

# **Aerial Video Assessment of Lesser Slave Lake, Alberta**

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## EXECUTIVE SUMMARY

Lesser Slave Lake (LSL) is Alberta's premier walleye lake. However, its shoreline and surrounding area is experiencing increased urban, cottage, and agricultural expansion. The lack of documentation of the current health status of riparian areas on the lake is an obstacle hampering the sustainable management of Lesser Slave Lake.

We used aerial videography to broadly quantify the health of LSL's shoreline habitat with respect associated landuse. The information was intended to enable regulatory and community groups to make informed decisions regarding the development of LSL's shoreline.

The majority of the Riparian Management Area (hereafter riparian zone) at Lesser Slave Lake was classified as healthy (78.7% of the total length of the shoreline) with lesser proportions identified as moderately impaired (12.5%) or highly impaired (8.8%).

## **ACKNOWLEDGEMENTS**

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## 1.0 INTRODUCTION

Water quality, aquatic habitats, and fish populations in Alberta are under increasing pressure from human related causes. Many lakes and streams in Alberta have suffered substantial riparian habitat degradation over past decades and the “health and integrity” of these systems are at risk. This is a result of cumulative land use factors including unrestricted cattle access, clearing of riparian vegetation, lakefront cottage development, and intensive agricultural practices directly next to banks and shores. These activities can contribute to degraded water quality and fish habitat. The lack of current and comprehensive riparian health information has been identified as an obstacle facing the effective conservation of the vital riparian habitats.

The main objectives of this project were to visually document and assess (qualitative and quantitative) LSL’s shoreline habitat. Low-level aerial videography, and the accompanying Riparian Health Score Sheets (assessed from collected aerial video) and GIS mapping were used to collect and display this information. This information can be used to monitor the results of habitat conservation efforts, facilitate aquatic habitat protection and promote low impact development of the shoreline.

## 2.0 STUDY AREA

This lake is located in northwestern Alberta and is one of the province's largest waterbodies (Mitchell and Prepas 1990). The lake supports five hamlets, one village, and one town including: the hamlets of Grouard, Jousard, Faust, Canyon Creek and Widewater-Wagner; the village of Kinuso, and the Town of Slave Lake (Figure 1). The lake is used as a water supply by municipalities, industries and farming operations (Mitchell and Prepas 1990). There are two provincial parks located adjacent to the lake including Hilliard's Bay and Lesser Slave Lake Provincial Parks. There are also several privately operated recreational facilities with direct access to the lake.

Lesser Slave Lake is managed for sport, commercial and domestic fisheries (Mitchell and Prepas 1990). Sport species include: walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), northern pike (*Esox lucius*), lake whitefish (*Coregonus clupeaformis*), cisco (*Coregonus artedii*), and burbot (*Lota lota*). The popularity of the lake for sport anglers continues to grow as a preferred fishing destination.

Lesser Slave Lake has a surface area of 1160 km<sup>2</sup> with a shoreline length of 241 km (Mitchell and Prepas 1990). The drainage basin is large (12 400 km<sup>2</sup>) and covers an area about 11 times greater than the lake (Mitchell and Prepas 1990). The lake is defined into two basins by a narrow stretch of shallow water known as "The Narrows". The maximum depth of the west basin is approximately 15.5 m while the east basin slightly deeper at 20.5 m (Mitchell and Prepas 1990). The water levels on the lake have been monitored since 1923, and fluctuate over a range of 2.86 m (Mitchell and Prepas 1990). A weir located at the single outlet of Lesser Slave River maintains a minimum lake level of 575.5 m.



Figure 1. Map of Lesser Slave Lake, Alberta, Canada.

### **3.0 MATERIALS AND METHODS**

Aerial videography of riparian zones were captured using a helicopter (A-Star or Bell 206 Jet Ranger) combined with a handheld Sony DCR-TRV 900 digital camera and VMS 200 Geo Mapping hardware, manufactured by Red Hens Systems Inc. (Figure 2). Video was captured when the helicopter was flown at approximately 30-35 knots in a counter clockwise fashion, at the height of approximately 45-60m (slower speed at areas of higher interest, such as shoreline cottage areas). The height provided the best balance between aircraft height and camera zoom capabilities (i.e., decreased zoom coincides with increased stability of the video footage). Global Positioning System (GPS) flight line information obtained from the camera and the VMS 200 system and subsequent assessment information derived from the videography were mapped as individual Geographic Information Systems (GIS) data layers using the VMS 200 Media-mapper GIS software. These layers were then exported to ESRI ArcGIS software and included with other standard GIS data layers (IRS imagery). Captured information was used to generate data outputs including ESRI based map layers.

The main shoreline of Lesser Slave Lake was filmed during three 2.5-3.0 hour flights on the 18, 19 & 20 of July, 2006. This included a portion of the South Heart River outlet (July 19) upstream to the Highway 750 bridge crossing. Dog Island was not included in the assessment.

#### **3.1 The Assessment Scoring System**

The characteristics of the LSL riparian zone were assessed using aerial videography and its associated scorecard as described by Mills and Scrimgeour (2003); (Appendix 1). This scorecard uses weighted multiple-choice responses to eight focal questions regarding vegetation and human disturbance to determine the condition of riparian zones. The score card was modified to address the unique natural sand and rock/cobble beaches of the LSL shoreline. These adjustments included adding a 'Nat' or natural category to the vegetation and woody plants questions to accommodate for the sandy and/or rock/cobble shorelines naturally not supporting >85% vegetated or >15% of woody plants. The 'Nat' score was worth 1 to 0.5 points respectively on the score sheet. The overall total available score was 13, with scores  $\geq 9.5$  resulting in riparian areas being classified as healthy. A score of 7.0 to 9.0 equated to moderate impairment, and 6.5 or

less equated to highly impaired. The assessment boundaries of the riparian zones were established when the answer to any one of the eight scorecard questions changed.

The score card questions are based on the key ecological functions of a healthy riparian zone as described by Cows and Fish (Ambrose et al. 2004). Those functions are as follows:

- Trap and store sediment
- Build and maintain banks and shores
- Store water and energy
- Recharge aquifers
- Filter and buffer water
- Reduce and dissipate energy
- Maintain biodiversity
- Create primary productivity

Natural rock/cobble and sandy shorelines are not able to perform all these functions, specifically creating primary productivity through a diverse plant community. Generally in the first assessment of the video, these shorelines were classified as “moderately impaired” despite the pristine nature of these landscapes. After the first review of the video, and the subsequent health ratings were assigned, the resulting map was presented to Alberta Sustainable Resource Development (ASRD) fishery biologists who were familiar with the LSL shoreline.

An ASRD fishery biologist then reviewed the shoreline video and identified several areas that required revised health scores based upon his on-the-ground knowledge. Some of the revisions included reclassifying some areas from a “moderately impaired” rating to a “healthy” rating because of their natural state. Also some areas were identified as having more severe cattle damage than readily visible from the video, and subsequently were reclassified into a “Highly Impaired” rating. (D. Derosa, pers. comm.)

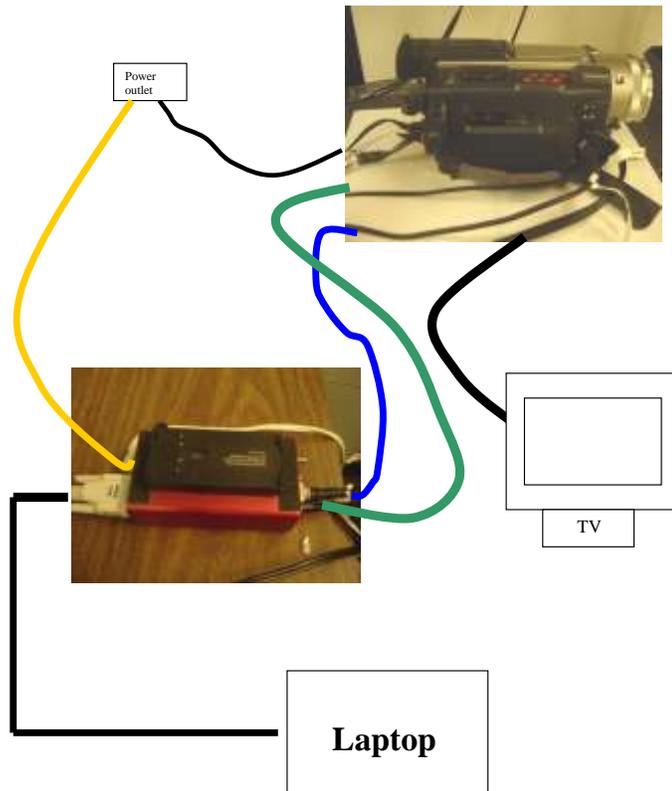


Figure 2. The Sony DCR-TRV 900 digital video camera and Red Hens Systems Global Positioning Systems mapping system used to display the geo-referenced aerial videography.



Figure 3. Aerial videographer George Walker recording the shoreline during the flight.

## 4.0 RESULTS

Results from aerial videography combined with the application of the riparian health scorecard showed that the majority (78.7%) of the riparian zones adjacent to LSL are healthy (in green on a colour map) with 12.5% and 8.8% of shorelines defined as moderately impaired (yellow) to highly impaired (red) respectively. The vegetation and human disturbance categories used to generate these riparian health values are described in Appendix 1, although some scores were revised when ASRD provided additional information. (Figures 4 and 5).

A majority of LSL's shoreline is still considered to be in a natural state, especially along the north shore where there are continuous tracts of undisturbed shoreline.

Areas of shoreline that were rated as "highly impaired" have more intensive housing, recreational, or agricultural activities than those areas rated as being more healthy.

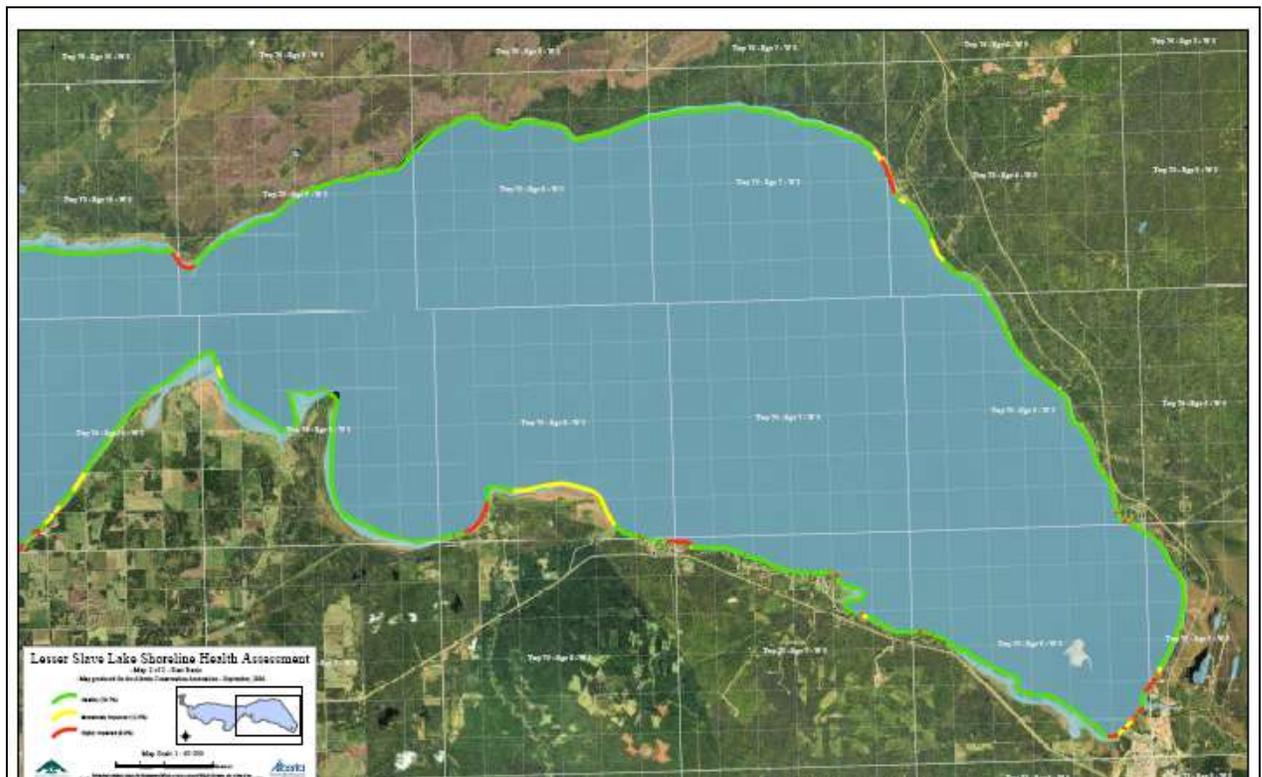


Figure 4. Riparian health scores for the east basin of Lesser Slave Lake.



Figure 5. Riparian health ratings for the west basin of Lesser Slave Lake

## 5.0 SUMMARY and RECOMMENDATIONS

The aerial videography of Lesser Slave Lake in July, 2006 resulted in the planned deliverables of an aerial video of the shoreline, with riparian health scores assigned to sections of the lake and a map showing those scores.

The video and the riparian health scores have been presented to both ASRD fisheries staff and the Lesser Slave Lake Watershed Group. It has been noted that some sections of the lake with naturally sandy or exposed shorelines, with less vegetated cover, initially scored as moderately impaired. It was recommended that some changes in the scoring criteria be made to reflect that these areas are “healthy”, in that there are no human causes for these conditions. A counterpoint has been that the map is a tool designed to document general riparian health, acknowledging that some areas require further investigation or ground truthing to determine their actual health. This was done in the development of this map, when the ASRD fishery biologist provided suggestions for health score changes. However, these post-assessment changes inhibit the ability to make lake-to-lake comparisons, due to the loss of consistent, standardized assessment criteria.

## 6.0 APPENDICES

### 6.1 **Appendix 1. Aerial videography lentic health and integrity score sheet (Lesser Slave Lake Riparian Health Assessment Project 2006).**

#### AERIAL VIDEOGRAPHY – LENTIC RIPARIAN MANAGEMENT AREA HEALTH AND INTEGRITY ASSESSMENT SCORECARD<sup>1,2,3</sup>

August 19, 2003

Human caused disturbance of lakeshores in North America continues and is resulting in significant negative changes to lake eco-systems and their species; especially fish (Radomske and Goeman 2001; Schindler, Geib and Williams 2000). In Alberta this disturbance is often seen as physical alteration or vegetation removal within the riparian/riparian-wetland area.

Riparian or Riparian-wetland Areas are found on the edge (shoreline) of lakes and streams and provide sufficient moisture to support the growth of vegetation that require moderate (riparian) to saturated (riparian-wetland) moisture conditions (Armantrout 1998; Prichard 2003). The upland boundary of this area can sometimes be determined by abrupt changes in the landform and/or vegetation. However, proper determination often relies on intuitive determination by experienced personnel (Cows and Fish 2003). In north-central Alberta this landform break is often seen as a change from grasses and lower woody shrubs to taller deciduous or coniferous trees. Historically, conservation and management activities (e.g., preservation, rehabilitation and enforcement) that target human caused disturbances at lakes have focused on the Riparian Management Area; the shoreline and immediate offshore area found within the riparian/riparian-wetland area.

This scorecard follows the general health and integrity approach described in Scrimgeour and Wicklum (1996). The scorecard, applied to low altitude (< 200 ft) aerial videography, delivers a rapid, “coarse filter” assessment of riparian management area health on individual polygons that can be summarized to describe the health and integrity of the entire lake. This information can be used to direct conservation and management activities at those human actions negatively impacting the health or integrity in the riparian management area.

**Assessment Questions and Scoring.**

1. 85% or more of the polygon area is covered with vegetation of any kind? (Polygon area does not include area covered by water).  
**Yes** \_\_\_\_ (2 points) **Nat** \_\_\_\_ (1 point) **No** \_\_\_\_ (0 points)
  
2. Cattails and bulrushes are visibly growing in the littoral zone adjacent to the polygon area? (Identifying immature bulrush and cattail stands may be difficult. On some lakes these species do not grow because of site and/or climate conditions. It is important you know this prior to deciding if their absence is natural or human caused).  
**Dense to Medium** \_\_\_\_ (1 point), **Medium to Sparse** \_\_\_\_ (0.5 points), **None** \_\_\_\_ (0 points)
  
3. Woody plants like willow, birch or poplar cover 15% or more of the polygon area? (In some cases riparian areas do not have the potential for woody plants because of soil chemistry and other factors, i.e., saline and drainage. In some cases woody plants do not meet this threshold because of site and successional reasons).  
**Yes** \_\_\_\_ (1 point) **Nat** \_\_\_\_ (0.5 points) **No** \_\_\_\_ (0 points)
  
4. Within the 15% woody zone, what is the abundance of woody plants? (If the answer to Question 3 is no, this question receives 0 points)  
**Dense to Medium** \_\_\_\_ (1 point) or **Sparse to Medium** \_\_\_\_ (0.5 points) **None** \_\_\_\_ (0 points)
  
5. 35% or more of the polygon shows visual signs of human caused removal or alteration of vegetation? (e.g., includes conversion of native vegetation to lawn grass, mowing, grazing, cutting of woody vegetation, etc.).  
**Yes** (0 points) **No** (2 points)
  
6. 35% or more of the polygon shows visual signs of human caused physical alteration? (e.g., addition or removal of sand or rock, harrowing beaches, retaining walls, boat houses, decks, patios, walking or ATV trails, cattle activity, etc.)  
**Yes** (0 points) **No** (3 points)
  
7. What picture does most of the polygon look like?  
**Picture A?** \_\_\_\_ (1 point) **Combination of A and B?** \_\_\_\_ (0.5 points) **Picture B?** \_\_\_\_ (0 points)



8. Does the lake have human caused water withdrawal (e.g., cottage, municipal, industrial, etc) or filling? (e.g., dams, weirs, drainage channel outflow) (This is a background question supported by the aerial videography but requiring local input or knowledge to answer).

None\_\_\_\_(2 points) **Minor**\_\_\_\_(1.0 points) **Moderate to Extreme**\_\_\_\_(0 points)

**Total possible points = 13 .**

**Actual points (sum from questions above) = .**

### Summary of Question Scorecard

If the score is **9.5 or more** it is likely the Riparian Management Area is **healthy**.

If the score is **7.0 to 9.0** it is likely the Riparian Management Area is **moderately impaired**.

If the score is **6.5 or less** it is likely the Riparian Management Area is **highly impaired**.

- <sup>1</sup> Aerial videography and scorecard developed by Blake Mills, Alberta Conservation Association and George Walker, Alberta Sustainable Resource Development, Fish & Wildlife Division.
- <sup>2</sup> This Score Card was adapted from the Lake Shoreline Health Assessment Videography Score Card, Vincent Lake Working Group, 2002 and Alberta Lentic Wetland Health Assessment Survey, Cows and Fish, 2003.

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