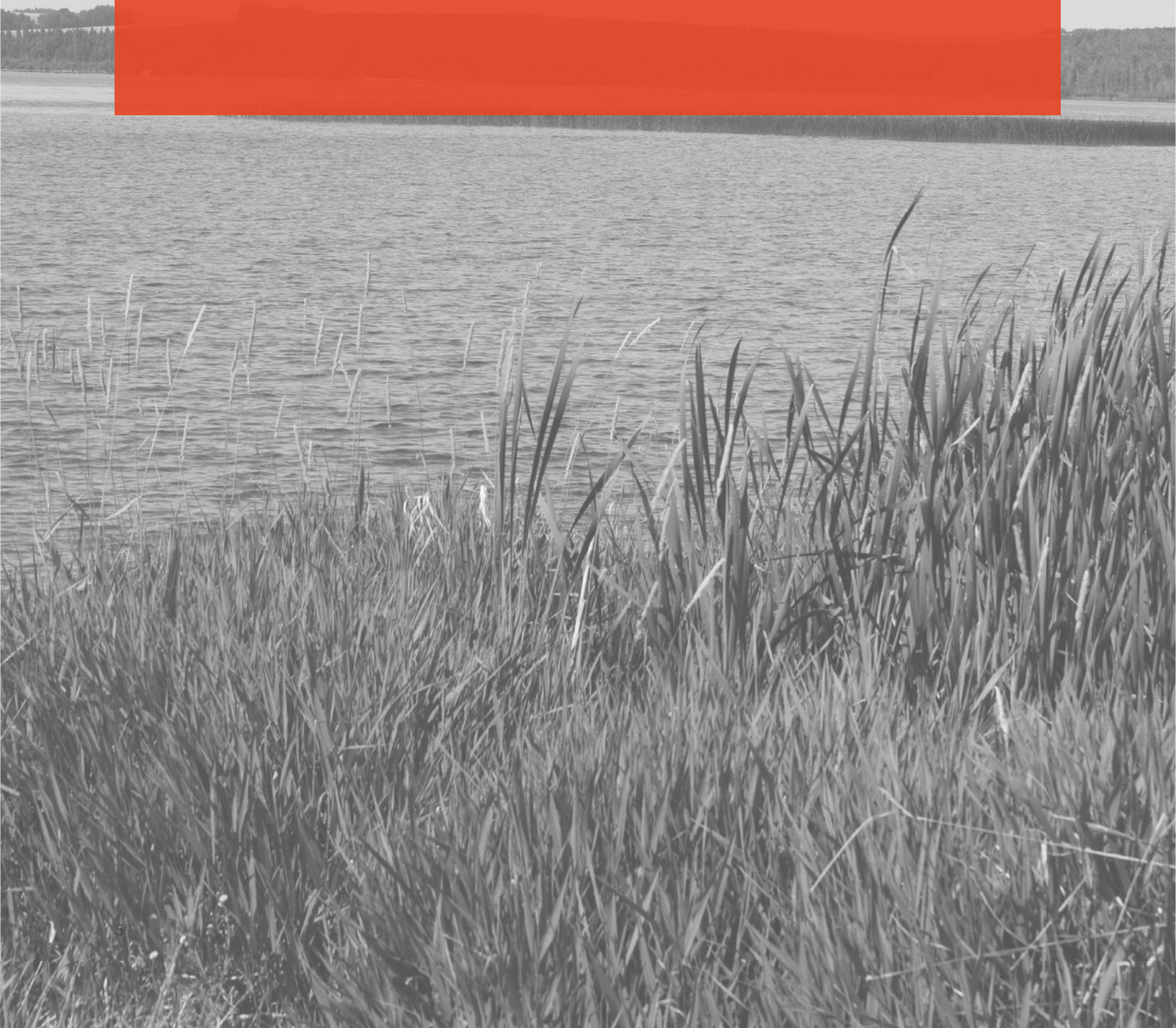
Environmentally Healthy Watershed + Lake

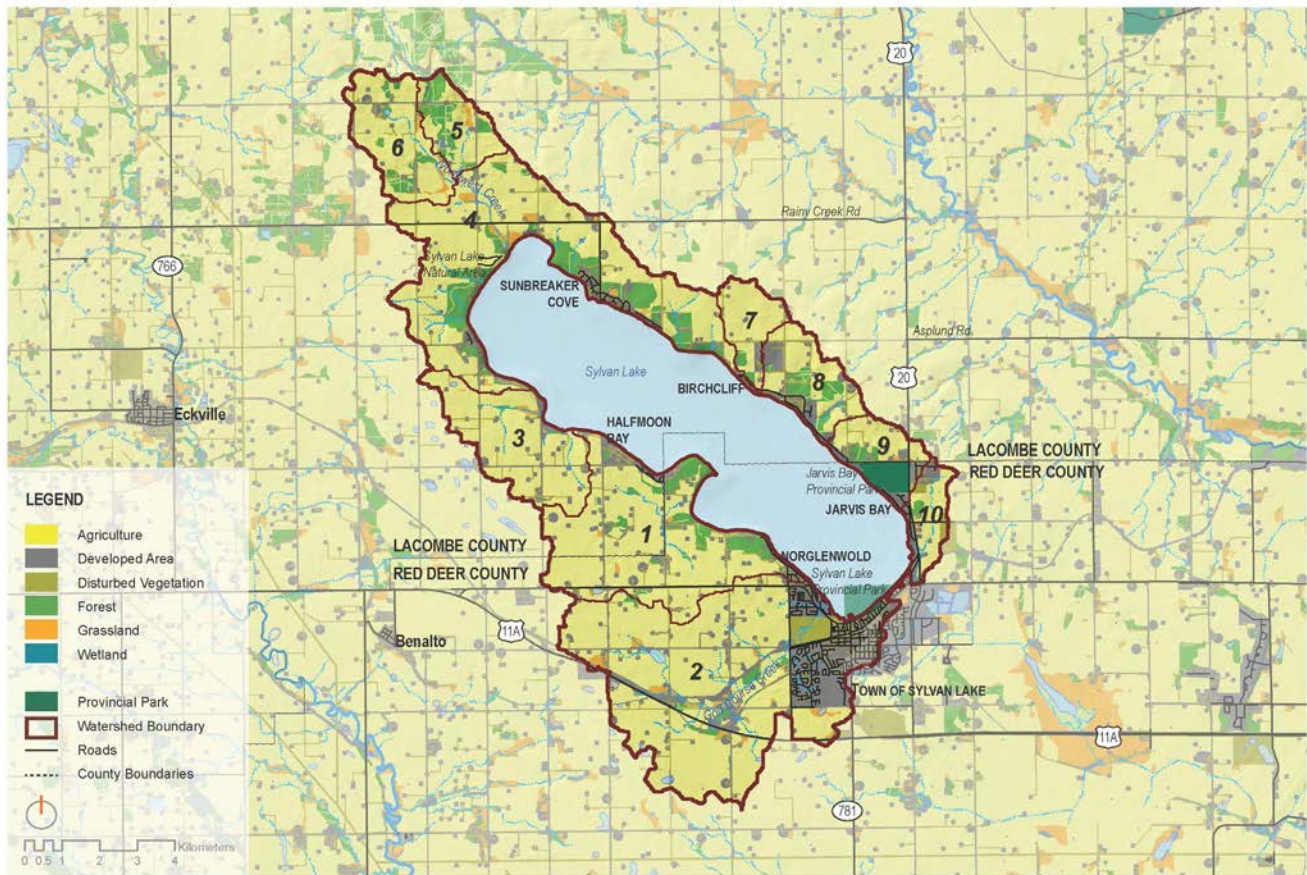
PHASE 1 WATER QUALITY OBJECTIVES	PHASE 2 IMPLEMENTATION ACTIONS
Understand the current watershed ecological health and risks to its health	<ul style="list-style-type: none"> - Research and Monitoring - Environmentally Significant Areas Inventory
Improve management of the watershed	<ul style="list-style-type: none"> - Subregional Plan for the Sylvan Lake Watershed - Environmentally Significant Areas Inventory - Riparian Setback Matrix Model - Development Controls - Education and Incentive Programs - Research and Monitoring
Work to protect and enhance water quality in the watershed	<ul style="list-style-type: none"> - Subregional Plan for the Sylvan Lake Watershed - Environmentally Significant Areas Inventory - Riparian Setback Matrix Model - Development Controls - Education and Incentive Programs - Research and Monitoring
Work with stakeholders to empower stewardship of the lake and watershed	<ul style="list-style-type: none"> - Education and Incentive Programs

¹The Planned Diverse Recreation Outcome will not be addressed where short-term water quality objectives are not related. Short term objectives related to this outcome were too indirectly related to water quality, and were therefore considered out of scope. Certain water quality issues related to recreation, such as invasive species and safe boat fueling procedures, will be covered in this report.

²The gap analysis conducted in this report is not technically an implementation action, but nonetheless fulfills the objective of identifying alignments, discrepancies, and gaps amongst governing bodies. The gap analysis was initiated at the request of SLMC members at the first engagement workshop.

2.0 Overview of the Watershed





This section presents a brief summary of the study area, and highlights major trends in water quality and land use within the Sylvan Lake watershed. This background overview echoes the indicators of watershed health outlined in the CEMS Phase 1 report, providing a contextual basis for understanding the applicability of implementation actions as they relate to the unique needs of the watershed.

Figure 1. The Sylvan Lake Watershed

2.1 Study Area

The Sylvan Lake Watershed is situated in Central Alberta, and is part of the greater Red Deer Watershed (Figure 1). The watershed area is 106 km², or 10,600 ha. At the heart of the watershed, Sylvan Lake occupies 42km². Due to its location just west of the City of Red Deer, Sylvan Lake is a popular destination for recreation, tourism, and lakeshore residential development. Beyond the lake, the rest of the watershed is largely dominated by agricultural land use. As development is expected to increase, concerns have been raised over the cumulative effects of many users within the watershed as a whole, and the ability of the lake to sustain continued development over the long term.

Most of the Sylvan Lake Watershed was originally dominated by mixed-wood forest, comprised of mainly trembling aspen. However, approximately 90% of the forest has been cleared for agriculture (Mitchell & Prepas, 1990). Cereal grain, canola production, and mixed farming are the main land uses in the watershed (O2 Planning + Design Inc., 2014). The bathymetry (underwater topography) of Sylvan Lake is generally flat, with a small area at the centre declining to the lake's maximum depth of 20.3 m. At an elevation of 936.5 m, 20% of the lake is occupied by the littoral zone, which is less than 3.5 m deep. The inflowing streams flow intermittently, with an outlet stream that enters Cygnet Lake to the southeast, continuing on to the Red Deer River.

2.2 Water quality

This section summarizes the lake water quality objectives and associated triggers and limits defined in the CEMS Phase 1 report as a means of highlighting the need for specific implementation actions. This information emphasizes the use of defined triggers and limits (thresholds) to initiate specific actions to maintain and improve lake water quality on a continual basis. This is the essence of adaptive management and the foundation of the CEMS framework.

The CEMS Phase 1 report selected total phosphorus (TP) and total nitrogen (TN) as indicators of water quality in the Sylvan Lake Watershed. Phosphorus and nitrogen result primarily from human activity and enter Sylvan Lake via runoff from agricultural fields, golf courses, urban and country residential and cottage areas, and air pollution. These nutrient indicators are relatively easy to monitor, and are capable of reflecting land use changes in the watershed that can be managed in order to maintain and enhance water quality. Based on the professional judgment of freshwater lake experts, the CEMS Phase 1 report concluded that a TP concentration of 0.035 mg/L is the maximum acceptable value to protect the meso-eutrophic condition of Sylvan Lake (Sylvan Lake Management Committee, 2014).

A water quality assessment conducted in 2005 (AXYS Environmental Consulting Ltd., 2005) indicated that Golf Course Creek and Northwest Creek are the primary sources of nutrient loading in the lake (Figure 1). Approximately 95% of the nutrients entering the lake via these tributaries are retained within the lake. While nutrient trends indicate stable mesotrophic conditions, a high proportion of nutrients entering the lake are retained in the lake, indicating the potential for a drastic shift toward eutrophic conditions. Trophic conditions may lead to chronic algal blooms.

Preliminary results from the 2014 Golf Course Creek and Northwest Creek projects confirm that the Sylvan Lake tributaries are consistently at or above the Alberta Surface Water Quality Guidelines (Alberta ESRD, 2014). These high nutrient concentrations are diluted by the lake's water volume, indicating that the lake can tolerate the addition of nutrients and other contaminants that are flushed into it with each annual cycle. Currently, the relationship between tributary nutrient loadings and lake nutrient concentrations in Sylvan Lake is poorly understood. Nonetheless, it is important to recognize that other highly urbanized water bodies have required intervention to reduce nutrient-laden runoff from surrounding land uses.

Adaptive Management

The CEMS Phase 1 report developed a series of triggers and limits for TP and TN to guide adaptive management and ultimately maintain water quality in the Sylvan Lake Watershed. These trigger amounts of TP and TN were calculated and classified into ranges, or percentiles. Table 1 lists the values associated with these percentiles in relation to the defined limit for maintaining mesotrophic conditions on the lake. The 50th percentile, or median range, represents the long-term value that should be maintained over time. As of 2005, measurements of TP and TN in Sylvan Lake indicate that the lake is hovering between the 90th and 50th percentile trigger range, with average TP and TN concentrations recorded at 0.021mg/L and 0.72mg/L, respectively. However, it is important to note that the upper range of mean TP concentrations measured in Sylvan lake during the open water season approach the mesotrophic/eutrophic status boundary (i.e. 0.035mg/L limit), reaching 0.034 mg/L (AXYS Environmental Consulting, 2005).

Table 1. Triggers and Limits for Water Quality Indicators (TP and TN)

TRIGGERS AND LIMITS	TOTAL PHOSPHORUS (mg/L)	TOTAL NITROGEN (mg/L)
Trigger at 50th percentile (median)	0.019	0.65
Trigger at 90th percentile	0.028	0.87
Limit	0.035 (to maintain mesotrophic)	1
Recent Measurements (2005) ³	Mean: 0.021 Upper range: 0.034	Mean: 0.72

The CEMS Phase 1 report further classified these triggers into management zones to streamline their application in the context of land use management. Management zone 1 includes TP and TN indicator values below the long-term median or 50th percentile. This zone represents a well-functioning management strategy that successfully applies monitoring, education, conservation, and regulatory mechanisms to minimize nutrient delivery to the lake. If long-term water quality sampling trends exceed this median value, investigations of source causes and adjustments to land use management will need to be undertaken to bring TN and TP back to long term median levels. Likewise, if water quality samples exceed the 90th percentile (indicating a shift into management zone 2), or the limit (indicating a shift into management zone 3), these thresholds signal the need to identify the cause and implement management actions to remedy the situation.

Table 2. Relationship of CEMS Triggers, Management Zones, and Required Actions

TRIGGERS AND LIMITS	MANAGEMENT ZONE	REQUIRED ACTION
Trigger at 50th percentile (median)	Zone 1 (long-term)	Ongoing monitoring, education, riparian and natural area conservation, consistent application of development controls, and continuous improvement of land use management
Trigger at 90th percentile	Zone 1 (short-term)	Ongoing monitoring, education, riparian and natural area conservation, consistent application of development controls, and continuous improvement of land use management
> 90th Percentile, below limit	Zone 2	Investigate cause of nutrient increase and adjust management activities accordingly
Over limit	Zone 3	Significant limitations to further development, significant upgrades to wastewater and stormwater infrastructure, enhancement of land management practices to curtail nutrient runoff into the lake.

Recent nutrient concentration measurements indicate that Sylvan Lake is currently in Management Zone 1 (short term). Remaining within this zone requires offsets to accommodate new management activities and potential restrictions on development to ensure that future growth in the watershed has minimal impact on the water quality of Sylvan Lake. This CEMS Phase 2 Implementation Plan is designed to initiate a series of feasible management actions and strategies that will help maintain water quality within management zone 1.

³ Values derived from the Sylvan Lake Water Quality Study conducted in 2005 by AXYS Environmental Consulting Ltd.

⁴ The Town of Sylvan Lake has experienced the most land use change of any municipality in the Sylvan Lake Watershed over the past decade, but has generally been isolated from the lake by sewer and stormwater capture and diversion outside the watershed.

Challenges and Potential Obstacles to this Framework

Land use is closely tied to freshwater quality. However, in the unusual case of Sylvan Lake, land use impacts are not evident in three decades of water quality data (concentrations of TN and TP analyzed in composite water quality samples collected from the lake). As development has increased and land use patterns have changed over the years, long-term trends for both TP and TN indicate that nutrient conditions in the lake have remained relatively constant over three decades of sampling. The good news is that the lake is still classified as meso-eutrophic. The bad news is that the data do not provide much insight into the lake's long term capacity to absorb more nutrients (e.g. sustain more development). Data analyses indicate that the main sources of nutrient loading into Sylvan Lake are from the ephemeral tributaries of Northwest Creek and Golf Course Creek (AXYS Environmental Consulting, 2005; Teichreb, 2005). Nutrient concentrations in these tributaries have always been found to exceed the concentrations in Sylvan Lake itself. Nutrients are diluted in the lake's water volume, which is at least two orders of magnitude (>100 times) greater than the annual cumulative surface flow into the lake. Nutrient loading estimates using different methods (AXYS Environmental Consulting, 2005; Strathdee, 2014) have covered a wide range and are inconsistent with the relative stability of lake water quality.

Data collected by Alberta Environment over two decades suggest a 2 metre thick TP-rich layer is present above the lake sediment and would be an internal nutrient source if transferred into the overlying lake water. Lake bottom sediments act as a sink by accumulating waterborne nutrients over time. Figure 2 demonstrates how TP concentrations increase at depth (AXYS Environmental Consulting, 2005). Under certain physical, chemical, and biological conditions, sediments can also act as an uncontrolled source of nutrients to the water column. This is referred to as internal nutrient loading (AXYS Environmental Consulting, 2005). Internal nutrient loading is extremely difficult and expensive to reverse, as was demonstrated in the case of Pine Lake, Alberta (Sosiak & Trew, 1996). Nutrient loading from both land use and internal sources combine to create a risk of "tipping" from a mesotrophic to eutrophic state without much warning. The challenge therefore is to collaboratively move forward with actions to protect Sylvan Lake, even in the absence of water quality triggers warning that the lake is in trouble. Additional research is needed to understand the relationship between land use and water quality on Sylvan Lake so the CEMS triggers and limits framework can be more effectively applied to manage cumulative effects in the watershed. In the mean time, lake loading data sampled from the tributaries of Northwest Creek and Golf Course Creek are considered to be more reliable indicators of lake health in response to land use change.

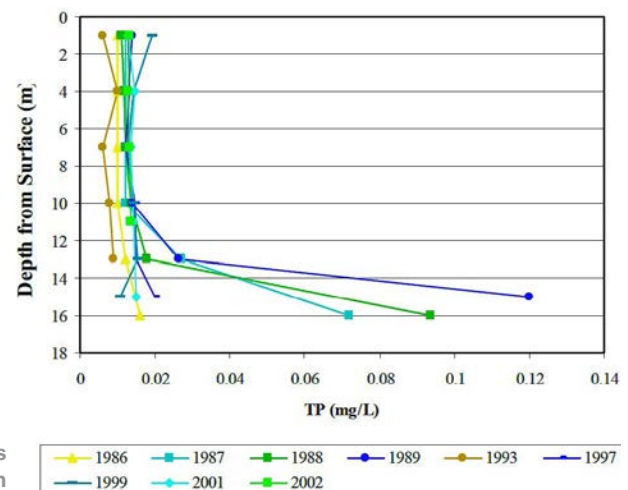


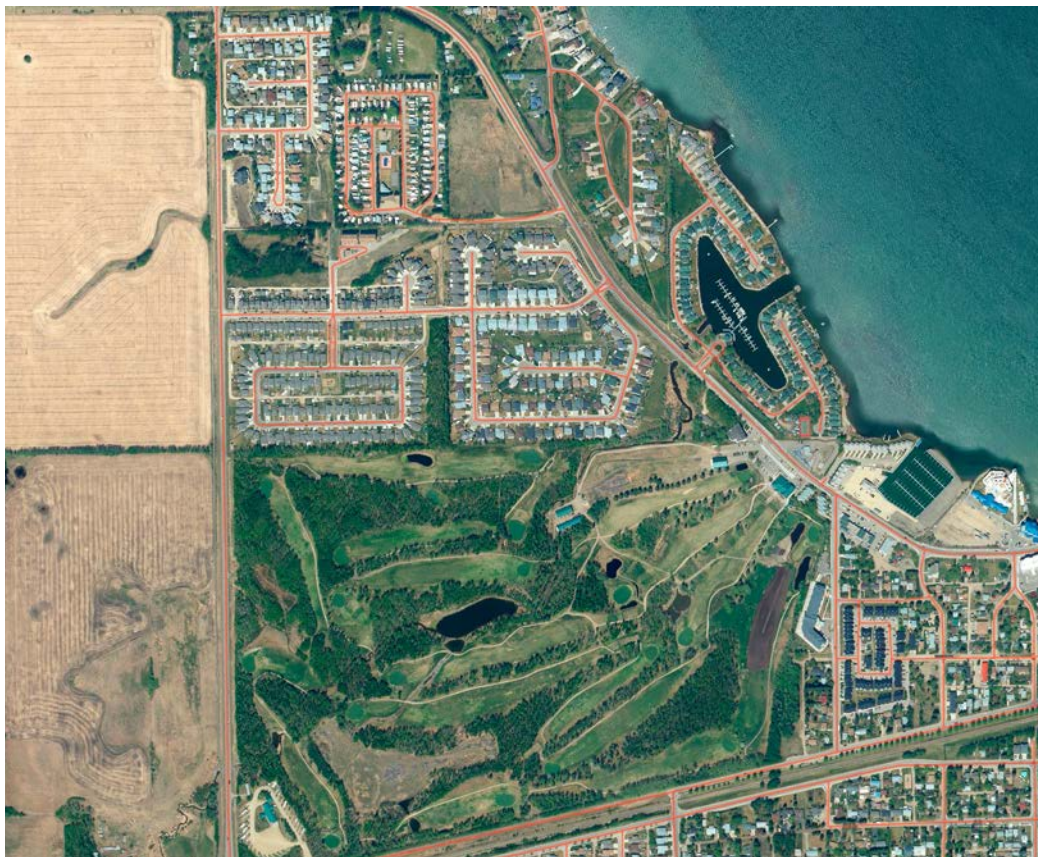
Figure 2. Total Phosphorus loading as a function of depth

2.3 Land Use Patterns

This section outlines the land cover types found within the watershed, as well as land cover and dominant land uses by individual watershed units, or subcatchments. This information is intended to inform prioritized decision making with regards to land use planning and watershed management. Table 3 summarizes the proportion of these land cover types found within watershed as whole. Appendix A provides these details on a unit basis.

Table 3. Proportion of land cover types found in the Sylvan Lake Watershed

LAND COVER	AREA	PERCENTAGE
Agriculture	7398.8	67%
Developed	1572.33	14%
Forest	1055.18	10%
Disturbed vegetation	673.51	6%
Grassland	247	2%
Waterways and water bodies	43.63	<1%
Vegetated	21.59	<1%
Wetland	7.12	<1%
Unvegetated	2.75	<1%



Land use/cover spanning Red Deer County and the Town of Sylvan Lake (Image source: Google Earth, 2013)

Watershed Units

A value added feature of this implementation plan is an assessment of land cover and land use patterns by individual watershed units, or subcatchments (Figure 3). Stratifying land cover by watershed unit breaks watershed management down into more manageable (and defensible) pieces by basing management on landscape characteristics and zones of influence rather than arbitrary municipal boundaries. Using watershed units to frame land use management arms planners and policy makers with more concise information to prioritize land use decisions at the scale of individual catchments. Ten watershed units were defined for the Sylvan Lake Watershed using the Soil and Water Assessment Tool (SWAT)(Texas A&M University, 2012). Land cover data was obtained from the Alberta Biodiversity Monitoring Institute (ABMI) (2010).

Note that the watershed boundary used to define the ten watershed units is different from the watershed boundary presented in Figure 1. This disparity originates from the fact that several boundaries have been defined by Alberta Environment and Sustainable Development (ESRD) for the Sylvan Lake Watershed, as demonstrated in Figure 4 (Chamulak, 2015). In order to remain consistent with other maps of the Sylvan Lake Watershed produced by ESRD, Figure 1 was generated using the Original Watershed boundary produced by ESRD. For the watershed units, however, the project team confirmed with ESRD that the Watershed_Hydro_Corrected boundary was the best boundary to use, in combination with a 25 x 25 m DEM to delineate the boundaries of subcatchments for the watershed (Chamulak, 2015). Prior to this report, subcatchment units have never been formally digitized.

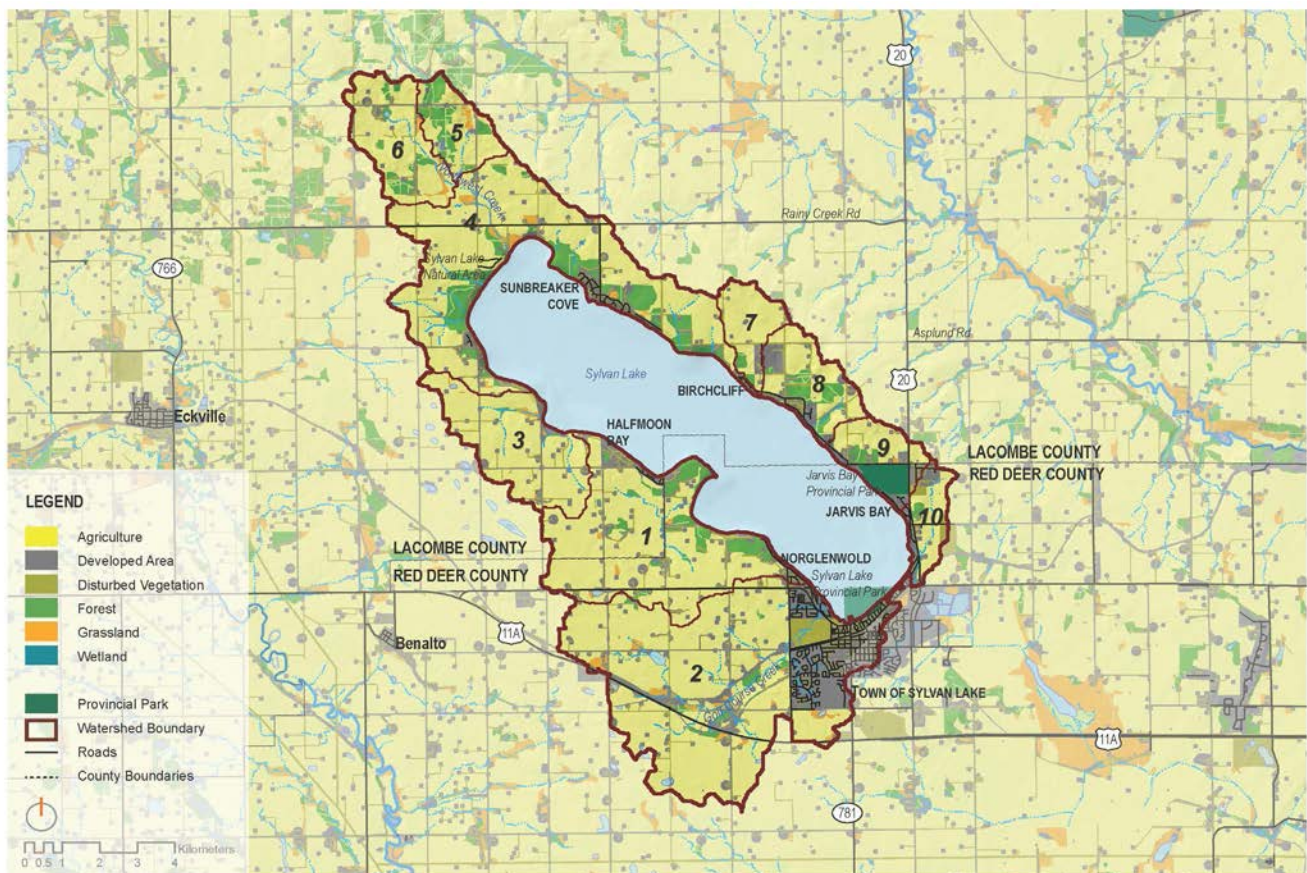


Figure 3. Watershed Units

The concept of using watershed units to quantify and manage land uses is well documented and has been demonstrated as a successful management framework in many municipal and regional contexts. However, in the case of the Sylvan Lake Watershed, which is shared by eight municipalities, the concept of watershed units is presented here only to provide supplemental information for land use planning and management. Given the great number of municipalities sharing responsibility for the watershed, it was deemed far more practical to frame implementation actions in the context of municipal boundaries rather than the boundaries of watershed units, some of which are shared by up to four different municipalities. Table 4 presents the distribution of municipalities per watershed unit. Nonetheless, an understanding of land use and land cover distributions per watershed unit may help individual municipalities make joint decisions with neighboring municipalities. Appendix A provides a land cover summary on a unit basis for each of the ten watershed units.

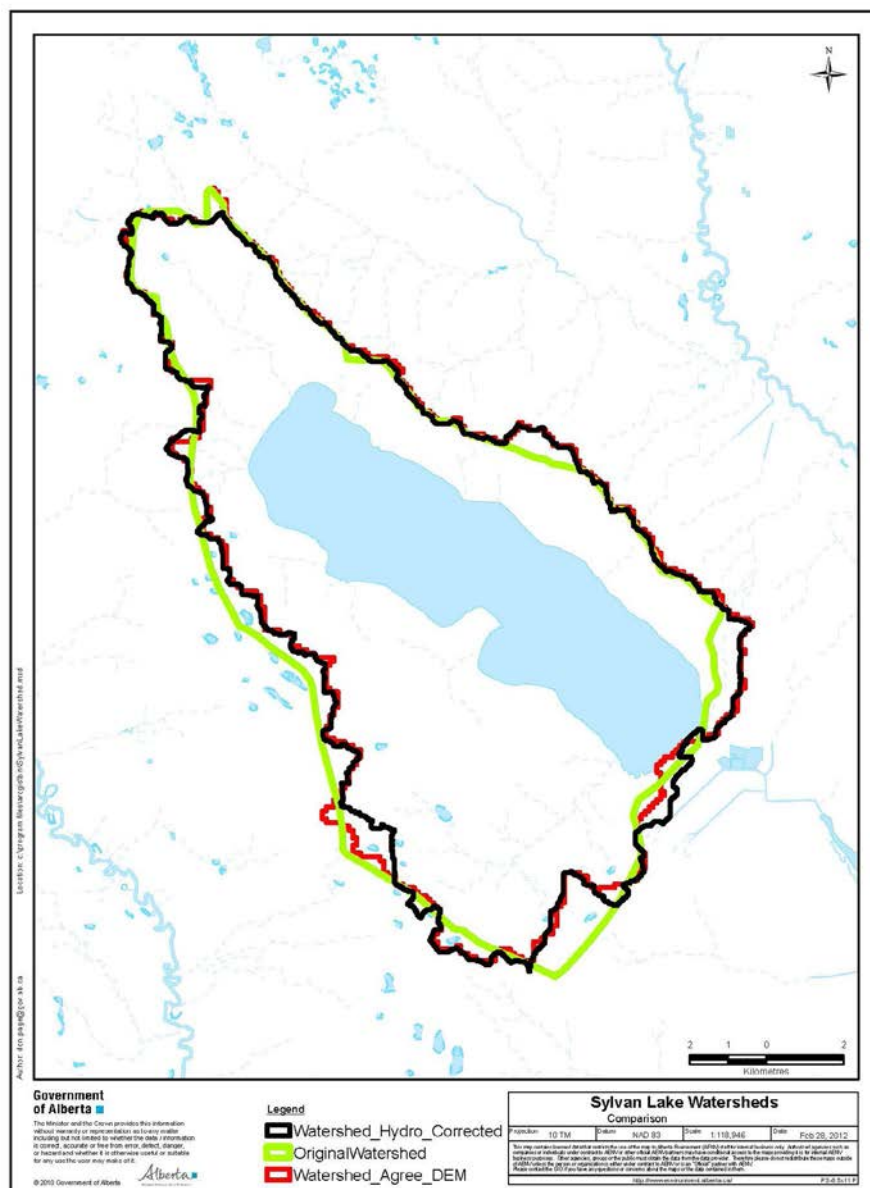


Figure 4. Sylvan Lake Watershd Boundaries

Table 4. Distribution of Municipalities per Watershed Unit

WATERSHED UNIT	MUNICIPALITIES
1	Summer Village of Half Moon Bay
	Summer Village of Norglenwold
	Lacombe County
	Red Deer County
2	Town of Sylvan Lake
	Red Deer County
3	Lacombe County
4	Summer Village of Sunbreaker Cove
	Lacombe County
5	Lacombe County
6	Lacombe County
7	Summer Village of Birchcliff
	Lacombe County
8	Summer Village of Birchcliff
	Lacombe County
9	Summer Village of Birchcliff
	Summer Village of Jarvis Bay
	Lacombe County
	Red Deer County
10	Summer Village of Jarvis Bay
	Town of Sylvan Lake
	Red Deer County

Land Use Distribution

Agriculture is by far the dominant land use in the watershed, occupying 67% of its total area. In terms of watershed units, unit 3 (Lacombe County) has the highest percentage of land area dedicated to agriculture, occupying 86% of the subcatchment, while unit 2 has the largest agricultural area (2105 ha) owing to the large agricultural land base of Red Deer County.

Developed land follows agricultural land use as occupying the greatest percentage of the watershed at 14% of the total area of the watershed. Watershed units 8 (Lacombe County, Summer Villages of Birchcliff) and unit 9 (Red Deer County, Lacombe County, Summer Villages of Birchcliff and Jarvis Bay) have the highest percentages of developed land, with 24% and 23% of their total area occupied by development respectively. Meanwhile, unit 2 (Red Deer County and most of the Town of Sylvan Lake) has the largest area of development (645 ha). Unit 2 (Red Deer County and the Town of Sylvan Lake) is also characterized by disturbed vegetation (e.g. the Sylvan Lake Golf Course) more so than any other watershed unit. This unit contains Golf Course Creek—the second largest tributary in the Sylvan Lake Watershed.

The watershed unit with the largest percentage of forested area (30%) is unit 5 (Lacombe County), which contains the headwaters of Northwest Creek. Unit 4 (Lacombe County, Summer Village of Sunbreaker Cove) however, contains the largest forested area (352 ha). Unit 6 (Lacombe County) also contributes to Northwest Creek, with 77% of its area in agricultural land use and 10% covered by forest.

While agriculture is the dominant land use in the watershed, it is important to highlight the role of urbanization on the perimeter of the lake as a very significant contributor to nutrient loading in Sylvan Lake. Stormwater runoff and impermeable surfaces associated with development contribute to nutrient runoff into the lake. Given the intensity of development around the lake, as well as the demand for future increases in development in the watershed, this implementation plan will have a strong focus on regulatory and non-regulatory means of controlling the negative impacts of existing and future development.

3.0 Gap Analysis of Existing Initiatives





This gap analysis of existing initiatives takes stock of what individual municipalities are currently doing to manage land use, promote stewardship, and enhance water quality in the Sylvan Lake Watershed.

3.1 Intent

The intention of this gap analysis is to present initiatives developed by the municipalities in the Sylvan Lake Watershed that related to lake and watershed health. The idea is to organize current efforts in one place to shed light on the collective strengths and missing links in watershed management. This process pinpoints specific needs, and is therefore an important step in identifying priority actions that will close watershed-wide management gaps.

This gap analysis summarizes existing watershed initiatives across the eight municipalities of the SLMC in table format, concluding with a discussion of strengths and gaps for each municipality. The findings of the gap analysis were then used to develop a short-list of priority actions for implementation, complete with designated responsibilities, estimated resource requirements, and potential funding sources. Appendix B provides a summary of each of the relevant plans, studies, programs, and services by municipality, serving as a 'library' of existing municipal watershed initiatives.

3.2 Summary of Existing Watershed Initiatives

This section describes the existing watershed health related initiatives for each municipality in the Sylvan Lake Watershed. Table 5 lists the watershed initiatives related to key aspects of water quality enhancement and watershed health across the eight municipalities of the Sylvan Lake watershed. Planning documents for the Summer Villages have been combined in one category for the sake of simplicity given the limited number and diversity of plans and programs in place for each community.

3.3 Discussion

The following sections provide an overview of the strengths and management gaps for each municipality in the Sylvan Lake watershed as they pertain to water quality initiatives in the watershed. Strengths and gaps were evaluated through the lens of the CEMS Phase 1 water quality objectives. Opportunities for improvements are focused solely on the water quality topic and do not pertain to additional programming that is carried out in the municipalities.

3.3.1 All Municipalities

Five plans and studies have been conducted for the watershed as a whole (listed in Table 5 under All Municipalities), with policies and recommendations intended to apply to all eight municipalities. These documents are largely characterized by a focus on lake water quality. All five planning documents provide an overview of the lake's hydrology and the major land uses and human activities that may contribute to water quality degradation within the watershed.

Agricultural land use was identified as a primary source of nutrient inflow to the lake via ephemeral streams that drain these areas. Recreational uses, run-off from urban and residential areas, and leaching from septic systems were also identified as significant sources of nutrient loading and sedimentation in the watershed.

Several of these watershed-wide plans and studies also discussed the implications of losing of natural cover such as wetlands and forested areas to residential development in the watershed, citing that increasing fragmentation of these areas may have consequences for biodiversity and water quality over time. In response to these issues, these plans and studies provide general direction for future sustainable development of the watershed, and outline recommendations for land use management and environmental protection.

Suggested missing components and opportunities for improvement in regards to water quality in the Sylvan Lake watershed are:

- **Subregional Plan to achieve regulatory leverage**

As identified as one of the key desired outcomes of the CEMS Phase 1 report, the municipalities of the Sylvan Lake Watershed are in need of an overarching land use framework to coordinate strategic efforts and resources within the watershed. Integrating CEMS principles into the regional planning process through the development of a Subregional Plan for the watershed under the Red Deer Regional Plan may be an effective way of achieving regulatory leverage for implementing CEMS goals.

- **Targeted application of environmental programs**



While the municipalities of the watershed boast a diverse range of environmental initiatives and programs, in many cases these programs are generally not applied in a targeted fashion. Lacombe County currently has a system in place through its Environmental Management Plan (EMP) to formalize and strategically plan their environment programming. It is currently focused on internal operations, but could be expanded to include CEMS-specific water quality targets and objectives.

Table 5. Watershed initiatives related to key aspects of watershed health by municipality

INITIATIVES	WATER QUALITY STRESSORS					ENVIRONMENTAL PROTECTION				MANAGEMENT INFLUENCES			
	Nutrient Loading	Residential, Commercial + Urban Land Use	Recreational Use	Invasive Species	Erosion + Sedimentation	Wetlands	Riparian Areas	Natural Areas	Forest Cover	Education	Stewardship Programs + Support	Governance + Partnerships	Monitoring
ALL MUNICIPALITIES													
Sylvan Lake Management Plan	X	X	X		X	X	X	X	X	X		X	X
Sylvan Lake Public Access Study Findings + Recommendations Report	X	X	X		X	X	X	X	X	X		X	X
Sylvan Lake Water Quality Study	X	X	X		X	X	X			X			X
Sylvan Lake CEMS Project – Phase 1	X	X	X	X	X	X	X	X	X	X		X	X
Sylvan Lake Regional Wastewater Commission Project		X											
SLMC Aquatic Invasive Species Program			X	X						X	X		
SLMC Take It Off Ice Fishing Hut Registration Program				X						X	X		
LACOMBE COUNTY													
Sylvan Lake Area Structure Plan	X	X	X		X	X	X	X	X				X
Municipal Development Plan + Land Use Bylaw		X	X		X	X	X	X	X			X	X
Sylvan Lake Rezoning Plans (The Slopes + Highland Park)		X	X			X		X	X				X
Environmental Management Plan										X	X	X	X
Tree Shelterbelt Program					X				X		X		
Soil Conservation Program					X		X				X		
Integrated Vegetation Management Plan	X	X		X									
River Weed Control Program				X	X		X						
Aquatic Invasive Species Education and Inspection Program				X						X		X	
Environmental Improvement Grant Program										X	X	X	
Communal Servicing Project	X	X											
RED DEER COUNTY													
Municipal Development Plan + Land Use Bylaw	X	X	X										
Sylvan Lake/Red Deer County													
Intermunicipal Development Plan	X	X	X				X	X				X	X
Agricultural Profile of Red Deer County	X										X		
Alternative Land Use Services (ALUS)	X			X	X	X	X	X		X	X		X
Grazing and Riparian Management Program	X				X	X	X	X		X	X		
Environmental Farm Planning Program	X			X	X	X	X	X	X	X	X		X
Tree Planting Program	X				X	X	X	X	X		X		
Safe Water Well Initiative	X										X		
Green Acreages		X		X	X	X	X	X	X	X	X		
Low Impact Development		X								X	X		
Water Conservation Measures		X								X	X		
Open Space Master Plan		X	X			X	X	X	X	X	X	X	X
ESA Inventory						X	X	X	X			X	
TOWN OF SYLVAN LAKE													
Sylvan Lake/Red Deer County Intermunicipal Development Plan	X	X	X				X	X				X	X
Municipal Development Plan + Land Use Bylaw		X	X		X	X		X	X		X	X	
Waterfront Area Redevelopment Plan	X	X	X		X							X	X
Municipal Sustainability Plan		X	X			X	X	X		X	X	X	X
Recreation, Parks, and Open Space Master Plan		X	X					X				X	
Lake Infrastructure Study Update (2014)		X	X			X							X
Growth Strategy (2008)		X	X					X					
SUMMER VILLAGES													
Summer Village of Birchcliff MDP + Land Use Bylaw (2013)		X	X		X	X	X	X					
Summer Village of Birchcliff Open Space Plan (2014)		X	X		X	X	X	X	X	X	X	X	
Summer Village of Jarvis Bay MDP + Land Use Bylaw		X	X		X	X	X	X					
Summer Village of Norglenwold MDP + Land Use Bylaw		X	X		X	X	X	X					
Summer Village of Sunbreaker Cove MDP + Land Use Bylaw (2003)		X	X		X	X	X	X					
Summer Village of Halfmoon Bay Land Use Bylaw		X	X		X	X	X	X					

It is recommended that all municipalities of the Sylvan Lake watershed develop a similar system for prioritizing water quality related issues as a basis for focusing the application of resources and programs.

- **Municipal management of stormwater**



It is recommended that municipalities take greater responsibility for stormwater management on municipally owned lands. It is recommended that municipalities consider an initiative to evaluate all stormwater systems and facilities on municipally owned lands to identify opportunities for upgrades and improvements, such as implementation of low impact development techniques where appropriate. A strategic plan for implementing identified improvements should be developed as part of this effort to guide stepwise progress and funding of stormwater improvement projects that will ultimately reduce nutrient runoff to Sylvan Lake.

- **Municipal management of riparian areas**



It is recommended that municipalities work towards prioritizing areas for riparian conservation and restoration project on municipally owned lands in their jurisdiction. This should ideally be coupled with a comprehensive outreach, education, and incentive program to promote conservation and restoration or riparian areas on privately owned lands within the watershed.

- **Invasive species management**



Invasive zebra and quagga mussels are a significant concern on Sylvan Lake. While the SLMC has promoted a public education campaign to help protect Sylvan Lake from zebra and quagga mussels, it was noted at the stakeholder engagement workshop that mandatory boat inspections would be an important additional measure to ensure that invasive species do not enter lake. Lacombe County has already undertaken an awareness campaign and boat inspection program (Aquatic Invasive Species Education and Inspection Program) to promote practices that prevent the introduction and spread of zebra and quagga mussels into Sylvan Lake. It is recommended that municipalities without a comparable program explore possible partnerships with Lacombe County to expand the existing program's influence and message to all recreational users of the lake. In addition to aquatic invasive species, the impact of invasive weeds was thoroughly not addressed in these plans. Invasive weeds can lead to soil degradation and erosion, as well as habitat loss, and should therefore be managed from a cumulative effects point of view as a key measure in upholding lake and watershed health.

- **Stewardship incentives for land owners**



While education was highlighted as an important strategy for enhancing watershed stewardship, more emphasis could be placed on the importance of incentive programs to encourage and support landowners in adopting more sustainable land use practices. Red Deer County has been a leader in adopting and implementing environmental incentive programs. Several municipalities in the watershed are in the process of reviewing current provincial and federal programs and adding synergistic municipal programs to their repertoire of education and stewardship programs, indicating that the watershed is collectively moving in the right direction in terms of advancing stewardship.

- **Comprehensive strategy for nutrient management**



Nutrients emanating from agricultural and residential land uses were identified in all documents as significant threats to watershed health. The Sylvan Lake Water Quality Study (2005) suggests the development of an adaptive nutrient management strategy as a key initiative to minimize the introduction of nutrients to the lake. However, no such plan has been developed to date. The development of the CEMS Plan for the Sylvan Lake watershed, through the implementation of triggers, limits, and additional monitoring, is an important step in achieving a coordinated, science based approach to nutrient management in conjunction with education and incentive programs.

3.3.2 Lacombe County

Lacombe County's Area Structure Plan (ASP) for Sylvan Lake adopts an adaptive management approach to future residential development by establishing a development phasing process based on water quality monitoring. The ASP sets a limit on the number of dwelling units allowed within the ASP boundary, and outlines a plan for stepwise development in phases based in part on water quality as an indicator of development capacity. The County's MDP and ASP generally provide forward-thinking provisions for higher density and cluster residential developments near the lakeshore as a means of reducing human footprint and maximizing the amount of open space to be preserved. These measures are intended to reduce nutrient inputs to the lake, enhance erosion control and storm water management, and maintain lake water levels while operating within the carrying capacity of the watershed.



Boating is a popular activity on Sylvan Lake



Invasive quagga mussels



Livestock (Image source: Creative Commons, 2014)



Shoreline residential development on Sylvan Lake

It should be noted, however, that the premise of the Sylvan Lake ASP plan for step-wise development should also consider lake loading data sampled from the tributaries of Northwest Creek and Golf Course Creek. As discussed in the previous pages of this report (Section 2.2), land use impacts are not evident in three decades of water quality data (concentrations of TN and TP analyzed in composite water quality samples collected from the lake). Due to the complexity of nutrient cyclin on Sylvan Lake, the lake water quality data bear no signature of land use change. The tributaries, in contrast, are more sensitive to land use inputs and are therefore considered to be more reliable indicators of lake health in response to land use change. Using water quality measurements from Northwest Creek and Golf Course Creek, rather than samples from the lake itself, may provide a more accurate reflection of incremental land use impacts to water quality, and should therefore be considered as additional indicators when gauging development capacity.

Lacombe County also provides several environmental programs to help farmers reduce erosion through shelterbelts, soil erosion control, and riparian management; however efforts could be made within the County to match the same level of environmental programming as in Red Deer County. As with Red Deer County, Lacombe County would benefit from targeting environmental programs to make the most effective and efficient use of available funding. Suggested missing components and opportunities for improvement include:

- **Additional Environmental Support and Education Programs**

In the interest of consistent management and optimum environmental stewardship across the municipalities of the Sylvan Lake Watershed, it is recommended that Lacombe County strive to match the same level of environmental programming (with regard to managing water quality) as in Red Deer County. This includes the addition of the following key programs to Lacombe County's environmental program repertoire: Alternative Land Use Services (ALUS) program, Green Acreages Program, Grazing and Riparian Management Program, and the facilitation of more Environmental Farm Plans within the watershed. In addition, while Lacombe County has organized and supported a number of workshops on environmental topics and has a dedicated Environmental Coordinator on staff to focus on environmental issues and initiatives, the availability of outreach programs focusing on water quality improvements in the Sylvan Lake watershed is currently lacking in comparison to those offered by Red Deer County. Additional efforts to promote stewardship amongst residential landowners and agricultural producers could go a long way to enhance lake and watershed health.

- **Payment incentives for environmental stewardship**

It is recommended that Lacombe County explore incentive programs as an option to promote active watershed stewardship. Establishing a system of payments to reward land owners who adopt beneficial management practices on their land may help actively promote behavioral change and environmental stewardship in the Sylvan Lake watershed. Incentives of this kind are currently being tried in Red Deer County for wetland conservation, with payments to landowners for restoration of environmental services. Payments, or possibly tax credits, can be used to incentivize the implementation of Environmental Farm Plans and Nutrient Management Plans. It has been noted however by some conservation professionals that payments are more effective than tax credits because it sends a more positive reinforcing message to willing land owners (Clarke, Personal Communication, 2015). Payments should be offered to landowners who actively implement their Environmental Farm Plans (as opposed to simply writing them). Funding to support a system of payments can be derived from grants.

3.3.3 Red Deer County

Red Deer County's initiatives exhibit a strong focus on agricultural management. The County has several education and incentive programs designed to promote sustainable farming practices among the agricultural producers in the County, as well as programs in place to help producers secure funding to support conservation projects. In 2014 alone, the County assisted 17 producers in applying for \$150,000 in Growing Forward 2 funding for 28 different agro-environmental BMP projects on their land (Lewis, Personal Communication, 2015). However, the County would benefit from targeting these environmental programs to make the most effective and efficient use of available funding while addressing environmental issues that influence the lake with more precision.

Red Deer County also conducted an inventory of the environmentally significant areas (ESAs) in the County. This ESA Inventory is important since a significant portion land area owned by Red Deer County that falls within the Sylvan Lake watershed is an ESA. The Red Deer County MDP provides policies for ESA management in a more general sense, while the Red Deer County Land Use Bylaw Section 48.a provides more specific management policies for the Sylvan Lake ESA. Suggested missing components and opportunities for improvement include:

- **Targeting of environmental education and incentive programs**

While Red Deer County boasts an impressive collection of environmental programs, these programs are generally not applied in a targeted fashion. Red Deer County, in collaboration with the other seven municipalities of the watershed, should develop a list of priority areas for conservation and restoration as a basis for focusing the application of resources and programs on areas, features, and behaviors that have the most impact on lake and watershed health.

- **Septic holding tanks for all new developments**

In Lacombe County, all new multi-lot developments are required to connect to the regional waste water line. Lacombe County requires holding tanks for all existing multi-parcels lakeshore residential development. Red Deer County should also consider implementing this practice within the Sylvan Lake watershed.

3.3.4 Town of Sylvan Lake

The Town of Sylvan Lake has developed a number of initiatives that strive to balance the need to accommodate future residential and recreational while protecting shoreline integrity and lake water quality. In particular, the Sylvan Lake Municipal Sustainability Plan outlines several actions for improving lake and watershed health, including recommendations for additional education and incentive programs to promote sustainable lawn care, water conservation, and recreational use practices amongst residents of Sylvan Lake. However, given the amount of developed land, and potentially developable land in and around the Town, the Town's Growth Management Strategy should have a stronger focus on maintaining watershed health in the context of growth.

It is important to note that most of the industrial development within the Town of Sylvan Lake is outside of the eastern watershed boundary. Land use changes in this area will not affect Sylvan Lake. However, commercial development along Highway 11 on the southern edge of the watershed could potentially affect the lake. For the purposes of this report, the following gaps and recommendations pertain only to areas of the Town of Sylvan Lake that exist within the Sylvan Lake Watershed. Suggested missing components and opportunities for improvement include:

- **Golf Course integrated environmental management**

Given that Golf Course Creek flows through agricultural lands and then a golf course before entering into the lake, surprisingly few management considerations or best practices have been published for this area. In the documents reviewed for this gap analysis, little to no information was provided to help guide sustainable management of the riparian area along the creek or fertilization and weed control practices on the golf course that may impact lake water quality. Current practices on the Golf Course suggest that the area's contribution to nutrient loading is insignificant due to limited fertilization, however an environmental audit for the golf course, as well as a list of Best Management Practices for golf course management could be developed to guide future planning and management of golf course operations.

- **Environmental and invasive species education**

Given the number of tourists with boats coming through the Town, there is a greater need to develop an invasive species strategy to minimize the spread of zebra and quagga mussels, including boat inspections as well as education and promotional materials, such as fact sheets, to be distributed at key locations throughout Town. Implementing many of the education and incentive programs recommended by the Sylvan Lake Municipal Sustainability Plan would strengthen the Town's position on lake and watershed stewardship while providing resources to influence and change public behavior patterns that can negatively impact the lake.

- **Growth management**

Sylvan Lake's Growth Management Strategy says surprisingly little about maintaining lake and watershed health in the context of growth. The focus was placed more heavily on economic development, with less emphasis on the environment. Given the growth rates anticipated for the area, it is important that growth management include stronger controls for residential development. An assessment of the impacts of surface coverage with buildings and linear structures has not been assessed, but should be to inform wise growth management. Stipulations for cluster development and application of conservation subdivision principles would help the Town reach its sustainability goals while accommodating additional development needs.

3.3.5 Summer Villages

With the exception of the Summer Village of Birchcliff's Open Space Plan, the Summer Villages surrounding Sylvan Lake generally do not have their own planning initiatives in place outside of Municipal Development Plans and Land Use Bylaws. Suggested missing components and opportunities for improvement include:

- **Stronger and more consistent standards for environmental protection in MDPs**

The Summer Village of Birchcliff's provides a good framework for understanding how the open space amenities of small communities, when properly planned and managed, can contribute to overall community and watershed health. Many of the actions provided in this plan, especially those surrounding the protection of natural areas, education and signage, stewardship incentives, and partnerships with surrounding municipalities, should be translated into MDP policies for all of the Summer Villages.

- **Environmental education for residential landowners – Fact Sheets**

The Summer Villages, with the support of the SLMC, the SLWSS, and Cows and Fish, could provide homeowners with tools for improving lake and watershed health on a voluntary basis through

the distribution of fact sheets. Fact sheets may be distributed to shoreland property owners, lake association members, handed out at meetings or information booths, and may be reproduced as pages in newsletters or included with mailings such as utility bills or tax statements. These fact sheets can include sustainable lawn care techniques, shoreline conservation techniques, guidelines for safe pesticide and fertilizer use, invasive species management, and water conservation strategies. Fact sheets may be an excellent way to leverage word-of-mouth communication and volunteer resources of these smaller tight knit communities.



4.0 Implementation Actions



Sylvan Lake waterfront (Image source: Creative Commons, 2014)

Based on the findings of the gap analysis, the following priority actions for implementation strive to fill the voids in environmental and land use management within the Sylvan Lake watershed, while meeting the water quality related objectives of CEMS Phase 1. Implementation actions are organized according to the Phase 1 Outcome they fulfill. Likewise, the water quality related objectives addressed in each action are specified as a means of demonstrating how Phase 1 objectives directly informed the development of targeted implementation actions. The details of each action item below, including scope, audience, and estimated resources, are intended to provide the SLMC with base information for grant applications to fund individual projects. The information may also help the SLMC develop more comprehensive Requests for Proposals (RFPs) to be issued for each action as funding becomes available. Each implementation action is organized according to the following component headings:

- **Applicable to:** identifies specific municipalities that would benefit the most from a proposed action
- **Scope:** describes the intention and essential components of each action
- **Estimated Resource Requirements:** an estimation of the staff, time, and budget required to complete a proposed action. Budget estimates were based on average hourly rates for consulting services and/or average annual salaries for municipal government employees (Government of Alberta, 2014) combined with time allocation estimates based on professional experience with projects of similar scope and scale.
- **Potential Funding Sources:** for certain actions, potential funding sources have been listed as a starting point for acquiring monetary support

It is worth noting that, prior to the initiation the CEMS project, the Sylvan Lake Water Quality Study (2005) identified a number of recommendations based on the outcome of the study. These recommendations have been incrementally addressed through the development of the CEMS project. For example, the Sylvan Lake Water Quality Study recommended the establishment of specific targets and thresholds for the watershed reflecting a desired level of protection. This was undertaken in the CEMS Phase 1 report and the established targets and thresholds have been carried forward in this Phase 2 implementation plan. The study also recommended the provision of an iterative framework or tool to assist municipalities in managing resources, the implementation of management practices and initiatives to minimize nutrient loading to the lakes, and the development of a monitoring program to ensure compliance with management objectives (developed in Phase 1). The implementation actions described in the following pages fully address these recommendations, while also fulfilling the needs of the watershed based on management gaps highlighted in the gap analysis. In summary, this chapter represents a culmination of efforts to improve water quality in the Sylvan Lake Watershed, starting with research and coming full circle to action.

4.1 Initiating Collaborative Planning

There is a clear need to ensure that all municipalities agree to work together toward the benefit of the Sylvan Lake watershed. Formalizing coordination among municipalities in the Sylvan Lake watershed is a high priority to ensure that the CEMS plan is effective. The following implementation action relates back to the CEMS Phase 1 Collaborative Planning Outcome. To achieve this outcome, it is recommended that the SLMC leverage the regional planning process to implement CEMS principles and goals through the creation of a Subregional Plan for the Sylvan Lake Watershed under the Red Deer Regional Plan.

4.1.1 Subregional Plan for the Sylvan Lake Watershed



Cumulative effects management is a critical component of the regional planning process. Alberta is shifting to a more effective and efficient management system that considers the cumulative effects of all activities and improves integration across economic, environmental and social dimensions of landscapes. This direction is the foundation of the Alberta Land-use Framework (LUF), which embodies a commitment by the Alberta government to manage the cumulative effects of development on air, water, land and biodiversity at the regional level (AESRD, 2015). The LUF and the *Alberta Land Stewardship Act* (ALSA) both call for a regional plan for each of seven watershed-based regions in Alberta to balance economic, environmental and social objectives.

The Sylvan Lake watershed would fall within the Red Deer Regional Plan. Regional plans integrate provincial policies at the regional level, set out regional land-use objectives and provide the context for land-use decision-making within the region, reflecting the uniqueness of the landscape and priorities of each region (AESRD, 2015). They are legal, enforceable public policy for the region. The Crown, government departments, local authorities, decision-makers, and the public must align plans and decisions with regional plans.

In some cases, detailed planning may be necessary within a region to address a subregional concern or specific issue, such as complex issues of land use and governance within a sensitive watershed such as the Sylvan Lake watershed. A binding watershed plan may take the form of a “sub plan” within the regional planning process under *ALSA*. As a subregional plan supported by the LUF and regional planning process, a subregional plan for the Sylvan Lake watershed would be an effective means of implementing enforceable planning standards, while coordinating resource and cost sharing amongst the eight municipalities of the Sylvan Lake Watershed.

Related CEMS Phase 1 Water Quality Objectives:

- Identify alignments and possible policy discrepancies or gaps among Municipal and Provincial and Federal governments

Applicable to:

- Lacombe County
- Red Deer County
- Town of Sylvan Lake
- Summer Villages

Scope:

Coordinating CEMS with subregional planning is an effective way to ensure that the CEMS system is implemented within the watershed (Unger, 2010). As a sub-plan under the Red Deer Regional plan, the subregional plan for the Sylvan Lake watershed would provide regulatory leverage to ensure that CEMS goals are universally achieved across the municipalities of the watershed. The CEMS system for Sylvan Lake could be adopted for the subwatershed as part of the Red Deer Regional Plan. As a sub-plan within the Red Deer Regional Plan, the plan for the Sylvan Lake subwatershed would be binding on all levels of government (except the federal government and First Nations) (Unger, 2010). Therefore, the content of the sub-plan is not directly approved for implementation purposes by the municipalities of the watershed, but rather is dependent on cabinet approval, which can present difficulties with regard to autonomous decision making among the municipalities of the watershed.

Key steps in the development of a subregional plan under the LUF include an inventory of existing landscape features, values, and pressures, an assessment and analysis of difference development scenarios, development of planning options, implementation strategies, and monitoring and evaluation schedules. As a first step toward initiating a comprehensive, knowledge-based subregional planning process, conducting an Environmentally Significant Areas (ESA) Inventory would provide the base information necessary to inform highlight priority areas for conservation and management. CEMS triggers and limits developed in the CEMS Phase 1 report could then be leveraged to gauge the viability of planning and development scenarios within the parameters of the ESA Inventory findings.

Other Options:

- *Intermunicipal Development Plan (IDP)*

IDPs are recommended for municipalities that share a shoreline by the Government of Alberta Land Use Policies. Under the *Municipal Government Act (MGA)* municipalities are encouraged to develop Intermunicipal Development Plans to direct coordinated development across jurisdictions. The *MGA* requires that an IDP provide:

- a. A procedure to be used to resolve or attempt to resolve any conflict between the municipalities that have adopted the plan
- b. A procedure to be used, by one or more municipalities, to amend or repeal the plan, and
- c. Provisions relating to the administration of the plan
- d. A cost sharing structure and agreement

- *Memorandum of understanding*

As part of the CEMS Plan, all municipalities (and other levels of government) may enter into a memorandum of understanding that would establish expectations for the watershed. To be effective, the memorandum should indicate the commitment of the signatories to the process of producing uniform bylaws for the watershed.

Estimated Resource Requirements (Subregional Plan):

- Estimated cost/staff time: \$75,000
- Consultant Required (Y/N): Yes. The Government of Alberta provides leadership in the development of subregional plans.

4.2 Supporting an Environmentally Healthy Watershed + Lake

The following implementation actions are recommended for consideration to promote an environmentally healthy watershed and lake.

4.2.1 Development Controls

Further urbanization of the perimeter of Sylvan Lake will affect stormwater runoff pulses and reduce infiltration. Reduced infiltration has the potential to affect the groundwater inventory of the watershed. The focus of this section therefore is on urban development controls to reduce surface runoff, preserve natural areas, and enhance green infrastructure within the communities surrounding Sylvan Lake. This section also recommends actions for enhancing the knowledge base of the watershed to further inform wise land use planning and decision-making.

It has been noted in previous studies that future developments must proceed with a “minimum nutrient contribution” policy to ensure the on-going health and sustainability of the lake (AXYS Environmental Consulting, 2005). Modern construction methods and landscaping techniques, when properly applied, can prevent stormwater and nutrient flows from reaching a body of water. If such flows associated with new development can be directed to safe storage and treatment areas away from the lake, then one of the most significant sources of water quality contamination can be removed (Lacombe County, 2010).

To achieve a “minimum nutrient contribution” policy, the following list of urban development controls is intended to provide municipalities with tools for improving watershed management in the context of existing and proposed development. These recommendations may be adopted either wholesale or a la carte into a regulatory Land Use Framework for the watershed (such as a subregional plan for the watershed), or into updated Municipal Development Plans or Area Structure Plans for individual municipalities.

Related CEMS Phase 1 Water Quality Objectives:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Applicable to:

- Lacombe County
- Red Deer County
- Town of Sylvan Lake
- Summer Villages

Scope:

Red Deer County, the Town of Sylvan Lake, and the Summer Villages, with support from the SLMC, should adopt more rigorous residential and commercial development controls as a means of collectively improving watershed health. It is important to note that development controls and sustainable patterns of development may be very different in rural versus more urban municipalities. In more rural

municipalities, where there are density requirements are not as high, open space provisions can be an effective way of reducing surface runoff and nutrient contributions to the lake. In more densely populated municipalities, such as the Town of Sylvan Lake, development controls may take on a different role, such as provisions for on-site stormwater management and minimum setbacks from waterways and water bodies.

Lacombe County already has a great number of development controls in place through the Sylvan Lake ASP. Many of the policies put forth in the ASP are progressive and should be modelled by surrounding municipalities in the watershed, including the concept of development phasing within a defined capacity. Future development in the watershed is a reality. Lacombe County has taken steps to develop a plan to coordinate informed development based in part on using lake water quality data as indicators of development capacity. Tributary water quality data should also be considered alongside water quality data drawn from the lake itself when attempting to gauge development impacts to the lake. The tributaries of Sylvan Lake (Northwest Creek and Golf Course Creek) are far more sensitive to land use change than the lake, and are therefore better indicators of development impacts in the watershed (refer to Section 2.2 for more information). It is important to note however, that even with the inclusion of tributary water quality data, there isn't one obvious solution for safeguarding water quality in the context of a developing watershed. For example, the Summer Village of Birchcliff, where development pressures are high, is not in the subcatchment of a tributary to Sylvan Lake. Therefore, it is difficult to gauge the contribution of development in this area to incremental nutrient loading to Sylvan Lake. This example illustrates the need for all municipalities in the Sylvan Lake watershed to approach future development with extreme caution. In the absence of empirical data as a clear indicator of the lake's capacity for development, it is recommended that the municipalities of the Sylvan Lake watershed work within the confines of the precautionary principle to implement progressive development controls and promote watershed stewardship to maintain lake water quality into the future.

The following development controls can be considered for incorporation into their Municipal Development Plans and/or future Area Structure Plans. This list is intended to serve as a starting point from and is by no means exhaustive. Individual municipalities may need to tailor these recommendations to suit their individual needs. Staff time and resource requirements for each item are difficult to determine given that the cost of implementation is dependent on the circumstance under which each item may be adopted.

Studies

- Municipalities should consider conducting an Environmentally Significant Areas (ESA) Inventory to prioritize development away from intact natural areas (such as forested lands and wetlands) that are important to upholding lake and watershed health (refer to action 4.2.2).

Strategies

- Explore the possibility of requiring a reporting standard, Sustainability Screening Report (SSR), from all developers looking to get new zoning within the watershed. The report shall indicate how the "triple bottom line" (social, environmental, and financial) is being achieved for each proposed rezoning.

- Develop an inventory on the number of functioning and legacy septic fields in existence
- Explore the potential for a Construction Water Conservation Bylaw to require water conservation plans for each development permit application, establishes plumbing efficiency standards, requires rain barrels, and dictates landscape standards (Sylvan Lake Municipal Sustainability Plan, 2010).
- Develop and implement an environmental planning checklist to determine whether greater levels of environmental planning and assessment are required for the development application:
 - a. Ensure that all development applicants have completed the Environmental Planning Checklist as part of the development application.
 - b. Identify if a development application requires pre-consultation. Pre-consultation should be undertaken if an application is located within an environmentally sensitive area (ESA) (see action item 4.2.2)
 - c. Undertake pre-consultation with applicants to identify any required environmental studies, opportunities to functionally integrate environmental values into site planning and design, and opportunities to use environmentally responsible building and / or landscape practices in development and building applications.
 - d. Ensure all costs associated with the completion of studies are borne by the applicant.
- Utilize the Riparian Setback Matrix Model (RSMM) to identify minimum setback requirements (threshold minimum of 30 metres) and ER dedication at the time of subdivision for new development and recreation uses along water courses and the shoreline of Sylvan Lake (see action 4.2.3)
 - a. Explore the potential to amend future waterfront development in the watershed adopting the RSMM
- Require developers to reclaim or remediate lands if the lands are in poor environmental or unsafe condition. Remediation must meet the technical requirements and standards of Alberta Environment and the Alberta Health Services, confirmed in writing to the satisfaction of the appropriate municipality.
- Consider and evaluate the cumulative effects of multiple land uses when reviewing and approving development applications. Require that development applications subject to greater levels of environmental assessment provide an evaluation of cumulative effects as part of the context analysis.
- Where not previously identified in an Area Structure Plan, require that applications for Multi-Lot Subdivisions establish run-off volume source control targets that comply with criteria identified for the watershed
- Require that applications for Multi-Lot Subdivision and Major Development demonstrate how the proposed development meets run-off volume source control targets, established either through an ASP or through the application for development permit process.

Estimated Resource Requirements:

- Estimated cost/staff time: N/A (see action 4.2.2. for estimated costing for ESA Inventory)
- Consultant Required (Y/N): No



4.2.2 Environmentally Significant Areas (ESA) Mapping Inventory

It is recommended that the municipalities of the Sylvan Lake Watershed consider collaboratively supporting an Environmentally Significant Areas (ESA) Inventory for the watershed to identify hotspots of ecological value and concern that are essential to maintaining lake water quality. ESAs are identified using on a multi-criteria modelling process to overlay data for multiple landscape values such as biodiversity, wetlands, surface water, groundwater, soils, and slopes. These values combine to generate a gradient map of overall environmental value with ESAs as critical nodes- or indispensable patterns- in the landscape. The value of an ESA inventory lies in the premise that if these indispensable patterns (ESAs) are properly conserved and managed, the majority of ecological functions in the landscape will remain intact.

It is important to note, however, that once identified ESAs do not carry any inherent level of environmental protection. Rather, they function as flags in the landscape indicating that greater levels of assessment are needed, and that specific management practices or protection measures may need to be implemented in these areas based on the outcome of the assessment. As such, the completion of an ESA Inventory may help municipalities prioritize development away from intact natural areas and other potentially environmentally significant areas that are important to upholding lake and watershed health. The inventory may also assist municipal environment extension and education program staff in targeting the application of various environmental education and incentive programs, such as conservation easements, potential environmental reserve dedication, and Environmental Farm Plans, to name just a few.

In the context of the Sylvan Lake watershed, remaining wetlands and forested patches around the lake are highly sought after for residential or acreage development. Continued loss and alteration of remaining fragments of habitat in the Sylvan Lake watershed may, over time, produce habitat patches too small and isolated to permanently sustain populations of some wildlife species (ISL Infrastructure Ltd., 2003). The loss of large forested patches, wetlands, and healthy riparian areas also have implications for lake water quality and quantity. It is therefore recommended that the SLMC consider conducting an ESA Inventory to help prioritize planning and management decisions around areas critical to upholding lake and watershed health.

Related CEMS Phase 1 Water Quality Objectives:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Applicable to:

- Lacombe County
- Town of Sylvan Lake
- Summer Villages

Scope:

It is recommended that the SLMC acquire funding to support a watershed-wide ESA Inventory as a priority action item for cumulative effects management. ESAs identified in the Red Deer County Environmentally Significant Areas Inventory (2011) should be incorporated into the watershed-wide ESA inventory for the Sylvan Lake watershed. The process of developing an ESA Inventory typically consists of the following components:

- A detailed inventory of all environmentally significant areas (ESAs) in the watershed, with each ESA ranked as being locally, regionally, nationally, or international significant in terms of rareness, sensitivity, and significance in the context of the broader landscape. Each ESA should also be categorized, from high to low according to its sensitivity to environmental disturbance. The location and relative significance ESAs should be mapped.
- An information sheet should be prepared for each ESA, complete with site location, land status, major biophysical features, level of significance, sensitivity, and management considerations specific to the ESA.
- Field verification and public consultation should be undertaken to confirm the validity of the mapping exercise.
- Management considerations should be developed for each ESA, accompanied by best management practices for environmental stewardship to be applied on all lands throughout the watershed.
- Once an ESA Inventory is completed, it is recommended that municipalities require the completion of a Biophysical Assessment for all development permit applications falling within or in close proximity to an established ESA.

Estimated Resource Requirements:

- Estimated cost/staff time: \$75,000 - \$80,000
- Consultant Required (Y/N): Yes



4.2.3 Riparian Setback Matrix Model

As indicated in the Sylvan Lake Water Quality Study (2005), surface streams are the predominant contributors of Total Phosphorus and Total Nitrogen to Sylvan Lake. Many of the larger streams that intersect a variety of upstream land uses (predominantly agricultural areas) carry high nutrient loads before reaching shoreline areas. Golf Course and Northwest creeks tend to exhibit the most prolonged flows throughout the year, and so tend to make the largest contributions to the nutrient budget of Sylvan Lake (AXYS Environmental Consulting, 2005). It is therefore important to conserve and enhance the quality of riparian areas, as well as wetlands and other natural areas within the Sylvan Lake Watershed as a means of filtering nutrients before they enter into waterways.

The Riparian Setback Matrix Model (RSMM) is a tool used to determine site specific setbacks for new developments and Environmental Reserve (ER) dedication at the time of subdivision. The RSMM creates unique, defensible setbacks based on slope, height of bank, groundwater table level, and vegetation/ground cover, groundwater risk/susceptibility, soil type, texture, and wildlife habitat requirements. These development setbacks help to protect riparian lands, maintain water quality, and support biodiversity. When adopted and implemented by municipalities, the RSMM provides a scientifically- and legally-defensible method for determining setbacks from waterbodies. Moreover, the RSMM has been recognized as an example of beneficial management practices for development near waterbodies (Alberta Environment and Sustainable Resource Development, 2012). The tool ensures adequate protection of the aquatic environment while maximizing the developable area of a property. It is recommended that all municipalities adopt and require the use of this tool for determining setbacks for new developments and Environmental Reserve (ER) dedication at the time of subdivision. As a condition of the RSMM, a minimum setback threshold of 30 metres would be built into the tool to ensure consistency with current setback policies.

Related CEMS Phase 1 Water Quality Objectives:

- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Applicable to:

- Town of Sylvan Lake
- Summer Villages
- Lacombe County
- Red Deer County

Scope:

The municipalities of the Sylvan Lake watershed should collaboratively invest in the development and implementation of a Riparian Setback Matrix Model (RSMM) tailored specifically to the water quality objectives (CEMS Phase 1) and conditions of the Sylvan Lake Watershed. In riparian areas, the Municipal Development and Subdivision Authorities of the Town of Sylvan Lake and the Summer Villages of the Sylvan Lake watershed should require the use of the RSMM to determine site specific setbacks for new developments, and Environmental Reserve (ER) dedication at the time of subdivision. An RSMM should be developed by a qualified hydrologist or environmental consultant. Going beyond the 30m minimum setback, the RSMM ensures additional protection of sensitive riparian environments thorough the determination of variable width buffers tailored to the conditions of the land.

Streams that intersect shoreline development areas may experience additional nutrient loading from these sites. To prevent such incremental loading, the Sylvan Lake Water Quality Study (2005) recommended a “no development” protection zones around these riparian areas in the context of future development. Lacombe County has developed guidelines for residential developments (Lacombe County, 2010) designed to protect shoreline areas of the lake through ER dedication. However, the RSMM can be used to more precisely determine the extent and shape of an ER dedication to maximize both environmental protection and development potential. Use of the RSMM to determine setbacks for riparian areas and wetlands is particularly important along Honeymoon Creek, Golf Course Creek Birchcliff Creek, Northwest Creek, and the wetland tributaries southeast of the Sylvan Lake Natural Area.

Estimated Resource Requirements:

- Estimated cost/staff time: \$18,000 - \$20,000
- Consultant Required (Y/N): Yes



4.2.4 Agricultural and Rural Residential Education + Incentive Programs

Given the extent of agricultural land in the Sylvan Lake Watershed, the role of agriculture as a contributing factor to lake health must be addressed. Most of the agricultural land within the Sylvan Lake Watershed is in feed, grain, and oilseed crops, with some pasture and winter feedlot (Lewis, Personal Communication, 2015). Research has shown that agricultural practices can lead to the deterioration of surface water quality by contributing contaminants such as nutrients (i.e., phosphorus and nitrogen), pesticides, sediments, and fecal bacteria to surface water bodies (Lorenz, et al., 2008). Currently the primary source of nutrients to Sylvan Lake is from runoff/snow melt from agricultural operations (Lacombe County, 2010).

A critical factor is when the rains come in May and June—once crops start growing, applied fertilizers will not travel far. Therefore, the impact of agricultural activities on water quality largely depends on the timing of fertilization, the amount and distribution of land under cultivation, farming practices employed, as well as factors such as soil type, topography, and climate patterns (Lorenz, et al., 2008). Farmers who have been implementing sustainable practices on their land likely contribute very little to the nutrient balance of the lake. Awareness of environmental concerns has grown significantly across the agricultural communities Alberta, as is evident in the increased use of environmentally friendly practices such as no-till seeding and conservation tillage (Lorenz, et al., 2008).

In keeping with this overall trend, the following recommendations are intended to promote and facilitate widespread education and voluntary adoption of best practices on privately held agricultural lands and residential acreages in the rural lands of the watershed. Given the number of agricultural education and incentive programs already in place in Red Deer County, Lacombe County is targeted in this respect to balance the availability of program offerings in the two agriculturally dominated counties. However, Red Deer County's existing environmental education and incentive programs could benefit from more targeted application on lands and practices that most directly influence the health of the lake and watershed.

Related CEMS Phase 1 Water Quality Objectives:

- Work with stakeholders to empower stewardship of the lake and watershed

Applicable to:

- Lacombe County
- Red Deer County

Scope:

Education

The following list of education and incentive programs is intended to provide municipalities with tools for improving watershed management on a voluntary basis within developed residential and commercial areas. In addition to the recommendations provided below, the Cows and Fish program provides examples of several education programs and resources tailored to rural lands and watershed health (www.cowsandfish.org). The following recommendations may be adopted either wholesale or a la carte into update Municipal Development Plans or Area Structure Plans, or can be initiated independently at the discretion of individual municipalities.

- Municipalities, with the support of the SLMC, Cows and Fish, and the Sylvan Lake Watershed Stewardship Society (SLWSS), should develop fact sheets to circulate and display at key locations such as local hardware and gardening stores, recreation stores, campgrounds, and municipal offices. Individual fact sheets may be copied and handed out at meetings or information booths, and may be reproduced as pages in newsletters or included with mailings such as utility bills or tax statements.
 - b. BMPs for farmers located along the lake shoreline, wetlands, or riparian areas
 - c. Guidelines to promote biodiversity in riparian areas
 - d. Guidelines and resources for responsible nutrient management
 - e. Guidelines for erosion control on cropped land
 - f. Guidelines for safe and responsible pesticide use and natural pest control alternatives
 - g. Links between crops and healthy riparian and aquatic habitat within the watershed
 - h. Conservation and restoration guidelines to protect streambanks and shorelines
 - i. Invasive species management guidelines
 - j. Benefits of conservation easements

Partnerships

- Lacombe County should explore the possibility of partnering with farmers and local leaders to conduct workshops on sustainable farming during an “environmental action” month.
- Lacombe County should consider partnering with Cows and Fish to develop targeted BMPs and provide workshops for farmers on erosion control practices, nutrient management, and environmental farm planning.
- Red Deer and Lacombe County should explore the possibility of partnering with interested land owners, a regional land trust, and the Alberta Land Trust Grant Program to facilitate conservation easements on private land. It is recommended that the County prioritize lands for conservation and through easements and other conservation mechanisms (e.g. environmental reserves) by conducting an Environmentally Significant Areas (ESA) Inventory. Conservation Easements are recommended where the landowner can benefit by retaining ownership of the land or some property tax reductions, and the municipality can benefit by not having to manage small parcels of land.

Incentives

It is recommended that the following environmental incentive programs be considered for adoption by Lacombe County as a means of supporting landowners with stewardship goals who may not have the means to enact sustainable practices on their own. When considering establishment of any of these programs, it is important to first confirm and build administrative interest and support from Council. Partnering with a local or regional non-governmental organization (NGO) to advertise and promote a pilot program, coupled with local advertising with forage associations and newspapers can help build community interest and support for a pilot initiative. Funding for these initiatives comes primarily through grants. A list of potential funding sources to support these programs is listed at the end of this section. Lastly, it is recommended that all incentive programs include a monitoring component to track success in terms of water quality improvements where feasible (e.g. stream sampling adjacent to exclusion fencing) and incremental behavioural change among users (e.g. user survey). As an example, the ALUS program in Red Deer County currently measures its success through riparian health assessments at project sites both before and after project establishment (3-5 years after) (Lewis, 2015).

- *Alternative Land Use Services (ALUS) Program*

Red Deer County launched an ALUS program in 2013, and has been quite successful. ALUS is a community-developed, voluntary, farmer-delivered program that provides support to agricultural producers to enhance and maintain ecosystem services. ALUS pays farmers to retain and reconstruct natural areas such as wetlands, grasslands, riparian areas and trees, with the goal of improving water quality, biodiversity, and watershed health (ALUS, 2014). The program establishes a cost sharing agreement with interested producers, with a typical 70/30 cost share between the County and the producer, respectively (Clarke, Personal Communication, 2015).

It is recommended that Lacombe County launch an ALUS program to match the services provided to producers through the same program in Red Deer County. The case of Parkland County and Lac Ste. Anne County provides a good example of how the ALUS program has been leveraged to improve lake health through intermunicipal efforts. Parkland County established an ALUS program in 2012, and has since assisted numerous interested farmers improve the productivity and environmental quality of their lands, especially along riparian areas and waterbodies that influence the condition of Lake Isle. Recently, Lac Ste. Anne County has initiated an ALUS program of its own, with the goal of assisting farmers in reducing nutrient contributions to water bodies on their side of the Lake Isle. Together, ALUS programs in these two municipalities combine to promote wise land use and environmental stewardship on private lands to improve the overall health of Lake Isle.

- *Green Acreages Program*

Red Deer County has already launched a Green Acreages Program. The program supports rural land owners in adopting practices that will reduce environmental hazards and protect the environmentally sensitive features (such as wetlands) of their property. A 60/40 cost share up to \$3,000 is available to land owners interested in taking action to enhance environmental stewardship on their property. It is recommended that Lacombe County look into launching a Green Acreages program so rural landowners within the Sylvan Lake Watershed can take advantage of the program's benefits.

- *Grazing and Riparian Management Program*

Red Deer County has established a program to provide information and resources to producers on managing their pastures, native range and riparian areas. The program intends to help producers simultaneously maximize productivity and environmental health. Riparian Health Assessments and Range Health Assessments are conducted for interested producers. The program also includes a "try-before-you-buy" initiative, allowing farmers and ranchers to borrow and test out innovative materials and technologies before purchasing them. It is recommended that Lacombe County look into launching a similar program so ranchers within the Sylvan Lake Watershed can take advantage of the program's economic and environmental benefits.

- *Nutrient Management Extension Programming and Environmental Farm Plans*

Several studies of Sylvan Lake water quality have cited the need for a Nutrient Management Strategy to help protect the lake and watershed (AXYS Environmental Consulting, 2005; ISL Infrastracutre Ltd., 2003). Given the extent of agricultural land use in the watershed, is recommended that the

municipalities with the largest agricultural land base in the watershed—Lacombe and Red Deer Counties—address the contributions of agricultural activities to the nutrient balance in Sylvan Lake. As Red Deer County has demonstrated, this can be accomplished by facilitating the development of Nutrient Management Plans (NMPs) in partnership with interested producers. Red Deer County has successfully conducted nutrient management education (extension) programming, emphasizing the link between agricultural practices and water quality. This work has included considerable extension programming in partnership with Cows and Fish. In addition, Red Deer County has supported many farmers and ranchers in developing and implementing Environmental Farm Plans (EFPs). It is important to note that EFPs and NMPs are only effective when implemented, rather than simply written. Cost sharing and/or payments to land owners should be made available to producers who actively implement their EFPs and/or NMPs.

For EFPs (which very often contain a nutrient management component), only trained Environmental Farm Plan technicians are able to provide the technical assistance required to develop the plan. Typically, larger farms and ranches in Alberta will hire a consultant to help develop and implement an NMP. However, on smaller farms or ranches, hiring a consultant is often not feasible or necessary given the scale or nature of the operation (Lewis, Personal Communication, 2015). In these cases, Alberta Agriculture has developed tools for interested smaller scale farmers and ranchers to develop and implement their and NMP on their own (Alberta Agriculture and Rural Development , 2008).

Potential Funding Sources:

- *Red Deer County Conservation Partners Program*

Under the Conservation Partners Program, which is funded by the Alberta Conservation Association and private donations, Red Deer County landowners can apply for funding to help them conduct various projects on their land that benefits the environment. Producers can receive up to \$5,000 per project.

- *Red Deer County Alternative Land Use Services (ALUS) Program*

In addition to providing funding and technical resources to farmers and ranchers adopting environmentally beneficial practices (including nutrient management practices); ALUS provides annual payments for ecosystem services provided to producers who adopt conservation practices on their lands.

- *Growing Forward II On-Farm Stewardship Program*

Federal Growing Forward II Funding is available to finance the completion of NMPs through the On-Farm Stewardship Program. The On-Farm Stewardship Program is designed to support the implementation of beneficial management practices (BMPs) that reduce the risk of agricultural contaminants entering surface and ground water supplies. The Program provides financial support to active producers for the implementation of approved projects that minimize impacts on water supply and quality. The maximum funding an applicant can receive from the On-farm Stewardship Program is \$50,000.

- *Growing Forward II Agricultural Watershed Enhancement & Watershed Resiliency + Restoration Program*

This program facilitates the delivery of targeted, comprehensive extension programs, increased uptake of wetland restoration and riparian health beneficial management practices (BMPs), and the realization of significant and measureable changes within high risk watershed areas. The program, at its heart, is focused on addressing water quality issues. This program will encourage watershed groups, municipalities, and/or industry organizations to develop implementation plans targeting the adoption of BMPs related to surface water quality by producers in high risk areas. This program could be leveraged to finance education and outreach campaigns, and to develop educational materials, resources, and BMPs to assist agricultural producers in enhancing their environmental stewardship contributions. Red Deer County has applied for funding from this program for two large projects, and is partnering with another organization on a third application to the program (Lewis, Personal Communication, 2015). Lacombe County producers could also benefit from the support offered through this program.

Estimated Resource Requirements:

- Estimate cost: Two full time staff per County
- Consultant Required (Y/N): No



4.2.5 Urban Education and Incentive Programs

As discussed in the context of development controls, future urbanization around Sylvan Lake has implications lake health. Increased stormwater runoff and reduce infiltration resulting from impermeable surfaces are two of most significant contributors of urbanization to nutrient loading in the lake. Efforts can be made by individual home owners, business owners, and recreational users to reduce surface runoff, preserve natural features, and enhance green infrastructure within the communities surrounding Sylvan Lake. When a community works together, the cumulative effects of individual efforts and behaviors pay big dividends on a watershed scale. The following incentive programs are recommended for development and implementation by all municipalities in the Sylvan Lake Watershed in an effort to improve opportunities for voluntary stewardship on lands with residential, commercial, and recreational land uses.

Related CEMS Phase 1 Water Quality Objectives:

- Work with stakeholders to empower stewardship of the lake and watershed

Applicable to:

- Lacombe County
- Red Deer County
- Town of Sylvan Lake
- Summer Villages

Scope:

The following list of education and incentive programs is intended to provide municipalities with tools for improving watershed management on a voluntary basis within developed residential and commercial areas. These recommendations may be adopted either wholesale or a la carte into update Municipal Development Plans or Area Structure Plans, or can be initiated independently at the discretion of individual municipalities.

Education

- Municipalities, in collaboration with the SLMC, the Sylvan Lake Watershed Stewardship Society (SLWSS), and Cows and Fish, should develop fact sheets to circulate (as appropriate) and display at key locations such as local hardware and gardening stores, recreation stores, campgrounds, as well as municipal offices. Fact sheets may be distributed to shoreland property owners, lake association members, local elected officials, technical staff, and other decision makers. Individual fact sheets may be copied and handed out at meetings or information booths, and may be reproduced as pages in newsletters or included with mailings such as utility bills or tax statements.
 - a. BMPs for landowners located along the lake shoreline, wetlands, or riparian areas
 - b. Sustainable lawn care techniques
 - c. Shoreline conservation techniques
 - d. Riparian conservation techniques
 - e. Guidelines for safe and responsible pesticide use and natural pest control alternatives
 - f. Low Impact Development (LID) guidelines for developers
 - g. Conservation subdivision guidelines for developers
 - h. Energy conservation guidelines for developers and residents
 - i. Invasive species management guidelines
 - j. Aquatic invasive species management (quagga mussels) for recreational boat owners
 - k. Safe fuelling procedures for cottage and boat owners
- It is recommended that the SLMC, in partnership with the SLWSS, produce a seasonal lake newsletter to keep landowners and residents informed of current lake management practices, programs, educational opportunities, and development updates (ISL Infrastracutre Ltd., 2003).
- Provide environmental stewardship education packages for land owners living adjacent to environmental reserves and the lake.
- When ER provides for recreation uses around the lake, municipalities could install interpretive signs to raise the profile of ecosystem services and potential risks in those areas.
- The SLMC should explore an environmental awareness branding strategy for the watershed.

Partnerships

- It is recommended that Lacombe County and the Town of Sylvan Lake explore the possibility of partnering with local retailers to conduct workshops on green home and landscape improvements during an “environmental action” month.
- It is recommended that municipalities actively partner with Cows and Fish to promote lakeshore health BMPs and provide workshops for residential home owners.

- It is recommended that municipalities continue to partner with the Central Alberta Recreation Lakes (CARL) Initiative to distribute fact sheets and information related to the impacts of recreational uses on lake and watershed health.

Incentives

- Where applicable, municipalities should explore the possibility of reducing permit fees or fast-tracked approval timelines for applications demonstrating green planning, design, building and/or landscape practices that:
- Conserve water use (e.g. gray water and/or rain water capture and re-use, installation of low-flow fixtures and water-efficient appliances);
 - a. Maintain water quality (e.g. application of low-impact development techniques such as rain gardens, stormwater planters, trenches, cisterns, and permeable pavement);
 - b. Enhance biodiversity (e.g. reduce habitat degradation and functionally integrate environmental values into site planning and design through conservation subdivision design or cluster development); or
 - c. Reduce energy use (e.g. application of alternative energy sources such as solar, wind and geothermal, installation of energy-saving appliances, installation of electric vehicle charging stations).
 - d. Municipalities should explore the potential for rebate programs for the purchase of water efficient fixtures. See Town of Sylvan Lake Toilet Rebate program as an example.

Estimated Resource Requirements:

- Estimated cost/staff time: One full-time staff member shared among the municipalities
- Consultant Required (Y/N): No



Educational signage for aquatic invasive species



Shoreline residential development

4.2.6 Research and Monitoring



Research and monitoring are essential parts of watershed management. Environmental monitoring is ongoing in the Sylvan Lake Watershed, thanks to efforts coordinated by the Sylvan Lake Watershed Stewardship Society (SLWSS) and ESRD, however both historical and baseline data indicate that there is no defensible link between land use and environmental response on Sylvan Lake. Additional research and ongoing monitoring efforts are needed to better understand this relationship. Partnerships with external organizations, such as the University of Alberta, to support a student in conducting their thesis or dissertation through an SLMC research grant may be an effective way of initiating deeper investigations into the potential impacts of land use on lake health. In addition, a water quality monitoring plan tailored to the unique conditions of Sylvan Lake should be developed by a professional limnologist, along with the establishment of a centralized information management system to track, store and retrieve lake and watershed monitoring data.

Related CEMS Phase 1 Water Quality Objectives:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Applicable to:

- Lacombe County
- Red Deer County
- Town of Sylvan Lake
- Summer Villages

Scope:

Water Quality Research – University Partnership

Monitoring efforts over the past 30 years have not indicated any significant changes in lake water quality as it relates to land use. Until this disparity is resolved, the application of CEMS triggers and limits as indicators of development capacity are limited. Partnering with the University of Alberta or the University of Calgary to financially support a doctoral dissertation looking into this issue may be an important step in better understanding the important relationship between land use and lake health. The SLMC has already set the precedent for such a partnership through its support of a master's thesis on groundwater contributions to Sylvan Lake in 2009. It is recommended that the SLMC consider supporting another research project to continue investigating the important relationship between water quality and land use in the context of cumulative effects management.

Potential Resources and Related Programs:

- *Alberta Lake Management Society (ALMS) Scholarship*

ALMS has created a scholarship to encourage and support students in disciplines related to lake or watershed management. Full time senior undergraduate or graduate students enrolled at Alberta universities or colleges are eligible to apply. The scholarship is intended to support students in the aquatic sciences, and related disciplines, and promote the objectives of the Alberta Lake Management Society (ALMS). The amount offered is \$2000.

Estimated Resource Requirements:

- Estimated cost/staff time: \$2,000-\$5,000 or more depending on project and available budget
- Consultant Required (Y/N): No

Riparian and Shoreline Health Assessments

Healthy riparian vegetation helps to filter, trap, and absorb nutrients, sediments, and pollutants in runoff before it reaches the lake. Using CEMS triggers outlined in the CEMS Phase 1 report, regular monitoring can help maintain vegetation within healthy parameters along the shoreline of Sylvan Lake. Riparian health has been monitored on Sylvan Lake in the past using a variety of techniques, including photo monitoring at key locations to track visual change over time (Figure 5). This work should continue, especially in areas experiencing increased development or land use change.

All on-the-ground environmental stewardship projects, such as the Alternative Land Use Services (ALUS) program, should be monitored using either photo-monitoring techniques, or Riparian Health Assessment techniques (or both) (Fitch & Ambrose, 2003). Consistent monitoring of ongoing restoration projects is important to tracking the success of certain programs, which has implications for applications for additional future funding to support future projects. Tracking the success of projects also generates additional data that can be added to a centralized information management system.

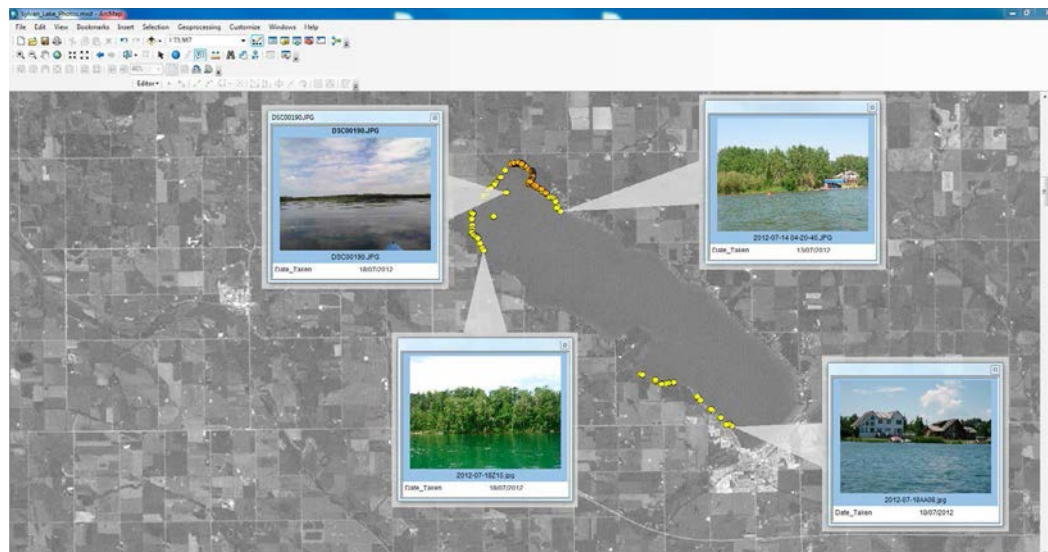


Figure 6. Geospatial photo monitoring tool (photos and data provided by Terrina Perley, ESRD)

Alberta ESRD has a collection of geospatially referenced photos with descriptive information about the state of the shoreline at the time that the photo was taken. Depending on the location, more than one year of data pertaining to the site is available. It is recommended that the SLMC build on this data base and tool as a way of tracking riparian health as an indicator of long-term lake and watershed health.

Estimated Resource Requirements:

- Estimated cost/staff time: \$40,000
- Consultant Required (Y/N): No

Water Quality Monitoring Plan

Given the complexity of nutrient cycling and land uses in the Sylvan Lake water shed, it is recommended that the SLMC consult a professional limnologist to develop a monitoring program with an agreed upon scope tailored to the unique conditions the watershed. A professional limnologist, in consultation with government experts, could work with the SLMC to develop a world-class monitoring program, schedule, and funding structure for the Sylvan Lake watershed that investigates and responds to the unique conditions, issues, and parameters of the lake. The water quality monitoring plan should build on the water quality indicators identified in the CEMS Phase 1 report (TP and TN). It should be comprehensive to the watershed, not just the lake, considering the tributaries in addition to Sylvan Lake itself.

Potential Educational Resources and Related Programs:

Once a monitoring plan is in place, leveraging the energy and enthusiasm of volunteers to conduct water quality monitoring (from tributaries and the lake) is a cost-effective way of collecting data while providing education and promoting awareness. The following programs, coordinated by the Alberta Lake Management Society (ALMS), can be implemented in the Sylvan Lake watershed to support citizen involvement in water quality monitoring efforts (ALMS, 2015):

- *LakeWatch*

LakeWatch is a volunteer-based water quality monitoring program coordinated by ALMS offered to Albertans who are interested in collecting information about their local lakes. ALMS technicians assist volunteers in testing the lake five times during the summer and collecting important data. Once data is collected, ALMS produces a LakeWatch Report for the lake which summarizes the data. LakeWatch reports can then feed in to educational and lake stewardship programs and materials to educate lake users and guide restoration and management efforts.

Alberta Water Quality Awareness Day

Alberta Water Quality Awareness (AWQA) is a province-wide program focused on increasing people's awareness and understanding of water quality and watershed health, through hands-on water quality testing. AWQA participants use water quality test kits to get outside and explore the health of their local waterways. Using their test kits, participants gather basic information about the health of Alberta's surface waterbodies and then contribute what they find to our online database and watershed map.

- *Citizen Science Programs*

The ALMS provides a number of resources and opportunities for residents to get involved in lake water quality monitoring, including the distribution of Secchi Disks to boaters to monitor water transparency, the IceWatch program to collect freeze and thaw data from lakes, and the Invasive Species Monitoring program to track the introduction and spread of zebra and quagga mussels.

- *Fact Sheets*

The ALMS provides a number of fact sheets on water quality monitoring parameters and lake nuisances to help educate lake users and volunteers on water quality issues and management.

Estimated Resource Requirements:

- Estimated cost/staff time: \$30,000 to develop a monitoring plan; \$100,000/year to carry out monitoring activities
- Consultant Required (Y/N): Yes for the development of the plan and guidance.
- Volunteer involvement in monitoring activities is encouraged.

Information Management System

Throughout the course of the CEMS project, the need for a centralized information database or library was emphasized repeatedly. An information management system for storing, retrieving, manipulating and disseminating data should be considered a high priority for storing and organizing the results of monitoring activities as they become available. The information management system should be designed to link data, to minimize information duplication, and to allow data queries to be made. The database should be accessible to all municipalities in the watershed. Maintaining such a database would likely require a part-time staff member at minimum.

Estimated Resource Requirements:

- Estimated cost/staff time: One part time staff member
- Consultant Required (Y/N): No



5.0 Conclusions and Priorities



An integrated and unified framework for decision making is required to ensure a consistent approach to watershed management. Currently, the Sylvan Lake watershed is governed by numerous and often disparate rules, regulations and policies across the eight municipalities of the watershed. The diversity of regulatory approaches to land use management and development among the municipalities of the watershed has posed a significant challenges to intermunicipal planning efforts in the past.

The CEMS Phase 2 Implementation Plan is founded on the water quality related objectives, triggers, and limits developed in the CEMS Phase 1 report. The implementation plan was also informed by a gap analysis of existing municipal watershed initiatives. The gap analysis organizes current efforts related to water quality in one place to shed light on the collective strengths and opportunities for improvement. This process pinpoints specific needs, and is therefore an important step in identifying priority actions that will close watershed-wide management gaps. In summary, the following actions are recommended to implement the water quality related outcomes and objectives of the CEMS plan. These actions are listed according to relative priority. They are categorized by CEMS Outcome and listed in order of importance with respect to estimated impact and how they may serve as stepping stones in the advancement of other future watershed protection initiatives.

Collaborative Planning Priorities



1. Subregional Plan for the Sylvan Lake Watershed

- **Priority:** Short Term (next 3-5 years)

Related Objective:

- Identify alignments and possible policy discrepancies or gaps among Municipal and Provincial and Federal governments

Coordinating CEMS with the regional planning process is an effective way to ensure that the CEMS system is implemented within the watershed (Unger, 2010). Therefore, it is recommended that the SLMC consider supporting the development of a subregional plan for the Sylvan Lake watershed. As a sub-plan under the Red Deer Regional plan, the subregional plan would provide regulatory leverage to ensure that CEMS goals are universally achieved across the municipalities of the watershed.

Environmentally Healthy Watershed and Lake Priorities



2. Environmentally Significant Areas (ESA) Mapping Inventory

- **Priority:** Short Term (next 3-5 years)

Related Objective:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

The development of an Environmentally Significant Areas (ESA) Inventory for the Sylvan Lake Watershed would make excellent use of the CEMS Phase 1 report indicators to target areas for conservation, management, and education.

It is recommended that municipalities collaboratively conduct an Environmentally Significant Areas Inventory for the watershed to identify hotspots of ecological value and concern. This exercise will help municipalities prioritize development away from intact natural areas and other areas that are important to upholding lake and watershed health. This will also assist municipal environment extension and education program staff in targeting the application of various environmental education and incentive programs, such as conservation easements, potential environmental reserve dedication, and Environmental Farm Plans, to name just a few.

3. Water Quality Research - University Partnership

- **Priority:** Short Term (next 3-5 years)

Related Objective:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Monitoring and research is an essential part of watershed management. Despite the fact that monitoring efforts over the past 30 years have not indicated any significant changes in lake water quality as it relates to land use, monitoring of Sylvan Lake must continue. Partnering with the University of Alberta or the University of Calgary to financially support a doctoral dissertation looking into this issue may be a cost-effective way of investigating the important relationship between land use change and lake health. The SLMC has already set the precedent for such a partnership through its support a master's thesis on groundwater contributions to Sylvan Lake in 2009.

4. Information Management Database

- **Priority:** Initiate in Short Term (next 3-5 years); ongoing and evolving as lake is sampled and more data is generated

Related Objective:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

A centralized database of monitoring and other information pertaining to the lake is needed to increase access and sharing of resources among the eight municipalities.

5. Education and Stewardship Initiatives

- **Priority:** Initiate in Short Term (next 3-5 years); ongoing and evolving as needs and public awareness change

Related Objective:

- Work with stakeholders to empower stewardship of the lake and watershed

Collective behavioral change is possibly the most effective measure of all in terms of supporting long term ecological health in any landscape. Yet it is also usually slow to take root and become part of the greater public consciousness. Therefore, it is important to continually initiate, improve, and adapt environmental education and stewardship programs in relation to changing social and environmental needs and patterns. Given the degree to which the actions of private land owners can collectively affect the watershed, a number of education and incentive programs and initiatives are recommended for adoption by municipalities, with the goal of raising awareness of watershed issues and enhancing opportunities for voluntary stewardship on privately owned lands.

6. Riparian Setback Matrix Model

- **Priority:** Medium Term (next 5-7 years), in conjunction with Municipal Development Plan Updates or the development of Area Structure Plans

Related Objective:

- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

All municipalities of the watershed should consider adopting a Riparian Setback Matrix Model (RSMM) tool to determine site specific setbacks beyond the 30 metre minimum from waterbodies for new developments and Environmental Reserve (ER) dedication at the time of subdivision. These development setbacks help to protect riparian lands, maintain water quality, and support biodiversity throughout the watershed.

7. Development Controls

- **Priority:** Medium Term (next 5-7 years), in conjunction with Municipal Development Plan Updates or the development of Area Structure Plans

Related Objective:

- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

To achieve a “minimum nutrient contribution” policy, it is recommended that municipalities adopt consistent urban development controls to manage the impacts of future development on the watershed. The recommendations provided in this report may be adopted either wholesale or a la carte into a regulatory land use framework for the watershed, or into updated Municipal Development Plans or Area Structure Plans for individual municipalities.

8. Water Quality Monitoring Plan

- **Priority:** Medium Term (next 5-7 years); to be reviewed and updated every 5 years upon completion

Related Objective:

- Understand the current watershed ecological health and risks to its health
- Improve management of the watershed
- Work to protect and enhance water quality in the watershed

Given the complexity of nutrient cycling and history of lake water quality monitoring on Sylvan Lake, it is recommended that the SLMC consult a professional limnologist to develop a monitoring program with an agreed upon scope tailored to the unique conditions the lake.



6.0 Additional Resources



The following resources can be referenced to supplement the information put forward in the implementation actions of this report. In particular, these resources should be referenced when developing educational materials and Best Management Practices (BMPs) tailored to the specific needs of the watershed.

6.1 Educational Materials

Fact Sheets

Cows and Fish Fact Sheets (Cows and Fish, 2014)

- Riparian Health Assessment and Inventory
- Invasive and Disturbance-caused Plants in Riparian Areas
- Invasive Weed and Disturbance-caused Undesirable Plant List
- Looking at my Lakeshore - Riparian Health Checklist
- Value of Wetlands
- Biodiversity and Riparian Areas-Life in the Green Zone
- Water Quality and Riparian Areas
- Economics of Riparian Areas
- Crops, Creeks and Sloughs - Tools for Riparian Management

Central Alberta Recreational Lakes (CARL) Initiative Fact Sheets (Central Alberta Recreational Lakes Initiative, 2013)

- Aquatic Invasive Species
- Blue-green Algae
- Resources and Programs for Lake Health

Alberta Environment and Sustainable Resource Development Aquatic Invasive Species Fact Sheets (AESRD, 2014)

- Quick Facts: Aquatic Invasive Species

Alberta Lake Management Society (ALMS, 2015)

- Lake Nuisances
- Water Quality Parameters

6.2 Best Management Practices

Residential BMPs

- Caring for Shoreline Properties: Changing the Way We Look at Owning Lakefront Property in Alberta (Valastin, 1999)
- The Shore Primer: A Cottagers Guide to a Healthy Waterfront (Ford, 2004)
- Understanding Shoreland BMPs: Shoreland Best Management Practices (University of Minnesota, 1998)
- Riparian Areas: A User's Guide to Health (Fitch, et al., 2003)

Agricultural BMPs

- Caring for the Green Zone: Riparian Areas and Grazing Management (Fitch & Ambrose, 2003)
- Beneficial Management Practices: Environmental Manual for Crop Producers in Alberta – Water Quality (Alberta Agriculture and Rural Development, 2004)

Development BMPs

- Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region (Alberta Environment and Sustainable Resource Development (ESRD), 2012)
- Protecting Riparian Areas: Creative Approaches to Subdivision Development in the Bow River Basin - A Guide for Municipalities, Developers and Landowners (McCall, 2002)

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Appendix A: Summary of Land Use Patterns by Watershed Subcatchment

Unit 1

The sub-catchment unit 1 covers an area of approximately 18 km², where agriculture represents 70%, followed by development covering 13% of the land area (Table 6, Figure 7). The forested land cover covers close to 11% of the unit, and it is mainly distributed throughout the edges of the lake. This unit contains the Summer Villages of Half Moon Bay and Norglenwold, and has part of both Lacombe and Red Deer Counties.

Table 6. Area (ha) and percentage of land cover type found in sub-catchment 1 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	1242.55	70%
developed	235.21	13%
forest	184.76	10%
disturbed vegetation	72.1	4%
grassland	15.42	1%
water	11.34	1%
wetland	2.45	<1%
vegetated	1.2	<1%
unvegetated	0.23	<1%



Figure 7. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 2

The sub-catchment unit 2 covers an area of approximately 32 km², where agriculture represents 66% of the land area, followed by development covering 20% (Table 7, Figure 8). The edges of the lake area are characterized by developed land and disturbed vegetation. In this case, the disturbed vegetation is mainly represented by a golf course where the second largest tributary of the watershed runs through (see Golf Course Creek, Figure 7). Disturbed land cover covers close to 9% of the unit. This unit contains most of the Town of Sylvan Lake that falls within the Sylvan Lake Watershed, and also contains part of Red Deer County.

Table 7. Area (ha) and percentage of land cover type found in sub-catchment 2 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	2104.71	66%
developed	644.63	20%
disturbed vegetation	302.06	9%
grassland	94.28	3%
forest	56.69	2%
water	3.77	<1%
vegetated	1.54	<1%
unvegetated	0.69	<1%
wetland	0.65	<1%

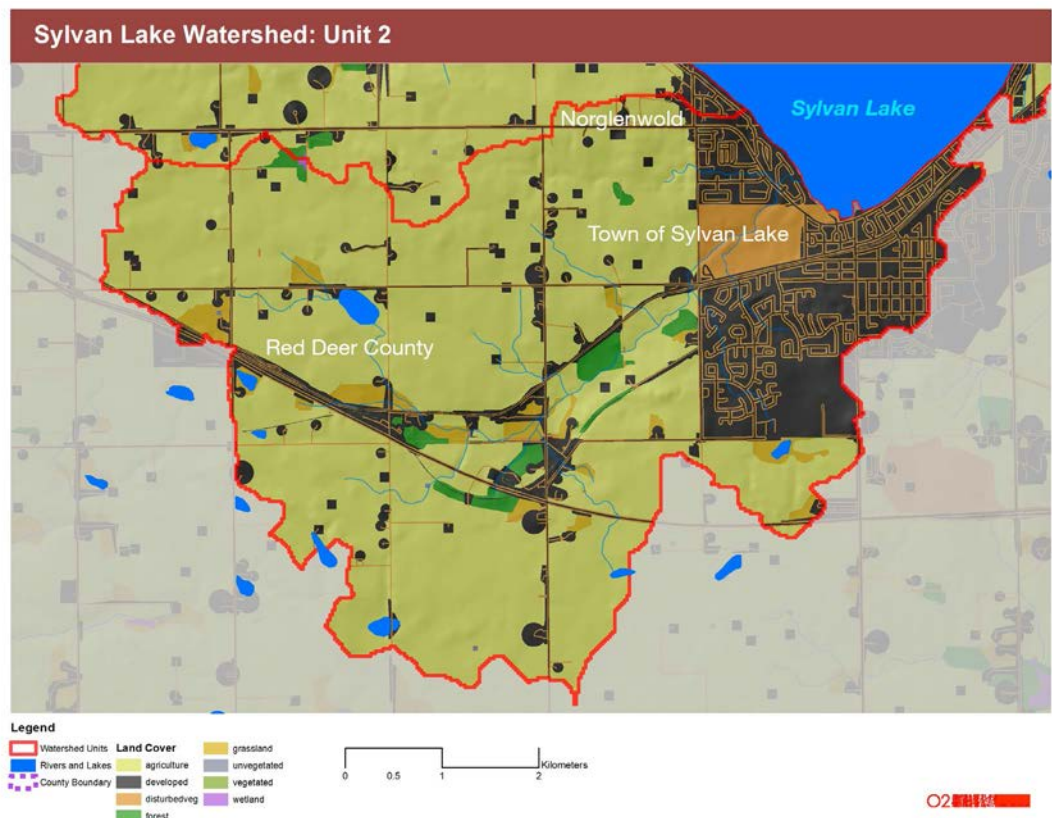


Figure 8. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 3

The sub-catchment unit 3 covers an area of approximately 9 km², where agriculture represents 86% of the land area, followed by development covering 7% (Table 8, Figure 9). The edges of the lake area characterized by developed land and agriculture to a lesser extent. The disturbed land cover covers close to 3% of the unit. The unit falls within Lacombe County.

Table 8. Area (ha) and percentage of land cover type found in sub-catchment 3 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	749.83	86%
developed	62.39	7%
disturbed vegetation	27.8	3%
grassland	16.65	2%
forest	7.99	1%
water	3.64	<1%
wetland	0.64	<1%
vegetated	0.25	<1%

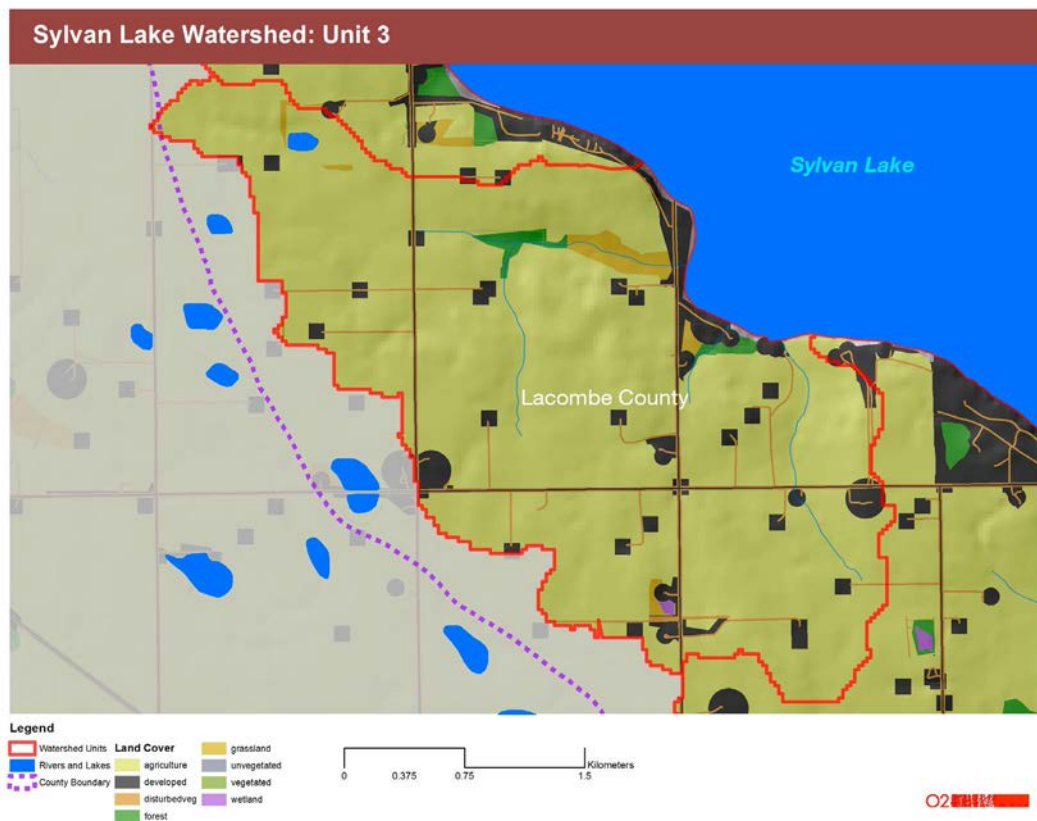


Figure 9. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 4

The sub-catchment unit 4 covers approximately 23 km², where agriculture represents 66% of the land area, followed by forested land cover at 16% (Table 9, Figure 10). The edges of the lake are characterized by developed land and forested areas to a lesser extent. Units 6 and 5 in the Northwest both drain into Unit 4 at Northwest Creek, the Sylvan Lake watershed's largest tributary (Figure 13). Developed land cover covers 11% of the unit. The unit contains the Summer Village of Sunbreaker Cove and falls within Lacombe County.

Table 9. Area (ha) and percentage of land cover type found in sub-catchment 4 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	1496.74	66%
forest	351.89	16%
developed	253.95	11%
disturbed vegetation	77.96	3%
grassland	55.79	2%
water	20.84	1%
vegetated	3.71	<1%
unvegetated	0.68	<1%
wetland	0.07	<1%



Figure 10. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 5

The sub-catchment unit 5 covers an area of approximately 4 km², where agriculture represents 57% of the land area, followed by forested land cover at 30% (Table 10, Figure 11). This unit has the largest percentage of forested area in the watershed, and shares the headwaters of Northwest Creek with Unit 6 (Figure 13), the Sylvan Lake watershed's largest tributary. Grasslands and developed land cover 4% and 3% of the unit, respectively. The unit falls within Lacombe County.

Table 10. Area (ha) and percentage of land cover type found in sub-catchment 5 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	214.94	57%
forest	114.23	30%
grassland	14.32	4%
developed	12.94	3%
disturbed vegetation	8.25	2%
vegetated	6.8	2%
wetland	3.31	1%

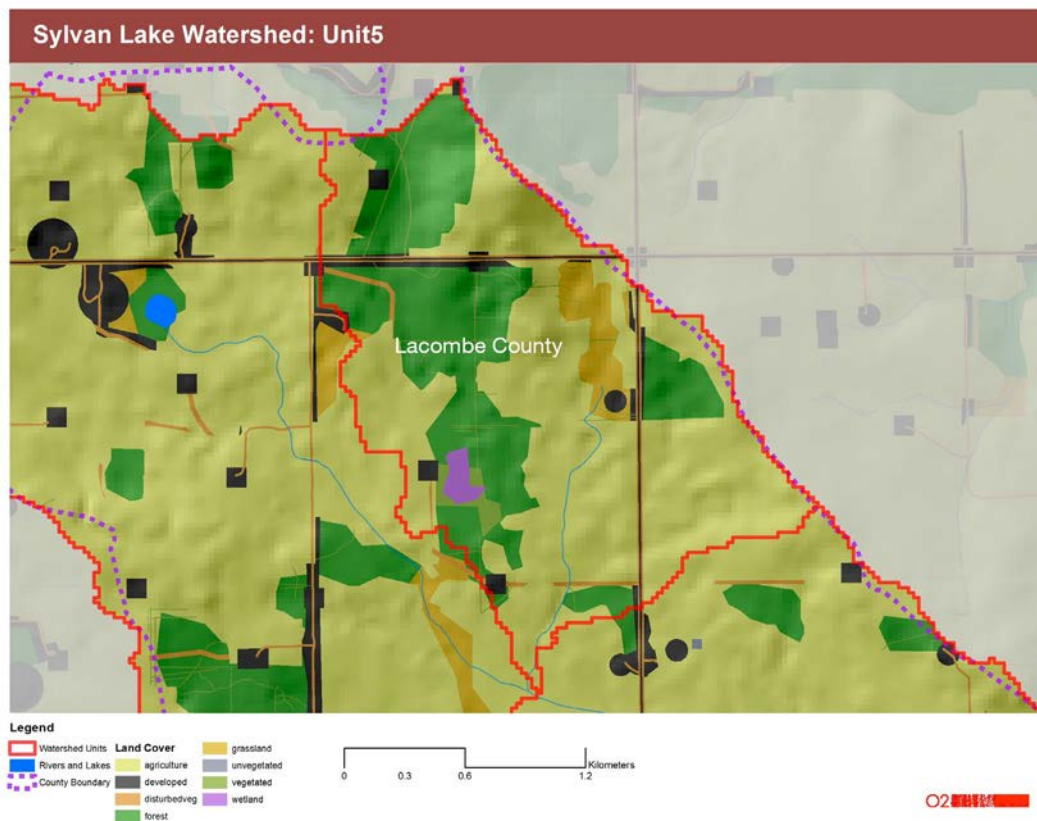


Figure 11. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 6

The sub-catchment unit 6 covers an area of approximately 6 km², where agriculture represents 77% of the land area, followed by forested land cover at 10% (Table 11, Figure 12). The unit shares the headwaters of Northwest Creek with unit 5 (Figure 12), the largest tributary in the Sylvan Lake watershed. Developed land and grasslands cover 5% and 4% of the unit, respectively. The unit falls within Lacombe County.

Table 11. Area (ha) and percentage of land cover type found in sub-catchment 6 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	490.06	77%
forest	65.97	10%
developed	33.52	5%
grassland	23.17	4%
disturbed vegetation	19.56	3%
vegetated	2.71	<1%

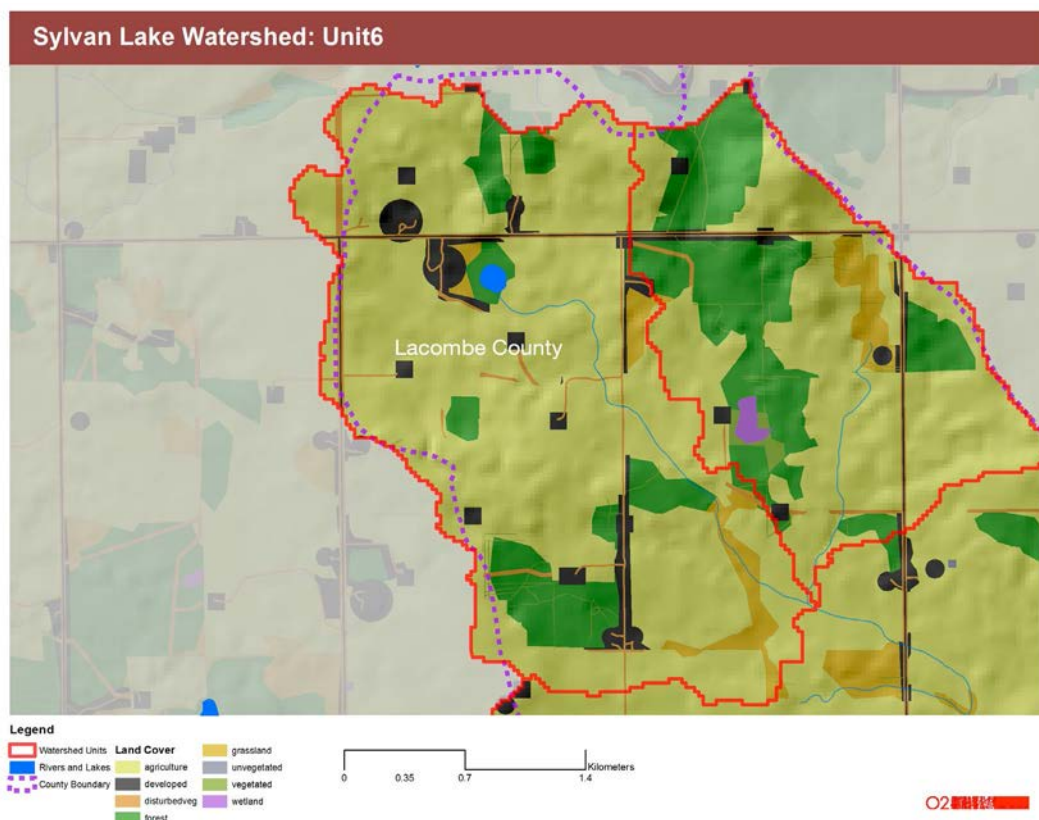


Figure 12. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 7

The sub-catchment unit 7 covers an area of approximately 3 km², where agriculture represents 80% of the land area, followed by developed land covering 12% (Table 12, Figure 13). The edges of the lake area characterized by developed land. This unit contains a large portion of the Summer Village of Birchcliff and falls within Lacombe County.

Table 12. Area (ha) and percentage of land cover type found in sub-catchment 7 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	251.60	80%
forest	16.88	1%
developed	36.46	12%
grassland	0.01	<1%
disturbed vegetation	7.64	<1%
vegetated	0.14	<1%

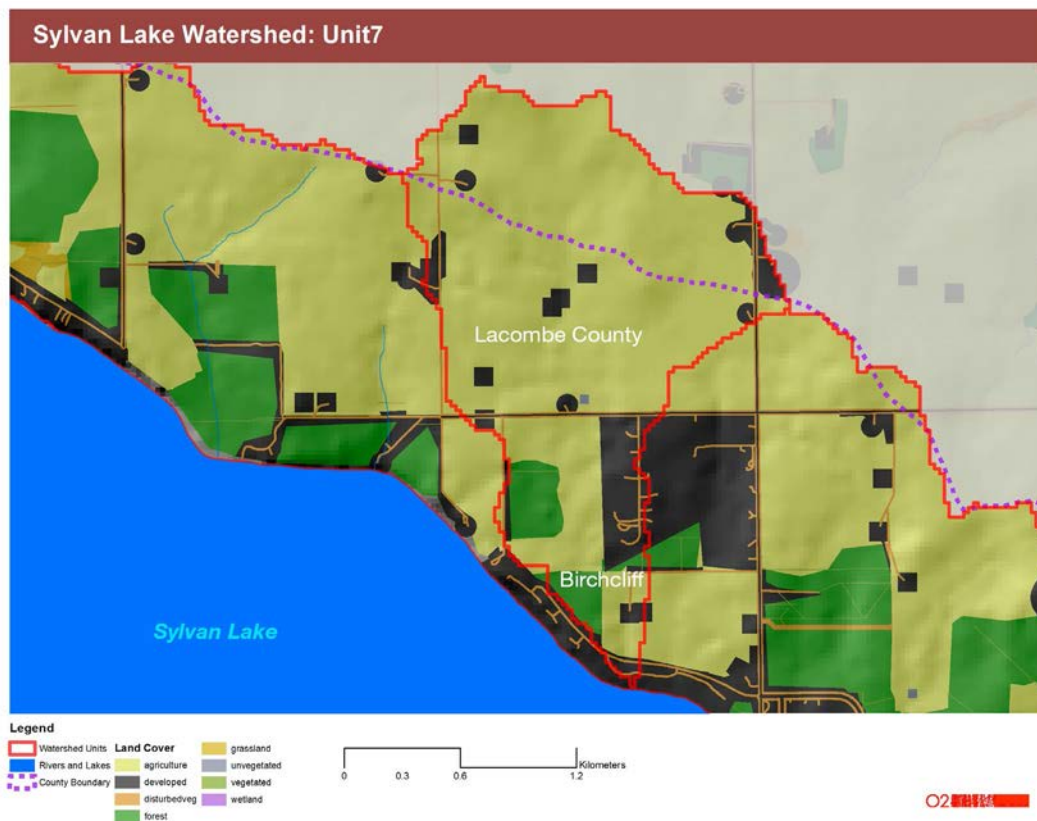


Figure 13. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 8

The sub-catchment unit 8 covers an area of approximately 5 km², where agriculture represents 52% of the land area, followed by developed land covering 24% (Table 13, Figure 14). The edges of the lake area characterized by developed land. This unit contains a large portion of the Summer Village of Birchcliff and falls within Lacombe County

Table 13. Area (ha) and percentage of land cover type found in sub-catchment 8 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	261.23	52%
developed	121.17	24%
forest	88.66	18%
disturbed vegetation	29	6%
vegetated	1.91	<1%
water	0.52	<1%
unvegetated	0.23	<1%

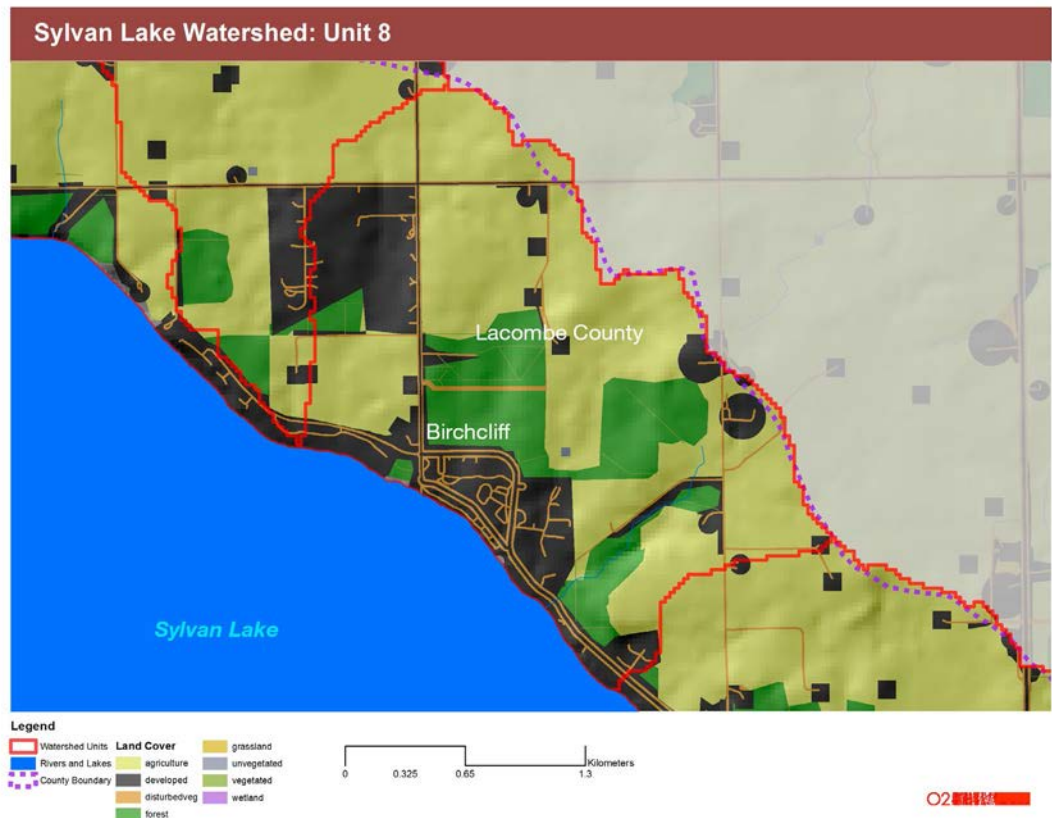


Figure 14. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 9

The sub-catchment unit 9 covers an area of approximately 4 km², where agriculture represents 45% of the land area, followed by developed covering 23% (Table 14, Figure 15). The edges of the lake area are characterized by developed land, as well as forested and disturbed vegetation. This unit contains large portions of the Summer Villages of Birchcliff and Jarvis Bay, which fall within both Lacombe and Red Deer Counties.

Table 14. Area (ha) and percentage of land cover type found in sub-catchment 9 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	174.34	45%
developed	87.5	23%
forest	59.51	15%
disturbed vegetation	58.61	15%
grassland	2.1	1%
water	1.76	<1%
unvegetated	0.46	<1%
vegetated	0.38	<1%

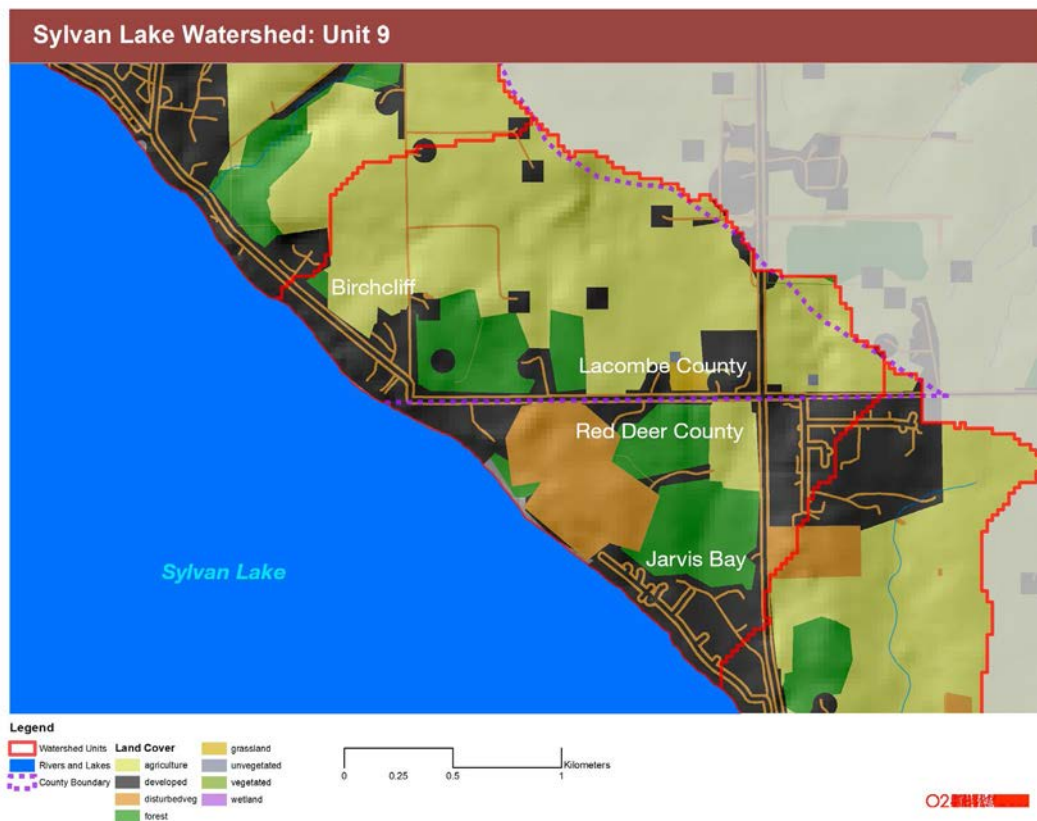


Figure 15. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Unit 10

The sub-catchment unit 10 covers an area of approximately 3 km², where agriculture represents 55% of the land area, followed by developed land covering 26% (Table 15, Figure 16). The edges of the lake area characterized by developed land. This unit contains a large portion of the Summer Village of Jarvis Bay, a marginal portion of the Town of Sylvan Lake, and mainly falls within Red Deer County.

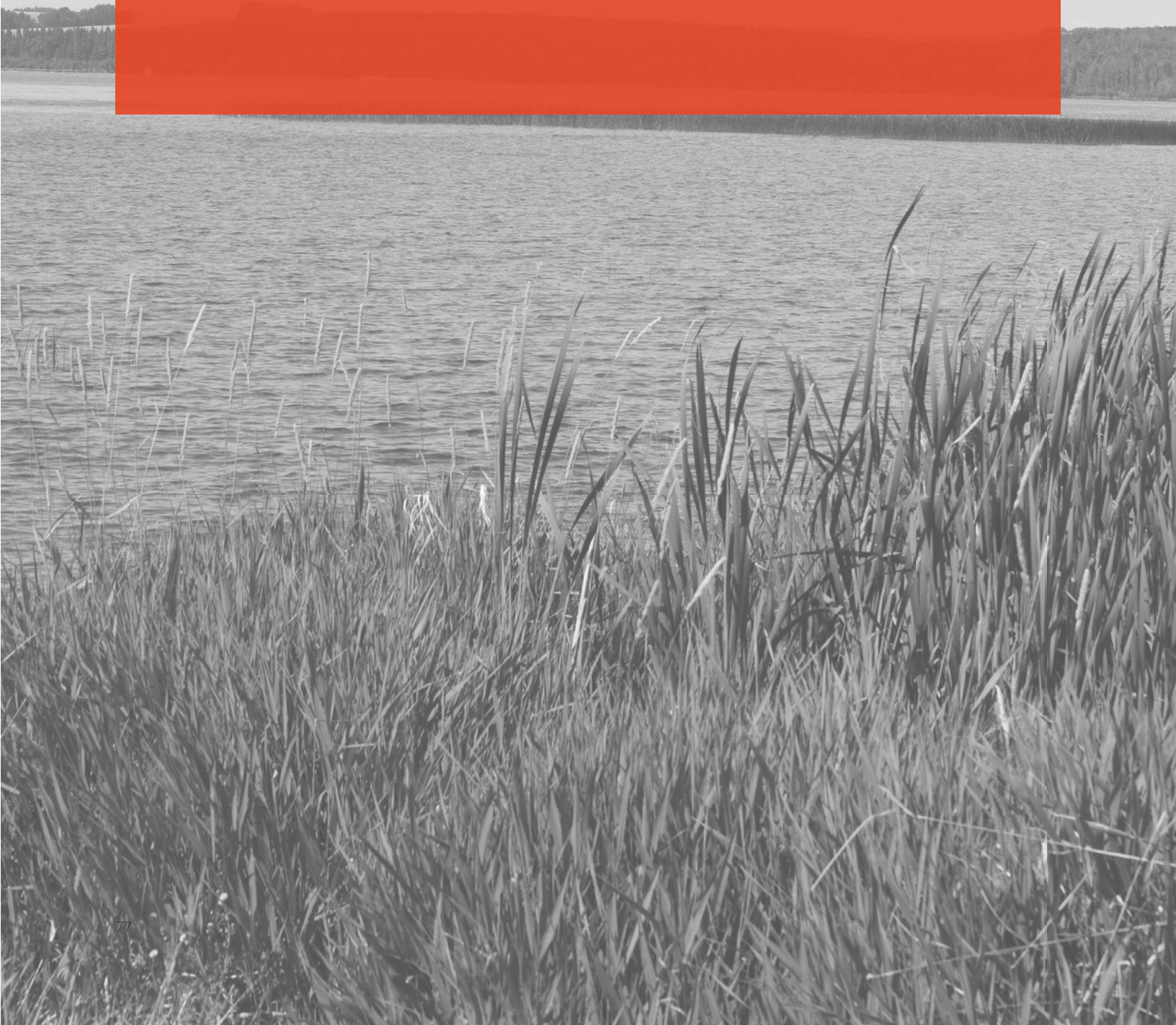
Table 15. Area (ha) and percentage of land cover type found in sub-catchment 9 of the Sylvan Lake watershed

LAND COVER	AREA (ha)	PERCENTAGE
agriculture	153.53	55%
developed	71.24	26%
disturbed vegetation	40.38	13%
forest	10.17	<1%
grassland	1.41	<1%
water	1.09	<1%



Figure 16. Sub-catchment unit 1, land cover and municipalities in the Sylvan Lake Watershed

Appendix B: Summary of Relevant Plans and Studies



Appendix B provides a comprehensive overview of relevant plans and studies by municipality, providing a descriptive direction for each as well as implications in the context of the CEMS Phase 2 Implementation Plan.

Regional Plans + Studies

Plan	Direction	Implications
<p>Sylvan Lake Management Plan: 2000 Update (2000)</p> <p>The updated Sylvan Lake Management Plan is intended to guide responsible land use and development around the lake and throughout the Sylvan Lake Watershed. It was developed for and applies to the eight municipalities in the Sylvan Lake Watershed.</p>	<p>The plan identifies areas where new development may be considered, and environmentally sensitive areas around Sylvan Lake where development is discouraged. However, the plan sets no defined limits for development. It was the intention that municipalities would rely on site-specific analysis to determine the level of development that could be supported in a given location.</p> <p>The Plan divides the watershed area into the Lake Development Area and the Residual Watershed Area. It outlines critical limiting factors for development including land and water based issues, as well as social limiting factors including future land use, recreation, and development pressures. Management policies are organized according to issues, with specific recommendations for the Lake Development Area versus the Residual Watershed Area.</p> <p>The Sylvan Lake Management Plan was adopted by all municipalities. Municipalities are required to amend their Municipal Development Plans, Area Structure Plans, and Land Use Bylaws to reflect the directions of the plan.</p>	<ul style="list-style-type: none"> • No defined limits for development • As of 2000, no lake carrying capacity study had been conducted • Very lake focused. Lack of attention to broader watershed-wide land use issues such as agriculture • No management considerations for agricultural land use • Identification of environmentally significant areas should extent to the entire watershed, not just around the lake

Sylvan Lake Public Access Study Findings + Recommendations (2003)

The Sylvan Lake Public Access Study provides the municipalities surrounding Sylvan Lake with a comprehensive, lake-wide action plan for addressing the demand for improved public access to the lake.

This study builds on the recommendations of the Sylvan Lake Management Plan by assessing the lake's overall capacity to support increased water-based recreation and identifying opportunities for improved public access to the lake, including future public access through subdivision MR/ER dedications, public access levies, and conservation easements.

At the time of its writing, the report concluded that Sylvan Lake had not yet reached its capacity to support additional recreational use. Boating capacity estimates are explicitly defined, with a future cap of 425 boats on the lake. A recreation capacity management program is defined in table format, providing tools and management actions aimed at addressing a range of recreation capacity indicators, along with the jurisdiction or group which should be responsible for monitoring and management activities.

The study also provides environmental and aquatic habitat protection recommendations that go beyond the realm of recreation and lake access. Management recommendations for maintaining lake water quality include: preserving forest cover, maintaining natural shoreline buffers, establishing no-wake and no-motor zones on the lake, promoting sustainable agricultural practices, responsible riparian zone management, and better fuel storage and handling procedures for boat and cottage owners.

The study concludes with a list of implementation priorities complete with estimated costs, timeframe, and responsibilities.

- Invasive species issues (e.g. zebra mussels) are not addressed
- The table format for recommendations and implementation priorities works well. This format and many of the priority recommendations should be evaluated and carried over into the CEMS Phase 2 Implementation Plan.
- The recommended Lake-wide Trail Master Plan should be completed using best practices for erosion control and invasive species management in order to support watershed stewardship goals while promoting intermunicipal connectivity around the lake.

Plan	Direction	Implications
<p>Sylvan Lake Water Quality Assessment and Watershed Management Considerations (2005)</p> <p>This study assesses the cumulative pressures on the lake and determines sensitivity of the lake to further development. It is intended to provide scientifically grounded constraints and recommendations to help guide planning and development decisions.</p>	<p>In response to gaps in the Sylvan Lake Management Plan: 2000 Update, the Sylvan Lake Management Committee contracted the development of this study to assess the cumulative effects of current land use on the lake water quality and determine the lake's capacity to support further development.</p> <p>The study is broken into two parts:</p> <p>Part 1 provides a baseline characterization of water quality conditions and trends that could adversely affect the lake's recreation potential and ecological integrity. This includes an assessment of the relative contribution of surface and groundwater flows to the lake's water balance, and nutrient flows into the lake from surface and groundwater sources and their relationship to land use activities within the watershed.</p> <p>Part 2 outlines implications for watershed planning and development. This includes an assessment of the lake's ability to assimilate additional nutrient inputs and the capacity of local groundwater resources to accommodate additional water use from new developments within the watershed. Management recommendations for watershed protection, including monitoring requirements for adaptive management, round out the study.</p>	<ul style="list-style-type: none"> • The inherent characteristics and sensitivities of the lake's water and nutrient balance (water balance) do not lend themselves to site-specific planning recommendations • Recommendations for groundwater protection must be more regional rather than site specific • The role of individual municipalities is unclear

Plan	Direction	Implications
<p>Sylvan Lake Regional Wastewater Commission Sanitary Servicing Project (2014)</p> <p>The lakeside sanitary servicing project is intended to replace septic systems within the Sylvan Lake watershed with communal holding tanks (for regular hauling) and eventually connect them to a regional line that would transport sewage to the City of Red Deer for treatment.</p>	<p>The Lakeside Sanitary Servicing Project was initiated in Lacombe County in partnership with the Sylvan Lake Regional Wastewater Commission, and is intended for expansion throughout the Sylvan Lake watershed.</p> <p>Short-term goals of the project include connecting the summer villages and any new developments to communal holding tanks, and providing opportunity for any existing development to connect. Operational costs for this service would be established by bylaw and billed to homeowners as a utility on monthly basis. Once the regional sewage trunk line is built, all multi-lot developments must be connected for transmission and treatment in the City of Red Deer. The long-term goal would be to return the treated water the watershed in the form of irrigation water to compensate for groundwater withdrawals and maintain the lake's water balance.</p>	<ul style="list-style-type: none"> • This initiative should be carried forward as a priority for funding acquisition in the CEMS Phase 2 Implementation Plan.
<p>Sylvan Lake Cumulative Effects Management System Plan: Phase 1 (2014)</p>	<p>The Sylvan Lake Cumulative Effects Management System (CEMS) Plan establishes targets and thresholds for three Priority Outcome Areas: Collaborative Planning, Environmentally Healthy Watershed and Lake, and Planned Diverse Recreation. The intent of the plan is to promote collective management of the cumulative effects of land use and other human activities on the lake and watershed while ensuring vibrant cultural and recreational amenities.</p>	<ul style="list-style-type: none"> • Recommended actions put forth in the Sylvan Lake Watershed CEMS Phase 2 Implementation Plan must align with the priority outcomes of the Phase 1 report.

Lacombe County

Plan	Direction	Implications
<p>Sylvan Lake Area Structure Plan (ASP) (2010)</p> <p>This ASP for Lacombe County lands surrounding Sylvan Lake provides a comprehensive set of policies to manage growth and guide land use decisions around the lake with the goal of maintaining lake water quality.</p>	<p>This ASP fulfills the task of determining development capacity, allowable densities, development locations, and sequencing as called for in the Sylvan Lake Management Plan: 2000 Update.</p> <p>The Sylvan Lake ASP divides the ASP area into two planning areas: the Lake Development Area and the Agricultural Area. Policies specific to the dominant land uses within these planning areas are prescribed for each.</p> <p>An important focus of the ASP is an analysis of development capacity within the ASP area. The ASP puts a cap on maximum development limited to 8500 units (including existing units). Development up to this threshold will be undertaken in phases to allow the County to evaluate the impacts of development prior to approving the next phase of development. This phasing and monitoring approach will allow for adaptive management to protect water quality.</p> <p>The ASP also outlines a land use plan and strategy for the ASP area, including key planning and development policies for residential, commercial, industrial, institutional, and recreational, and agricultural land uses in the Lake Development Area. Key policies for watershed-wide environmental protection and enhancement are also defined, including provisions for riparian setbacks, ER dedication, preserving natural vegetation, and residential property initiatives. Concept plans, stormwater management plans, environmental impact assessments and other assessments shall be required for multi-lot subdivision proposals.</p>	<ul style="list-style-type: none">• The adaptive management strategy for the Sylvan Lake ASP should consider water quality data drawn from the tributaries of Sylvan Lake in addition to water quality data sampled from the lake itself. Tributary data is far more sensitive to changes in land use and are therefore more accurate indicators of lake nutrient loading.

Plan	Direction	Implications
<p>Lacombe County Municipal Development Plan (MDP) (2013)</p> <p>The Municipal Development Plan for Lacombe County provides direction on how growth and development in Lacombe County will be managed.</p>	<p>Lacombe County's MDP contains policies on land use and the environment intended to protect environmentally sensitive areas and enhance watershed health.</p> <p>The MDP includes a growth management strategy for the County, with specific policies for residential conservation (cluster) subdivision design and higher density/lakeshore residential development in within the Sylvan Lake area. These policies promote higher density housing along the lakeshore in return for requiring developers to provide publically accessible lakeshore park space in excess of what would normally be required through MR and ER dedication. Environmental Management Policies include specifications for riparian setbacks and watershed planning initiatives in cooperation with provincial agencies and adjacent municipalities.</p>	<ul style="list-style-type: none"> Recommended riparian setbacks are not based on site specific variations in environmental conditions. Development and use of a Riparian Setback Matrix Model (RSMM) tool would be useful in determining more precise development setbacks and ER dedication based on variable site criteria. Environmentally Sensitive Areas are not clearly identified. An inventory of ESAs within the County (or at least for the Sylvan Lake watershed) would be beneficial for strategic planning purposes.
<p>Lacombe County Environmental Management Plan (2014)</p> <p>The Environmental Management Plan for Lacombe County is an internally focused guiding document that helps provide direction to Lacombe County staff and Councilors in regards to environmental management.</p>	<p>The Environmental Management Plan (EMP) for Lacombe County outlines a specific plan for how the County will carry out environmental stewardship. The plan includes targets, objectives, activities, responsibilities, procedures, and resources for maintaining and enhancing environmental quality. The plan was created after the County's environmental policy as a means of attaching guiding actions to the policy. Actions are organized according to five priority areas: water quality, waste creation and disposal, efficient water use, energy consumption, and land use. Targets, indicators, and metrics and estimated timeframes for each action form a framework for implementation.</p>	<ul style="list-style-type: none"> Unclear what the tangible outcomes of many actions will be (e.g. categorizing and monitoring actions undertaken by Lacombe County that may result in lower water quality) Opportunity exists for the EMP to be expanded to include external engagement focused on achieving CEMS specific water quality targets and objectives.

Red Deer County

Plan

Direction

Implications

Agricultural Profile of Red Deer County (2003)

The Agricultural Profile of Red Deer County chronicles the development of agriculture in Red Deer County from the 1800s to 2003, with distinct sections devoted to the history of agricultural development, biophysical resources, agricultural trends, and the effects of other land uses on agriculture.

The “agricultural trends” section of this report describes trends in the use of conservation practices in agriculture across Red Deer County over time. The report indicates that conservation practices, such as crop rotation, permanent grass cover, winter cover cropping, shelterbelts, and the use of green manure increased in Red Deer County from 1991 to 2001. The report lists the conservation practices in use on Red Deer County farms and the percentage of the total number of farms that used each practice in 2001. The report also outlines the number of organic farms and livestock operations in the County, and development trends that may result in the loss of agricultural land.

- This information can be used to inform best management practices for agricultural land use and be used to make a case for acquiring provincial funds for conservation programs/services for agricultural producers
- It would be beneficial for Lacombe County to undertake a similar assessment and report to outline trends in agriculture and conservation practices as a means of 1) identifying contributing factors to water quality degradation and 2) tracking the popularity and use of conservation practices to make a case for further funding

Plan	Direction	Implications
<p>Open Space Master Plan (2009)</p> <p>The Red Deer County Open Space Master Plan (OSMP) provides the framework, key priorities, policies, and implementation strategies required to create a county-wide open space system.</p>	<p>The OSMP presents an inventory of existing County-owned lands and classifies them into open space typologies in an effort to streamline planning and management activities. An assessment of issues and opportunities, including an examination of linkages, environmental sensitivities, and potential future partnerships with surrounding municipalities are included as part of the plan. The plan culminates in an open space concept plan, presented by zone, accompanied by more detailed plans to be undertaken within short to mid-term timeframes. Implementation tools and strategies, as well as monitoring and evaluation are presented in the final chapter of the plan.</p> <p>In relation to Sylvan Lake and the Sylvan Lake watershed, the plan outlines an open space concept for the Alberta Central Railway (ARC) project zone which includes trail connections from Benalto through Sylvan Lake to the City of Red Deer and the Waskasoo Park System. It is noted that recreational development in and around Sylvan Lake make the lake an important node along this proposed corridor.</p>	<ul style="list-style-type: none"> • An intermunicipal trail plan should be completed for the eight municipalities, incorporating Red Deer County's plan for the ARC project zone along with recreation planning best practices for environmental and watershed stewardship to ensure trails do not compromise the ecological integrity of the shoreline.

Plan	Direction	Implications
<p>Red Deer County ESA Inventory (2011)</p> <p>The Environmentally Significant Areas (ESA) Inventory surveyed, mapped, and reported on the most environmentally significant areas in Red Deer County.</p>	<p>One of the County's ESAs in the Red Deer County ESA Inventory is the Sylvan Lake ESA. The Sylvan lake ESA is located on the peninsula of land that juts out into Sylvan Lake. The Sylvan Lake ESA is included in the Sylvan Lake Management Plan Area and is significant owing to the diversity of breeding birds and bird habitat in the adjacent riparian and upland areas, and because it is an important sport fishery and spawning area for northern pike, walleye, and yellow perch.</p> <p>Given that the only Red Deer County land that falls within the Sylvan Lake watershed is the Sylvan Lake ESA, management policies for ESAs (found in the Red Deer County MDP) have particular relevance for the watershed.</p>	<ul style="list-style-type: none"> • The ESA inventory does not provide management considerations for the ESAs • It would be beneficial for a similar inventory of ESA be conducted for the entire watershed as a first step in outlining watershed-wide policies for environmental conservation and management.

Plan	Direction	Implications
<p>Red Deer County Municipal Development Plan (MDP) (2013)</p> <p>Red Deer County's MDP contains land use and the environmental policies aimed at guiding future growth and economic development.</p>	<p>Given that the only Red Deer County land that falls within the Sylvan Lake Watershed is a designated Environmentally Significant Area (ESA), the MDP's policies on ESA management are significant.</p> <p>The policy framework of the Environmentally Significant Areas (ESA) Study approved in 2011 was incorporated into the environmental stewardship policies of the MDP.</p> <p>ESA policies protect ESAs from fragmentation, require Environmental Reviews for planning applications within ESAs, and encourage conservation easements and stewardship recognition on ESAs that fall within privately owned lands.</p>	<ul style="list-style-type: none"> • Management policies specific to the Sylvan Lake ESA should be developed for inclusion in future Area Structure Plans or an Intermunicipal Development Plan for the Sylvan Lake Watershed.

Town of Sylvan Lake

Plan	Direction	Implications
<p>Town of Sylvan Lake Waterfront Area Redevelopment Plan (2006)</p> <p>The Waterfront Area Redevelopment Plan (ARP) is intended to guide growth and development within the downtown and waterfront areas over the next 20 years.</p> <p>The ARP ensures that development makes the best use of the limited land base, protects the integrity of the lake as a natural resource, improves lake access, and identifies opportunities for commercial growth.</p>	<p>The ARP provides an overview of current conditions and trends, a vision and planning principles, a future development concept, design guidelines, and an implementation strategy and action plan.</p> <p>The plan implements the Town of Sylvan Lake Recreation, Parks, and Open Space Master Plan and identifies opportunities and funding sources for improvements to parks and open spaces.</p> <p>The ARP also implements recommendations of the Sylvan Lake Management Plan and the Sylvan Lake Public Access Study, including provisions for ER dedication, waterfront setbacks, management of environmentally sensitive areas, and the need for visual impact assessments.</p> <p>The ARP requires new developments within 300 m of the waterfront to implement construction management practices that prevent erosion, sedimentation and flow of nutrients into the Lake. Environmental Impact Assessments (EIAs) are also recommended where development may have a potentially detrimental effect on the lake. For development that may affect view corridors either from or to the Lake, the ARP requires a Visual Impact Assessment. On-site infiltration of stormwater is recommended as part of the design of open spaces and site development throughout the ARP area, but is not stipulated as a requirement.</p> <p>Strategies and actions required to implement the ARP are presented in table format as intermediate and long-term goals. Potential funding sources to support these actions are also listed.</p>	<ul style="list-style-type: none"> • The ARP does not include sustainable management recommendations for the golf course. • A greater emphasis on stormwater management and Low Impact Development within the ARP area would enhance the Town's contribution to watershed stewardship

Town of Sylvan Lake Growth Strategy (2008)

This plan is a formal document adopted by Council to serve as a general guide for future planning. It is largely a conceptual land use planning study that establishes high level policy direction to guide and shape growth within a municipality over 30+ years.

This plan establishes three long term population thresholds as a basis for understanding how Sylvan Lake is expected to expand and change over the next several decades.

Based on three population projections (30,000, 45, 000, and 60,000) and an evaluation of current conditions/ development pressures, the plan outlines broad estimates of the amount and type of land uses needed under each population threshold scenario.

The preferred option—the Land Use Concept—accommodates growth to a population threshold of 60,000. The primary focus of this Land Use Concept is on the lands beyond the Town boundaries. The plan outlines the location and amount of additional residential, commercial, industrial, and open space areas, as well as additional transportation infrastructure.

- The preferred Land Use Concept can help inform the creation of an Intermunicipal Development Plan for the municipalities in the Sylvan Lake Watershed.
- A list of best management practice for lake and watershed health should accompany and guide more detailed development of the land use plan to ensure that growth does not compromise watershed integrity.

Plan	Direction	Implications
<p>Sylvan Lake Municipal Sustainability Plan (2010)</p> <p>The Municipal Sustainability Plan (MSP) for the Town of Sylvan Lake is designed to guide the development of future plans in a way that ensures issues are addressed with sustainability at the forefront of policy and decision making.</p>	<p>The MSP for Sylvan Lake organizes goals and actions for achieving sustainability into five themes: environment, social, governance, economic, and culture. For each theme, the plan includes a listing of the community's current strengths and challenges, providing a useful framework for identifying goals and priority actions related to that theme.</p> <p>In the context of the environment theme, goals and actions for sustainability are listed according to resources and infrastructure, including natural areas, the built environment, water, energy, waste management, and transportation.</p> <p>Several actions are proposed for maintaining lake water quantity and quality including water recycling, low impact development incentives and rebate programs, recreational use regulations, lake and riparian setbacks, and water audits to determine per capita water use.</p> <p>The plan concludes by listing three evaluation questions to be used to help prioritize actions in order of importance and feasibility.</p>	<ul style="list-style-type: none"> • Evaluation questions to determine how actions will be prioritized is a useful tool • The MSP contains several useful actions for improving lake and watershed health that could be carried over into the recommendations of the CEMS Phase 2 Implementation Plan.

Plan

Direction

Implications

Town of Sylvan Lake Recreation, Parks, and Open Space Master Plan (2010)

The purpose of the Recreation, Parks and Open Space Master Plan is to support future planning and maintenance of indoor and outdoor recreational facilities and services. The plan provides a review of community needs and priorities, a threshold analysis, and recommendations based on Sylvan Lake's projected development phases. While the plan recognizes the importance of protecting and incorporating natural areas into an established open space system, the plan does not provide a clear strategy for implementing the open space master plan.

- Revisions to this plan should build on the Town's strong desire to protect natural areas by developing a more detailed implementation strategy that acknowledges and incorporates the open space plans of adjacent municipalities.

Plan	Direction	Implications
<p>Sylvan Lake/Red Deer County Intermunicipal Development Plan (IDP) (2011)</p> <p>This IDP strives to resolve some of potential conflicts between urban and rural land uses between Red Deer County and the Town of Sylvan Lake by coordinating infrastructure and the provision of municipal services.</p>	<p>In light of growth projections over the next 50 years, the IDP provides policies for growth management, coordinating future land uses and development along the boundary between municipalities.</p> <p>The IDP's Growth Management Plan includes policies for cost sharing amongst the Town and County, policies for economic development, and a potential joint development area. The IDP's Land Use Concept includes policy direction for a variety of land uses, transportation, and utility services, as well as policies specific to maintaining the recreational and ecological value of Sylvan Lake. The IDP specifies that, while existing ASPs take precedence over the IDP, new or amended ASPs will be used to flesh out the detailed land use for the IDP land use concept. For example, environmentally significant areas and features of the lake shall be inventoried and identified for preservation on both town and County lands through the process of preparing area structure plans.</p> <p>The IDP's section on plan implementation stipulates the formation and organization of an intermunicipal committee including two mayors and two councillors from each municipality to review and approve proposed amendments, oversee and monitor implementation actions, and make recommendations on intermunicipal matters to their respective councils. Recommendations for data sharing, communications and referral processes are also outlines, including a dispute resolution flow chart to be used in times of intermunicipal gridlock.</p>	<ul style="list-style-type: none"> • An Intermunicipal Development Plan for the eight municipalities in the Sylvan Lake Watershed should be undertaken • A Communications Plan for the SLMC should outline intermunicipal roles, responsibilities, and include communications tools such as the dispute resolution flow chart, similar to what is specified in this IDP's for an Intermunicipal Committee.

Plan	Direction	Implications
<p>Town of Sylvan Lake Municipal Development Plan (MDP) (2014)</p>	<p>Sylvan Lake’s MDP provides policies to encourage a healthy growth while protecting and enhancing the environmental integrity of the lake, natural spaces, parks, and trail systems through the pursuit of environmentally responsible practices.</p> <p>The MDP includes a use of land and infrastructure with specific policies to promote compact development in order to support the efficient provision of public services, improve the performance of transportation networks and preserve open space. While these policies promote the ability to accommodate growth through higher density or intensification, their connection to their Natural Environment Policies is vague or too broad. There are no specific guidelines to deal with riparian setbacks, wetlands, or environmental sensitive areas.</p> <p>The MDP has a specific section for policies around regional collaboration. In there, environmental preservation is recognized as a critical planning component. Specific policies of interest are an integrated land use planning for the watershed, the creation of a regional open space networks of natural areas, management of the regional water supply, as well as promotion of the implementation of the Sylvan Lake Management Plan.</p>	<ul style="list-style-type: none"> • Recommended setbacks are not based on site specific variations in environmental conditions. • Environmental policies related to watershed health are too broad. • An inventory of ESAs for the Town of Sylvan Lake would be beneficial for strategic planning purposes. • Regional Collaboration policies are an important stepping stone towards a collaborative strategy for watershed management and environmental health

Town of Sylvan Lake Infrastructure Study Update (2014)

This study evaluates infrastructure required for existing and future growth in the Town of Sylvan Lake.

Building upon the Town of Sylvan Lake Growth Strategy, which outlines broad estimates of the amount and type of land uses required based on various population projections, this report analyzes infrastructure needs in terms of those population projections. Furthermore, the study identifies specific improvements that will be required to improve the existing system based on these growth projections. This includes a determination of requirements for connecting the City to the future regional water and sanitary sewer systems.

Key recommendations of the study include:

- New serviceability standards, which could be used to determine cost and scheduling of upgrading, repairs or replacement.
- A database of the existing infrastructure to be used in conjunction with modeling software to more accurately determine the capacities of the system.
- Establish a schedule for future infrastructure expansions based on population projections.
- Identify the required future extensions to the existing infrastructure, on serviceable lands outside the current Town boundaries, in order to meet the servicing needs of the Town's expected future growth areas.

- The CEMS Phase 2 Implementation Plan should similarly provide an estimated list of costs and schedule for all recommended initiatives.
- Recommendations put forward in the CEMS Phase 2 Implementation plan should account for population projections and associated infrastructure requirements put forth in this study and the Town of Sylvan Lake Growth Strategy (2008).

Summer Villages

Plan	Direction	Implications
Summer Village of Birchcliff Municipal Development Plan + Land Use Bylaw (2013)	The MDP for the Summer Village of Birchcliff contains environmental conservation policies to protect sensitive environments, including shoreline contact zones and riparian areas along the lake. The MDP aims to guide growth and manage land use change while maintaining a traditional small village atmosphere.	<ul style="list-style-type: none"> The MDPs contains several useful actions for improving lake and watershed health that could be carried over into the recommendations of the CEMS Phase 2 Implementation Plan.

Plan	Direction	Implications
Summer Village of Birchcliff Open Space Plan (2014)	<p>The purpose of the Open Space Plan is to ensure that community open spaces remain accessible and connected while conserving sensitive landscape features. The Open Space Plan aims to implement the open space goals and policies contained in the Summer Village of Birchcliff MDP. These include:</p> <ul style="list-style-type: none"> To use MR and ER for the purpose of open space conservation To conserve natural areas as an integral part of the community To provides the means for passive recreation and pathway linkages <p>The Open Space Plan takes inventory of all open spaces in the Summer Village, including designation, size, location, adjacent land uses, access, sightlines, present land use, vegetation, bank height, paths, and potential future uses. Open spaces were then classified into management categories. As a supplement to the open space polices included in the MDP, part three of the Open Space Plan outlines actions for conserving environmentally sensitive areas and improving community open spaces. Priority actions are summarized in a list of 17 recommended actions to implement the Open Space Plan.</p>	<ul style="list-style-type: none"> The Open Space Plan does an exceptional job of evaluating the land use planning directions adopted by surrounding municipalities as a means of understanding how adjacent developments will influence the quality and accessibility of Birchcliff's community open space. The Open Space plan acknowledges the important link between natural areas and lake water quality. The CEMS Phase 2 Implementation Plan should likewise make this connection abundantly clear in any recommendations to conserve natural areas. The list of implementation actions is concise, but does not include estimates for budget or timelines for completion of each action. This information would be helpful in implementing the plan within operating budgets.

Plan	Direction	Implications
<p>Summer Village of Jarvis Bay Municipal Development Plan + Land Use Bylaw (1998)</p>	<p>This 1998 Municipal Development Plan for Jarvis Bay is the first statutory plan developed for the municipality. The MDP is intended to serve as a framework for future growth and development of Jarvis Bay, while being mindful of the larger lake community. The MDP contains policies for Open Space and the Natural Environment. This portion of the plan states that the majority of residents desire a trail system along Highway 20 connecting to Petro Park. The plan also outlines policies for enhancing stormwater management and requiring upgrades to the sanitary sewer system. Lastly, the MDP acknowledges the importance of coordination with adjacent municipalities, including the need for an intermunicipal development plan.</p>	<ul style="list-style-type: none"> • The MDP and LUB for Jarvis Bay are out dated and in need of revision to remain relevant to changing conditions. • Stronger language is needed for open space designation in the context of higher density residential development.

Plan	Direction	Implications
<p>Summer Village of Norglenwold Municipal Development Plan + Land Use Bylaw (2011)</p>	<p>The MDP for the Summer Village of Norglenwold serves as a framework to guide decisions on community growth, land uses, and the conservation of resources. The MDP states that the Summer Village of Norglenwold is committed to integrated lake-wide planning, and was prepared to reflect the goals of the Sylvan Lake Management Plan (2000).</p> <p>Notably, the SV of Norglenwold intends to proactively expand its land base. Area structure plans are to be prepared for the annexed lands. The MDP therefore provides strategic direction, principles, and policies for guiding expansion and growth in keeping with the vision and values of the municipality. Strategic planning directions for protecting the lake include provisions for cooperation with adjacent municipalities, conservation of riparian areas, lake stewardship education for land owners and lake users, and plans for the regional delivery of wastewater services.</p> <p>Intermunicipal planning and cooperation are stressed as an important means of ensuring sustainable development, especially along the fringe areas of the municipality. This is especially important in the context of recreation and environmental conservation. The MDP stresses the need for watershed planning.</p>	<ul style="list-style-type: none"> • Shoreline development restrictions are well founded; environmental conservation policies are strong. Other Summer Villages in the Sylvan Lake Watershed would benefit from adopting similarly extensive policies for environmental conservation in their MDPs. • Stronger language is needed around the design of subdivisions to retain the natural character and quality of the landscape (guidelines needed). • This MDP can help inform Area Structure Plans and an intermunicipal development plan for annexed lands in order to guide harmonious growth that maintains lake and watershed water quality.

Plan	Direction	Implications
<p>Summer Village of Half Moon Bay Land Use Bylaw (2013)</p>	<p>The Summer Village of Half Moon Bay does not have Municipal Development Plans and relies on its Land Use Bylaw (LUB) to guide management and development. Policies for permitted and discretionary uses, site development requirements, and supplementary regulations are outlined according to land use districts. The SV of Half Moon Bay has two land use districts: A Residential district and an Environmental Open Space district. The LUB for the Summer Villages of Half Moon Bay and Sunbreaker Cove are very similar in content and organization.</p>	<ul style="list-style-type: none"> • A Municipal Development Plan should be developed for the SV of Half Moon Bay to provide clearer strategic direction for residential growth and open space management in the context of lake and watershed management. • Given that residential properties are located so closely to the lakeshore, the SV of Half Moon Bay would benefit from the development and implementation of a Riparian Setback Matrix Model to help determine site specific setbacks for development and ER dedication. • Policies supporting environmental stewardship incentives and education are needed.

Plan	Direction	Implications
<p>Summer Village of Sunbreaker Municipal Development Plan (2003)</p>	<p>This 2003 Municipal Development Plan (MDP) for the Summer Village of Sunbreaker Cove was the first MDP developed for the municipality. It was initiated in response to increasing development pressures around the lake and adjacent to the Summer Village borders. It provides a basis for actions and decisions to protect and improve quality of life within Sunbreaker Cove.</p> <p>The core values of the MDP include: maintaining a low density residential community within a recreational environment, monitoring lake water quality, water safety, and shoreline management in conjunction with other municipalities, providing abundant open space, protecting the natural environment, and promoting a safe secure community. In alignment with these core values, the document provides a policy framework to guide future development and environmental protection within the Summer Village.</p>	<ul style="list-style-type: none"> CEMS principles should be integrated into the MDP when it is updated.

Plan	Direction	Implications
<p>Summer Village of Sunbreaker Cove Land Use Bylaw (2013)</p>	<p>The Summer Villages of Sunbreaker Cove does not have a Municipal Development Plan and relies on its Land Use Bylaw (LUB) to guide management and development. Policies for permitted and discretionary uses, site development requirements, and supplementary regulations are outlined according to land use districts. The SV of Sunbreaker Cove has three land use districts: A Residential district, a Community Reserve District, and an Environmental Open Space. The LUB for the Summer Villages of Half Moon Bay and Sunbreaker Cove are very similar in content and organization.</p>	<ul style="list-style-type: none"> Given that residential properties are located so closely to the lakeshore, the SV of Sunbreaker Cove would benefit from the development and implementation of a Riparian Setback Matrix Model to help determine site specific setbacks for development and ER dedication. Policies supporting environmental stewardship incentives and education are needed.

Appendix C: Summary of Relevant Programs and Services

Appendix C provides a comprehensive overview of relevant environmental programs and services by municipality, providing a descriptive direction for each as well as implications in the context of the CEMS Phase 2 Implementation Plan.

Provincial

Programs + Services	Description	Associated Land Use or Activity
Agricultural Watershed Enhancement Program	<p>This program facilitates the delivery of targeted extension programs that focus on addressing water quality issues, the restoration of wetlands, and improving riparian health.</p> <p>Watershed groups, municipalities, and/or industry organizations are encouraged to develop implementation plans targeting the adoption of BMPs related to agricultural land use and water quality in high risk areas.</p>	Agriculture

Sylvan Lake Management Committee (SLMC)

Programs + Services	Description	Associated Land Use or Activity
Aquatic Invasive Species Program	<p>This is a public education campaign aimed raising awareness of the impact of Zebra and Quagga Mussels on lake health. These highly invasive species can cause significant damage to infrastructure and the environment. In an attempt to promote awareness, the SLMC has provided signs at all lake access points as well as distributed brochures throughout the region. Brochures have been placed at locations within Sylvan Lake that sell fishing licenses as well as placed at boat launches in the County and Summer Villages.</p>	Recreation

Programs + Services	Description	Associated Land Use or Activity
TAKE IT OFF – Ice Fishing Hut Registration	In an effort to decrease the number of ice fishing huts left on the lake during spring melt, the SLMC has initiated a program for people to register their ice hut. Contacting people to remove their huts before spring melt reduces detrimental impacts to fish and waterfowl habitat.	Recreation

Lacombe County

Programs + Services	Description	Associated Land Use or Activity
Soil Conservation Program	The Lacombe County Environmental and Protective Services' Soil Conservation program assists landowners in planning for shelterbelts and grassed waterways to help alleviate soil erosion by wind and water.	Agriculture
Tree Shelterbelt Program	Lacombe County Environmental and Protective Services' Tree Shelterbelt Program assists land owners with shelterbelt planning and planting to reduce wind and water erosion on their properties.	Agriculture
Integrated Vegetation Management Plan	Lacombe County's Integrated Vegetation Management Plan establishes guidelines for controlling the spread of weeds into adjacent properties while reducing the use of herbicides and incurring minimal impact the environment. The County also allows landowners and tenants to apply to be in a "no spray area" to ensure that the right of way adjacent to their property is not sprayed with herbicides.	Many
Communal Servicing Project	The lakeside communal sanitary servicing project is intended to replace septic systems within the Sylvan Lake watershed with communal holding tanks (for regular hauling). The goal of the program is to eventually connect the holding tanks to a regional line that would transport sewage to the City of Red Deer for treatment.	Residential

Programs + Services	Description	Associated Land Use or Activity
River Weed Control Program	<p>Weeds and invasive plant species often spread along waterways. Lacombe County, in collaboration with Red Deer County, Ponoka County, Stettler County and the Public Lands Branch, have established the River Weed Control Program. As part of this program, staff take canoes onto the river systems to handpick weeds from sensitive areas along the riverbanks. This labor intensive program has greatly reduced the spread of Scentless Chamomile, as well as many other potentially dangerous weeds.</p>	Agriculture
Aquatic Invasive Species Education and Inspection Program	<p>Lacombe County has launched an Aquatic Invasive Species (AIS) program to educate lake users about the potential impact of aquatic invasive species, such as quagga and zebra mussels, on lake health and to perform routine inspections of boats prior to entering the lake. Lacombe County, in partnership with ESRD and other municipalities in the Sylvan Lake watershed, has hosted a number of educational events about the threat of invasive quagga and zebra mussels to Sylvan Lake. Boat inspections were conducted at these events and educational materials were made available to boat owners. ESRD has also hosted a watercraft inspection and decontamination training at the Lacombe County office. The County has posted signs at all boat launches that it maintains, and operates an awareness campaign consisting of media releases, a website, and newspaper articles to inform rate payers of issues and changes related to the AIS program.</p>	Recreational boat use

Programs + Services	Description	Associated Land Use or Activity
Environmental Improvement Grant Program	<p>In 2013, Lacombe County Council approved the launch of the Environmental Improvement Grant Program and Policy as a 3-year pilot program. The grant program provides financial assistance to community groups and schools to develop or deliver community-based environmental services and programs within the County. The program, which is based on a competitive selection process, involves an application form, regular reporting and demonstration of environmental benefits resulting from the proposed project. The County holds regular workshops to guide potential applicants through the application process.</p>	Variable by project

Red Deer County

Programs + Services	Description	Associated Land Use or Activity
Alternative Land Use Services	A community-developed, farmer-delivered program that provides support to farmers and ranchers to enhance and maintain nature's benefits on their properties	Agriculture
Grazing and Riparian Management Program	<p>Red Deer County provides information and resources to producers on managing their pastures, their native range and riparian areas, for maximum productivity and maximum environmental health.</p> <p>Riparian Health Assessments and Range Health Assessments are conducted with and for interested producers. The program also includes a "try-before-you-buy" initiative, allowing farmers and ranchers to borrow and test out innovative materials and technologies before purchasing them.</p>	Agriculture

Programs + Services	Description	Associated Land Use or Activity
Environmental Farm Planning Program	Red Deer County leverages this provincial program by assisting producers in identifying and addressing risks and opportunities on their property. An Environmental Farm Plan intends to help communities conserve ecological values while enhancing ecosystem services. The Environmental Farm Planning program also helps producers to keep their plans up to date.	Agriculture
Growing Forward II	Red Deer County is helping producers access funding from the provincial Growing Forward II programs dealing with agriculture and the environment (including the On-Farm Water Management Program and the On-Farm Stewardship Program).	Agriculture
Tree Planting Program	Red Deer County assists landowners in applying for funding to plant trees in riparian areas and other environmentally significant areas in order to conserve ecological values while enhancing ecosystem services.	Agriculture
Safe Water Well Initiative	Red Deer County's Safe Water Wells Program provides information to well owners about how to properly plug their abandoned wells. In addition, funding is available to assist landowners to properly plug their abandoned water wells. Up to \$1,000 per well is available.	Groundwater
Green Acreages Program	A provincial program that assists landowners in identifying and addressing the potential environmental hazards on their property (ex. leaking or outdated septic system). The program features workshops and one-on-one assistance to help landowners improve their contribution to watershed health. The program may even assist landowners financially; with a 60/40 cost share up to \$3,000, if they take actions to reduce environmental risks on their properties.	Country Residential

Town of Sylvan Lake

Programs + Services	Description	Associated Land Use or Activity
Toilet Rebate Program	<p>In an effort to conserve water the Town of Sylvan Lake offers a toilet rebate program to individuals wanting to replace their high flow toilets with dual flush, low flow toilets.</p> <p>All new construction, or renovations to water fixtures requiring a permit must install low water use fixtures as per bylaw.</p>	Residential



