

# Rosen Lake Foreshore Inventory and Mapping, Fish and Wildlife Habitat Assessment and Shoreline Management Guidelines



Submitted to:  
**East Kootenay Integrated Lake Management Partnership**

Submitted by:  
**AMEC Earth & Environmental  
Nelson, BC**

25 November 2010

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**AMEC Earth & Environmental  
a division of AMEC Americas Limited**

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#### **IMPORTANT NOTICE**

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## **Executive Summary**

Increased pressure for recreational and urban development along the foreshore of lakes in the East Kootenay, such as Rosen Lake has created concern for the state of natural resources in the area. In response to growing concern surrounding the rapid development of lake shorelines, the East Kootenay Integrated Lake Management Partnership (EKILMP) was formed in 2006 to “protect lakes by producing ecologically based land use and development guidance documents and encouraging more integrated and coordinated approaches by all levels of government, property owners and developers.” In order to meet their objectives, EKILMP has been undertaking foreshore inventory along several lakes within the East Kootenay. These inventories include the completion of a Foreshore Inventory and Mapping (FIM) survey and report, a fish and wildlife habitat assessment and the production of Shoreline Management Guidelines that incorporate the results of the two preceding studies to highlight the locations of high value aquatic habitats that are vulnerable to the impacts of foreshore development. The current report includes all three of the aforementioned assessments, including shoreline management guidelines for Rosen Lake with applicable maps depicting valued aquatic habitats. EKILMP recommends that areas designated as having very high value aquatic habitats be designated for conservation use and that no development occur within them. Areas with high value aquatic habitats require detailed environmental assessments and regulatory approval prior to development, which is considered high risk in these sensitive areas, though some activities may be allowed. Development and undertakings are more acceptable within moderate to very low valued habitats so long as important habitat features identified as zones of sensitivity, are avoided.

The Rosen Lake shoreline is approximately 5,440 m long and is dominated by a vegetated shore, mud substrates and a mixture of urban and high density recreation land uses. All areas of the Rosen Lake foreshore, except for a small vegetated island at the northern end of the lake, exhibit a high level of impact due to a high level of urbanization. Numerous docks, retaining walls, and substrate modifications were observed along the foreshore of Rosen Lake. However, some small wetland and marsh areas were observed along the main lakeshore as well as along the uninhabited island at the north end. Overall, the AHI analysis for Rosen Lake ranked the main lakeshore as low, whereas the island contained very high value habitats.

## 1.0 INTRODUCTION

Rosen is a small (<75 Ha), relatively shallow (<13 m maximum depth) lake located in the southeast corner of British Columbia near the communities of Jaffray, Cranbrook, and Fernie and neighbouring Tie Lake (Figure 1). Fisheries records indicate that both native and stocked non-native salmonids occur (FISS) in Rosen Lake, but higher numbers of non-sport fishes have more recently been observed (FISS; B. MacDonald, Columbia Section Head, Fisheries & Oceans Canada (DFO), pers. comm., 2010). Development pressure along the foreshore of the lake has been relatively high, given its close proximity to larger cities such as Calgary, AB, warmer water temperatures in the summer and a general desire for lakefront living makes Rosen Lake attractive for seasonal recreation. For example, in 2006 approximately 101 residences were observed along the shoreline of Rosen Lake, of which, under 20% were occupied by full time residents (BCLSS 2006). Historically, the area surrounding Rosen Lake has been used for agriculture and forestry, which still exist at present (Wilson 2008).

Increased pressure for recreational development along the foreshore of lakes such as Rosen in the East Kootenay has created concern for the state of natural resources in the area. In response to growing concern surrounding the rapid development of lake shorelines in the East Kootenay, the East Kootenay Integrated Lake Management Partnership (EKILMP)<sup>1</sup> was formed in 2006 to “protect lakes by producing ecologically based land use and development guidance documents and encouraging more integrated and coordinated approaches by all levels of government, property owners and developers.” Guidance documents have been developed using information collected from standardized Foreshore Inventory and Mapping (FIM) techniques developed by DFO on several lakes in the East Kootenay and throughout British Columbia. The data collected during FIM surveys can be integrated with additional fish and wildlife information to highlight lakeshore areas of high ecological value and incorporate the results into Shoreline Management Guidelines for various activities that may occur such as the construction of retaining walls, docks, boat launches, etc. This is done by preparing an aquatic habitat index (AHI) that, when applied to lake shorelines segments differentiated during the FIM survey, can identify the value of aquatic habitat within that segment. The results are produced in a manner that identifies habitat vulnerability zones on a categorical scale (very low to very high) which are then color coded (red, orange, yellow and grey) and mapped. Guidelines are applied to the various colour zones to guide what development is acceptable in that zone and are made available to community planners and regulatory agencies by FrontCounter B.C. and community associations on each lake. These documents provide a relatively simple means of relating aquatic habitat value information to community planners. This current methodology was employed for Rosen Lake to provide a basis for integration of environmental information into land use policy documents.

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<sup>1</sup> EKILMP's current membership includes: DFO, British Columbia Ministry of Environment (MOE), Regional District of East Kootenays (RDEK), District of Invermere, Integrated Land Management Bureau, Transport Canada, Wildsight, IHA, Canadian Columbia River Inter-tribal Fisheries Commission (CCRIFC), Wasa Lake Land Improvement District, Moyie Community Association, Jimsmith Lake Community Association, and Rosen Lake Ratepayers Association.



## **1.1 Objectives**

The following are the overall project objectives for Rosen Lake provided by the EKILMP:

1. Identify, inventory, and map the entire foreshore of the subject lakes and their associated riparian habitats and important fish and wildlife habitat features (Foreshore Inventory and Mapping project).
2. Prepare a habitat index that will be used to identify sensitive shoreline features and habitats surrounding the lakes. This AHI has been used on other lakes and uses inventory data (above), field sampling, and air photo interpretation to rank the habitat value of shoreline segments.
3. Prepare a shoreline management guidelines document that can be integrated into local mapping and planning initiatives. This document facilitates local government planning, such as development of Official Community Plans (OCP's), and development project approvals by regulatory agencies.

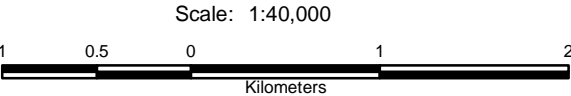


Y:\GIS\Projects\VE\VE51966\_Tie\_Rosen\_Lake\_FIM\Mapping\MXD\Drafts\overview\_v3.mxd



**Legend**

- City / Town
- Highway
- Watercourse
- Lake



**Reference**  
Rosen Lake Inventory- EKILMP


CLIENT:

EKILMP

PROJECT:

Rosen Lake FIM

Rosen Lake Overview

DATE: April 15, 2010	ANALYST: EO	<b>Figure 1</b>
JOB No: VE51966	QA/QC: CL	
GIS FILE: overview_v2.mxd		
PROJECTION: UTM Zone 11		
DATUM: NAD83		



## 2.0 PROJECT STUDY AREA

Rosen Lake (WBID- 349-284500-14300-37800) is located at an elevation of 820 m, has a surface area of 0.73 km<sup>2</sup> (73 ha), a mean depth of 4.3 m, and a maximum depth of 12.8 m (Oliver 2003, BCLSS 2006). Physical and biological information for Rosen Lake is lacking, but fish species recorded have included brook trout (*Salvelinus fontinalis*), longnose sucker (*Catostomus catostomus*), largescale sucker (*Catostomus macrocheilus*), rainbow trout (*Oncorhynchus mykiss*), reidside shiner (*Richardsonius balteatus*), Westslope cutthroat trout (*Oncorhynchus clarki lewisi*), and Dolly Varden (*Salvelinus malma*) (Oliver 2003, FISS 2010). Though historical observations of Dolly Varden have been recorded in Rosen Lake, they are most likely misidentified bull trout (*Salvelinus confluentus*; McPhail 2007, J. Bisset, senior aquatic biologist, CCRIFC, pers. comm., 2010). Spawning kokanee (*Oncorhynchus nerka*) were observed in 2002 downstream of Rosen Lake outlet in Little Sand Creek, but there was no evidence of spawning within the lake along the shoals or lake margins (Oliver 2003). Monitoring, conducted between 2004 and 2006, indicated that the ice-on to ice-off period occurs from late November to late March and that maximum surface water temperatures of approximately 22°C are reached in late July/early August with a mean secchi depth of 5.5 m at this time (BCLSS 2006). Water levels are regulated by control structures on outlet creeks.

## 3.0 METHODS

The protocol for the inventory, mapping, classification, and guideline document production for East Kootenay lakes is based on previously developed Sensitive Habitat Inventory and Mapping (SHIM) procedures. In general, there are three stages to the inventory of each lake: the completion of a Foreshore Inventory and Mapping (FIM) survey and report, a Fish and Wildlife Habitat Assessment and the development of Shoreline Management Guidelines.

The objectives of each stage of the assessment process as outlined by EKLIMP (2010) are provided below and detailed information relevant to the current project is described in Sections 3.1 through 3.5.

**Foreshore Inventory and Mapping (FIM)** is a project where GIS, GPS and field observation are used to identify and document the land uses (i.e. residential development), shoreline modifications (i.e. docks), and biophysical attributes (i.e. marshes) along the lake shoreline. The report identifies baseline inventory information that can assist with monitoring, the development of land management objectives for the shoreline and the development of management plans and policies.

The **Fish and Wildlife Habitat Assessment** reports are a result of a range of activities to assess the values associated with the habitat. Activities can include historical air photo analysis, fisheries, aquatic invertebrates and wildlife field assessments, aquatic habitat indexing and determination of zones of sensitivity for the lake foreshore. The result of the report is the identification of Ecological Value rankings and recommendations of future actions to be undertaken to provide direction for opportunities for conservation and restoration.

The **Shoreline Management Guidelines** are intended to be used as an initial step when reviewing, planning for, or prescribing alterations along the shoreline. The Guidelines are developed based on the information contained within the FIM and Fish and Wildlife Habitat Assessment reports for each lake. The Guidelines identify shoreline sensitivity zones, activity risk analysis and the process of proceeding with applications for works along the shoreline. The Guidelines are intended to result in cooperative management between all levels of government who have responsibility for approvals and permits and to provide direction to applicants when considering development along the foreshore.

### **3.1 Foreshore Inventory and Mapping (FIM) Field Surveys**

Standardized FIM surveys were conducted on Rosen Lake following methods outlined in Schleppe and Mason (2009). Data was collected on 6 June 2008 by three members of MOE Conservation Corps as well as Peter Holmes, an Ecosystem Biologist with MOE (Invermere B.C.). The foreshore of the lake was mapped and foreshore characteristics collected using a handheld Trimble GEOXT 2005 GPS receiver loaded with the SHIM v2.4 data dictionary as per Schleppe and Mason (2009). A georeferenced shoreline video was also recorded and representative photos of each segment were taken during the survey. MOE transferred all related GIS and shoreline characteristic data to AMEC Earth & Environmental (Nelson, BC) to conduct further analyses and reporting.

### **3.2 Fish and Wildlife Surveys**

Fish and wildlife surveys were conducted in Rosen Lake on 21 July 2009 by Bruce MacDonald (Section Head, Columbia Region, DFO, Nelson B.C.) and Peter Holmes (Ecosystem Biologist, MOE, Invermere B.C.). Information on fish and wildlife in each lake was collected on a segment-by-segment basis corresponding to the 2008 FIM survey. Additional photos were taken within each shoreline segment during the fish and wildlife surveys.

Fish observations were taken visually in each segment from the side of the boat as it slowly moved along the shoreline. Aquatic habitat observations taken during these surveys included: aquatic vegetation, substrate type, foreshore impacts and land use.

Wildlife observations were also taken for each segment. General observations were taken from the boat, while a foot-survey provided further details on the riparian zone and included wildlife trees, coarse woody debris, and the composition of both the forest canopy and shrub community.

Information collected during the 2009 fish and wildlife surveys was used in conjunction with historical fisheries information for incorporation into the AHI (see below), as applicable, and to identify important habitat features as zones of sensitivity.

### **3.3 Data Analysis**

Data collected during the 2008 FIM surveys was provided to AMEC as Microsoft® Excel spreadsheets, GIS shape files, as well as separate jpeg photo files (Appendix A). Shoreline

characteristics included in this dataset were divided into the following categories separately for each lake:

- Natural vs. disturbed shoreline;
- Land use;
- Shore type;
- Substrate type;
- Aquatic vegetation and littoral zone;
- Riparian characteristics;
- Shoreline modifications; and
- Level of impact.

Segment length was calculated for these shoreline categories and categorical comparisons were conducted, where possible. For example, shore type for each segment was divided by the amount of vegetated, sand beach, and low rocky shore found within that segment. For certain riparian characteristics (e.g., number of snags), qualitative descriptions were provided as categorical comparisons could not be directly made. Information collected during fish and wildlife surveys conducted in 2009 was also included to clarify comparisons, where required.

### **3.3.1 Aquatic Habitat Index**

An AHI is a means of assessing the value of aquatic habitat or the sensitivity of the aquatic habitat along a lake's shoreline (Schleppe 2009). The AHI score can be calculated for various segments within a lake and a comparison made to determine higher valued aquatic habitats. Dimensionless values are assigned to a suite of variables (Table 1) that can be added together to provide an overall AHI score for each shoreline segment. AHI's have been developed separately for Okanagan, Windermere and Moyie lakes (Schleppe and Arsenault 2006, McPherson and Hlushak 2008, Schleppe 2009) and are currently in development for Columbia and Wasa lakes (B. MacDonald, pers. comm., 2010).

The AHI index used for Rosen Lake followed that developed for Moyie Lake (Schleppe 2009), so that future comparisons may be possible between inventoried lakes throughout the East Kootenays (B. MacDonald, pers. comm., 2010). The Moyie AHI assigns higher scores to 'natural' and sensitive aquatic habitat features (e.g., confluence and wetland areas), while modifications present along the natural shoreline (e.g., retaining walls, docks, marinas) receive a lower score (Table 1). Schleppe (2009) provides an explanation for the criteria and the scoring system used for this AHI index (Table 1). Scores were assigned to each AHI category and tallied for each segment within Rosen Lake as outlined in Table 1 and described in Schleppe (2009) with the following exceptions:

1. Shore Type: A vegetated shore type was included in the SHIM version 2.4 data dictionary used during the Rosen Lake survey, which was not included in the Moyie Lake analysis. A vegetated shoreline parameter was included for Windermere Lake and the relative value attributed to it was greater than cliff/bluff and less than sand beach (McPherson and Hlushak 2008). As vegetated shoreline was the dominant shore type observed during Windermere and Rosen FIM surveys, and the fish species observed in

the lakes were relatively similar, the vegetated shore type was included in the current AHI at a similar ranking to that of Windermere Lake's AHI. The remaining shore types were given the same ranking as used for Moyie Lake (Schleppe 2009) and the logic behind the delineation of these categories can be found in that report as well as those for Okanagan and Windermere lakes (Schleppe and Arsenault 2006; McPherson and Hlushak 2008).

2. Fisheries: Fish information available for Rosen Lake to date does not include specific spawning, staging, or rearing locations for native fishes. Locations specific to individual life histories of native fishes were included in the Moyie Lake assessment (Schleppe 2009). Only a juvenile fish rearing parameter is included in the AHI for Rosen Lake based on the current fish species review, though it is likely native cyprinids observed in Rosen Lake would use these areas as adults as well as juveniles. Similarly to Moyie Lake, juvenile fish rearing locations are any natural, wide littoral areas associated with stream mouths, outlets, aquatic vegetation and/or wetlands that can be used by these life history stages for foraging and refuge. Segments were given a ranking of low (2), medium (5) or high (10) based on the presence of these features. For example, a natural, unmodified segment with wetland areas would receive a high ranking while a segment with small patches of wetland and a creek mouth would be ranked medium. Segments with little to no wetlands or natural areas were given a ranking of low, as it is still possible rearing locations exist in these areas. Though this parameter was included under the fisheries category, these areas also represent locations of ZOS such as those likely to be used by the turtle population in Rosen Lake.

**Table 1: Aquatic Habitat Index (AHI) criteria and scoring used for Rosen Lake. This AHI was based on that used for Moyie Lake with modifications for vegetated shore type and juvenile rearing area; see text for further description.**

Category	Criteria	Maximum Point	Logic	Designation Value Description (Points)	Model Weight (% of Total)
Biophysical	Shore Type	20	% of Segment * Shore Type Value (summed for all substrates in that segment)	<b>Shore Type Value:</b> Stream Mouth = Wetland (20); Gravel Beach = Rocky Shore (15); Sand Beach = Cliff/Bluff = Vegetated (10); Other (5)	20.5
	Substrate	10	% of Segment * Substrate Value (summed for all shore types in that segment)	<b>Substrate Value:</b> Cobble (10); Gravel (8); Boulder = Organic = Mud = Marl = (6); Fines = Sands (4); Bedrock (2)	10.2
	Percent Natural	15	% Natural * Natural Score		15.3
	Aquatic Vegetation	8	% Aquatic Vegetation * Aquatic Vegetation Score		8.2
	Overhanging Vegetation	6	% Overhanging Vegetation * Overhanging Vegetation Score		6.1
Riparian	Riparian Band 1	10	Vegetation Bandwidth Value * Vegetation Class Value * Riparian Band 1 Score	<b>Vegetation Bandwidth Value:</b> 0 to 5 m (0.2); 6 to 10 m (0.4); 11 to 15 m (0.6); 16 to 20 m (0.8); > 21 m (1)	10.2
	Riparian Band 2	6	Vegetation Bandwidth Value * Vegetation Class Value * Riparian Band 2 Score	<b>Vegetation Class Value:</b> Natural Wetland = Disturbed Wetland = Broadleaf = Shrubs (1); Coniferous Forest = Mixed Forest (0.8); Herbs/Grasses = Unvegetated (0.6); Lawn = Landscaped = Row Crops (0.3); Exposed Soil (0.05)	6.1

Category	Criteria	Maximum Point	Logic	Designation Value Description (Points)	Model Weight (% of Total)
Fisheries	Juvenile Rearing Area	10	High (10), Medium (5), Low (2)	High (10); Medium (5); Low (2)	10.2
	Retaining Wall	-3.5	% Retaining Wall * -5		3.6
Modifications	Docks	-4	# Docks * -0.1		4.1
	Groynes	-0.25	# Groynes * -0.25		0.3
	Boat Launch	-3	# Launches * -1		3.1
	Marina	-2	# Marinas * -1		2.0

### 3.3.1.1 Segment Ranking

A five class categorical ranking system was used to convert the AHI scores assigned to each segment into a summarized aquatic habitat value from Very Low to Very High (Schleppe 2009). The determination of breaks between the rankings (e.g., Low and Moderate) was slightly different than that used in Schleppe (2009) for Moyie Lake, since the removal of two Fisheries category criteria (see Section 3.3.1) resulted in a lowered overall maximum score for Rosen Lake by approximately 10%. This adaptation is a means of calibration that allows comparisons to be made between Rosen Lake and other lakes using the Moyie Lake AHI, if required. The results were mapped and viewed spatially to confirm adjustments to the ranking designations were appropriate. Segment rankings (or habitat values) included: i) Very Low = <18; ii) Low = 19 to 30; iii) Moderate = 31 to 42; iv) High = 43 to 54; and, v) Very High = >55 (Appendix D).

### 3.3.1.2 Potential Aquatic Habitat Value

The Potential Aquatic Habitat Value (PAHV) of each segment was also calculated by replacing negative values associated with shoreline modifications within the AHI with a value of zero (Schleppe 2009). PAHV can provide an indication of the aquatic habitat that may have existed prior to shoreline modification, as well as highlight potential shoreline restoration opportunities.

## 3.4 GIS

Section breaks and other point features were interpolated using GPS data, overlaid with TRIM level lake line work and available imagery. Data provided by EKILMP had already been post-processed and shape files for each lake segmented by GPS section breaks had also been provided. The lakeshore sections depicted in Appendix B (Map 1) should be used for cartographic purposes and larger scale mapping may require further refinement. Bing Map imagery was included with the maps to provide context. Offsets used during the field survey were automatically incorporated by the Trimble unit and further processing was not warranted.



Data provided to AMEC for analysis had already had the total linear distance (meters) calculated in ArcView GIS and was divided by segment characteristics to allow for additional analyses and percentage calculations. Maps were developed using ArcView GIS and 2008 segments were plotted by the overall segment ranking calculated in Section 3.3.1.1. Vulnerability Colour Zones were applied to segment rankings as follows: i) Grey = Very Low and Low; ii) Yellow = Moderate; iii) Orange = High; and, iv) Red = Very High (McPherson and Hlushak 2008).

### **3.5 Zones of Sensitivity**

Zones of sensitivity (ZOS) have been defined as environmentally sensitive areas that have the potential to be negatively affected by development (McPherson and Hlushak 2008). ZOS can be used to map the specific locations of important habitat features within lake segments, regardless of the overall ranking of a particular segment. The areas included as ZOS in analysis of the Rosen Lake shoreline include wetlands, creek mouths, outlet areas, turtle habitat and loon nesting locations. Description of the ecological importance of these habitats can be found in McPherson and Hlushak (2008).

Information used to determine the locations of ZOS included FIM survey data (including shoreline video and photos), fish and wildlife assessment data, imagery and professional input. These locations were then added as spatial units to lakeshore segment maps depicted in Appendix B (Map 1). These locations can be further refined and identified in future years by additional field investigations that spatially record the boundaries of ZOS. ZOS were not incorporated into the Rosen AHL though they have been for other East Kootenay lakes such as Columbia and Wasa (Interior Reforestation, in prep). Additional field studies that further refine the locations of ZOS may warrant their addition to the AHL.

### **3.6 Shoreline Management Guidelines**

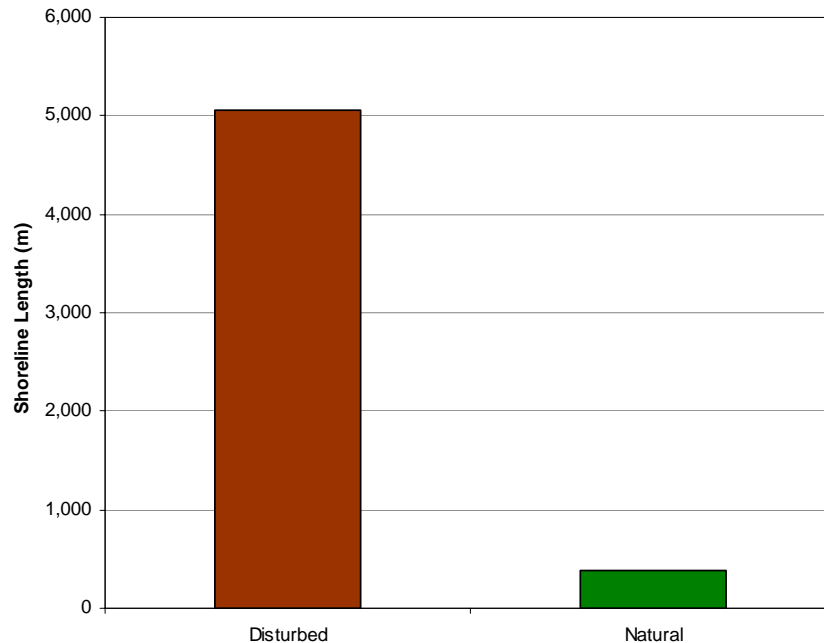
EKILMP has developed standard shoreline management guidelines for Windermere Lake (EKILMP 2009), which have been incorporated into the Moyie Lake FIM (Schleppe 2009) and are currently being incorporated into Columbia and Wasa lakes FIM (Interior Reforestation, in prep). These guidelines “utilize a risk-based approach to shoreline management” (Schleppe 2009) and have built-in recommendations for each Vulnerability Colour Zone assigned to FIM lake segments. This baseline information can be provided to government agencies for incorporation into their Official Community Planning, municipal bylaw development and land-use planning activities, and used for screening development applications. The EKILMP template (EKILMP 2009) was incorporated directly into the present report for the production of shoreline management guidelines for Rosen Lake (Section 7).

## **4.0 RESULTS**

The results of Rosen Lake 2008 FIM and 2009 fish and wildlife surveys are presented below. Data collected during the 2008 FIM survey are included with representative photos as segment summaries in Appendix A and GIS maps are included in Appendix B. Data collected during 2009 fish and wildlife survey information is found in Appendix C.

#### 4.1 Natural vs. Disturbed Shoreline

The total shoreline length of Rosen Lake is 5,440 m. The foreshore was divided into a total of 3 segments ranging from approximately 120 m to 3420 m. The majority of the shoreline (93%) was classified as disturbed (5,062 m), while approximately 7% (378 m) was classified as natural shoreline areas (Figure 2). Segment 1, a small island (120 m foreshore length) in the northern corner of the lake, consisted of entirely natural foreshore areas while the remaining two segments were classified as disturbed in over 90% of their foreshore areas.



**Figure 2:** *Disturbed vs. natural shoreline length observed along Rosen Lake, 2008.*

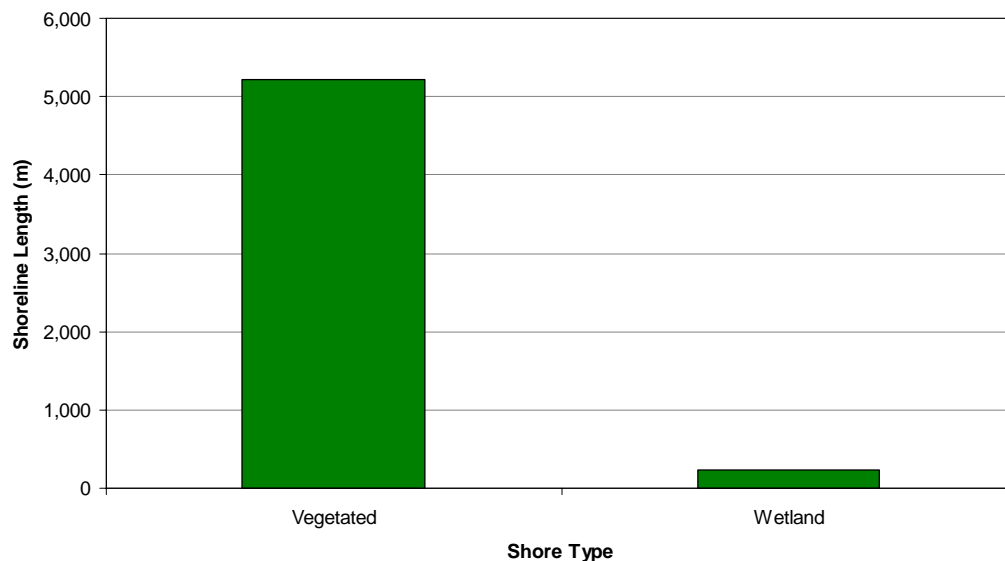
#### 4.2 Land Use

The predominant land use along Rosen Lake was urban residential which accounted for 5,320 m (98%) of shoreline. The only area not designated as urban residential land use was Segment 1, the small island at the north end of the lake which was not classified during the FIM survey (Appendix A). RDEK land use maps for Rosen Lake indicated that this unclassified area was zoned as Crown land (RDEK 2010) and would be classified as Natural using FIM categories. Comparison with satellite imagery available for Rosen Lake confirms that this area is designated as Natural.

#### 4.3 Shore Type

The predominant shore type observed along Rosen Lake was vegetated shore (5,212 m; 96%) followed by wetlands (228 m; 4%; Figure 3). A significant amount of natural shoreline plant communities have been replaced with non-native species (such as grasses). Small

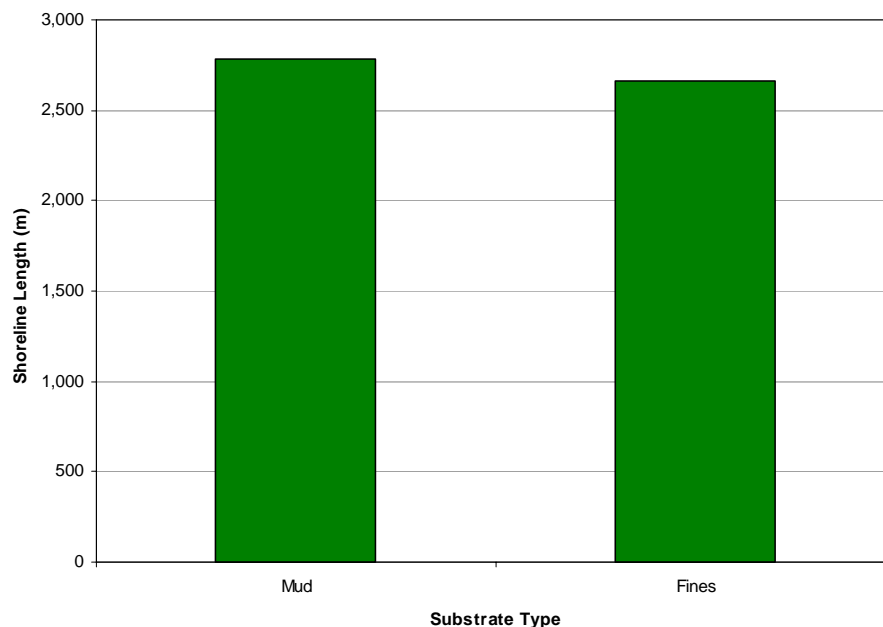
wetland areas occurred in both Segments 2 and 3 (5% and 3%, respectively; Appendix A) along the main lake shore. Even though Segment 1 was classified as 100% vegetative shore type, review of photographs and riparian vegetation (Section 4.6) indicates that small wetland areas were present along the island in the northern section.



**Figure 3:** *Shore types observed along the foreshore of Rosen Lake, 2008.*

#### 4.4 Substrate Type

Two substrate types observed in relatively equal amounts along the Rosen Lake foreshore included mud (51%; 2,780 m) followed by fines (49%; 2,660 m; Figure 4).



**Figure 4: Substrate types observed along the foreshore of Rosen Lake, 2008**

#### 4.5 Aquatic Vegetation and Littoral Zone

Aquatic vegetation occurred along approximately 20% (1,065 m) of the shoreline (Appendix A) and was identified as pondweed (*Potamogeton sp.*) and rushes (not identified to genus; Appendix C). The only type of aquatic vegetation observed along the shoreline of Rosen Lake during 2008 FIM surveys was classified as emergent vegetation, which occurred in all segments (Appendix A). However, submerged aquatic vegetation (pondweed) was observed floating in sparse beds in Segments 1 and 3 during surveys the following year (Appendix C). The small island (Segment 1) had the highest proportion of aquatic vegetative cover (80%) and the main lake foreshore (Segments 2 and 3) had noticeably less (20% and 15%, respectively).

The size of the littoral zone along Segments 2 and 3 was classified as Moderate and ranged between 10 and 50 m, while Segment 1 was classified as Wide because it was greater than 50 m. A small amount of large woody debris (LWD; less than 5 pieces per segment) was found in Segments 2 and 3, whereas Segment 1 did not contain LWD (Appendix A).

#### 4.6 Riparian Characteristics

Nearshore riparian areas (i.e. Riparian Band 1) along Rosen Lake were approximately 20 m wide and ranged from 15 to 25 m (Appendix A). The riparian class of the entire nearshore riparian area of Rosen Lake, except for the small island at the north end of the lake, was landscaped (5,320 m; 98%). The riparian class of the small island (Segment 1) was natural wetland (120 m; 2%). The riparian stage of the entire lake was classified as tall shrubs being between 2 and 10 m tall (Appendix A). Nearly one third of the Rosen Lake shoreline had overhanging riparian vegetation (1,699 m; 31%) and nearshore cover was classified as

moderate (5,320 m; 98%), except for around the island (Segment 1) which was classified as sparse (120 m; 2%).

Upland riparian area (i.e. Riparian Band 2) was not recorded for Segment 1 as this small island did not have an upland area (Appendix A). The main lake shoreline, Segments 2 and 3, were dominated by mature coniferous forest with abundant cover levels (Appendix A). The bandwidth of this riparian area ranged from 25 to 35 meters.

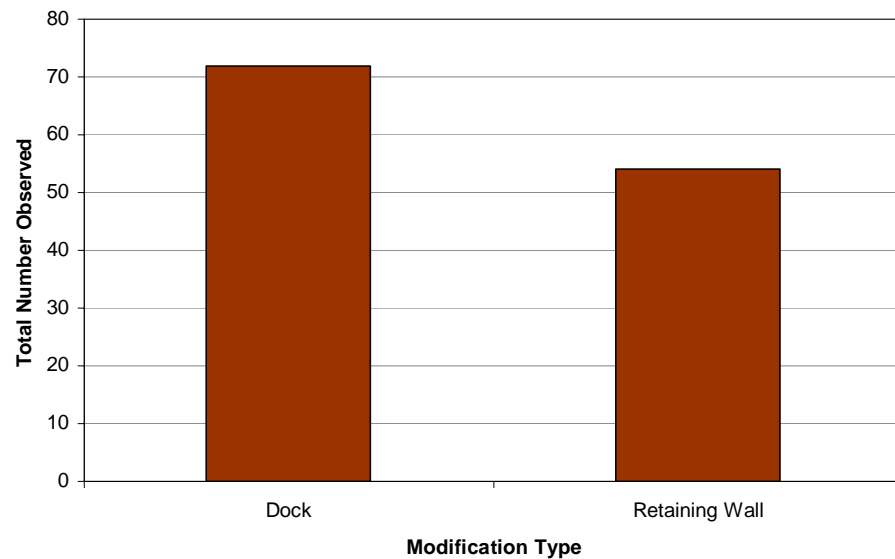
Riparian characteristics were described during fish and wildlife surveys in July 2009 indicating the main lake shore (not the Segment 1 island) consisted of a mature, closed canopy forest with tree species including Douglas fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*) and ponderosa pine (*Pinus ponderosa*). The shrub species found in all segments included willow (*Salix sp.*), red osier dogwood (*Cornus stolonifera*) and alder (*Alnus sp.*; Appendix C).

Few veteran trees and snags were observed in Segments 2 and 3, but none were in Segment 1 (Appendix A). Few wildlife trees were observed during July 2009 surveys in Segments 2 and 3 and none were listed in Segment 1 (Appendix C).

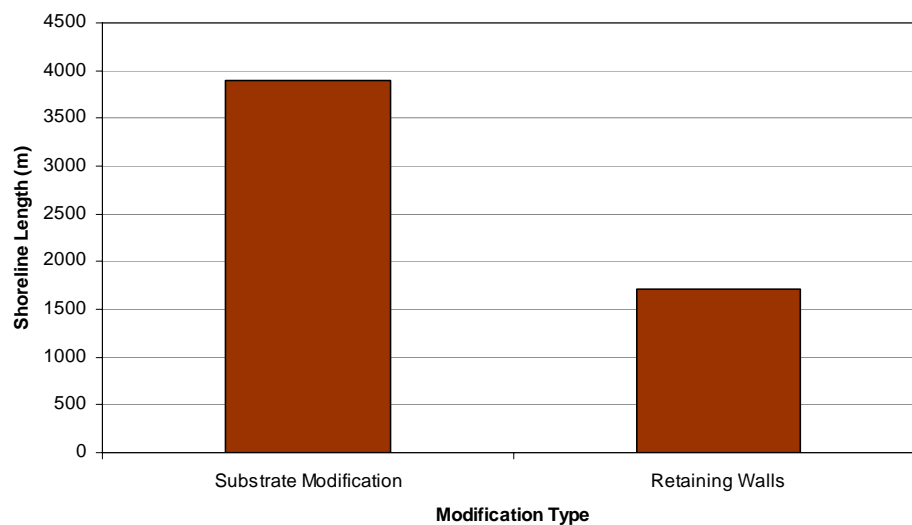
#### **4.7 Shoreline Modifications**

Three types of shoreline modifications were observed along Rosen Lake: retaining walls, docks, and substrate modification (Figures 5 and 6). No shoreline modifications were observed in Segment 1 (Appendix A). Docks comprised the majority of modifications seen in 2008 with 72 found along the 5,320 m of the main Rosen Lake shoreline (Segment 2 and 3; Figure 5). There were approximately 13.5 docks/km in Segments 2 and 3 (Appendix A). A total of 54 retaining walls were present in Segments 2 and 3 and these were the only other foreshore modification enumerated in 2008 (Figure 5). Boathouses and floats were also observed during fisheries observations in 2009, but the total number observed was not recorded (Appendix C).

Shoreline length was further divided into the following modification categories: roads, retaining walls, and substrate modification (Appendix A). Substrate modification comprised the highest proportion of the total modified shoreline length, which occurred along 72% (3,895 m) of the Rosen Lake foreshore (Figure 6). Except for Segment 1, all segments contained foreshore substrate modifications, which included grass to the water edge and some infill areas (Figure 7; Appendix C). Retaining walls were present along 31% (1,710 m) of the total shoreline, right to the water line (Figure 6 and 7). The presence of retaining walls along the foreshore ranged from 0% in Segment 1 to 46% in Segment 2 (Appendix A).



**Figure 5:** *Total number of docks and retaining walls observed along the foreshore of Rosen Lake, 2008.*



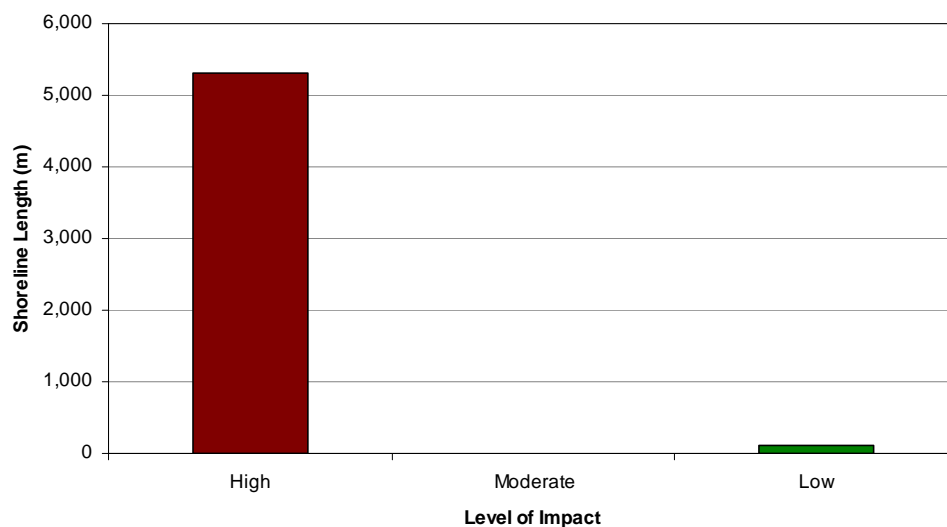
**Figure 6:** *The total shoreline length observed to have been altered by substrate modification and retaining walls along the foreshore of Rosen Lake, 2008.*



**Figure 7:** *An example of the Rosen Lake foreshore depicting grass right to the water line and a stonework retaining wall (Segment 2). Photo taken by Peter Holmes (MOE), July 2009.*

#### 4.8 Level of Impact (LOI)

Almost the entire foreshore of Rosen Lake was classified as having a high level of impact (98%; 5,320 m; Figure 8), which was based on both Segments 2 and 3. Only the small island, Segment 1, was observed to have a low level of impact (2%; 120 m).





**Figure 8:**     ***The total shoreline length classified as a high, moderate or low level of impact on Rosen Lake, 2008.***

#### **4.9       Fish and Wildlife Summary**

Fish species documented to occur in Rosen Lake are listed in Section 2.0. Recent observations taken during the July 2009 boat survey indicated that dominant species include juvenile cyprinids (minnows), adult redbreasted sunfish and suckers (not identified to species). These species were observed in all three segments delineated for Rosen Lake, with the exception of Segment 1 where only adult fish species were observed (Appendix C).

Other wildlife observed along nearshore areas of Rosen Lake included birds such as kingfisher (*Megaceryle alcyon*), loon (*Gavia sp.*, Figure 9), osprey (*Pandion haliaetus*), merganser (species not specified) and sandpiper (species not recorded, Appendix C). The small island in the north basin (Segment 1) has been described as loon nesting habitat (BCLSS 2006), and a loon nesting site was recorded in 2009 (Appendix C).

Though not observed in July 2009, a painted turtle (*Chrysemys picta*) population is present in Rosen Lake. In addition, a heron (*Ardea herodias*) rookery is in the area (P. Holmes, Ecosystem Biologist, MOE, pers. comm., 2010).



**Figure 9:**     ***Loon observed in Rosen Lake (segment not specified). Photo taken by Peter Holmes (MOE), July 2009.***

#### **4.10       Aquatic Habitat Index**

Segments along the foreshore of Rosen Lake were ranked as either Low or Very High; no segments were ranked as Very Low, Moderate, or High (Table 2). Shoreline Vulnerability Colour Zones applied to each segment based on rankings in Section 3.3.1.1 are illustrated in Appendix B.



The majority of segments delineated along Rosen Lake were ranked as Low (97.8%). The remaining 2.2% of the shoreline was ranked as Very High value habitat (Table 2). Detailed analysis of the relative value of each AHI parameter for each segment can be found in Appendix D. The only Very High value habitat observed in Rosen Lake was found in Segment 1, the small island at the north end of the lake (Appendix B). The Very High ranking in Segment 1 resulted because the entire island consisted of natural shoreline with abundant aquatic vegetation. The remaining two shoreline segments (Segments 2 and 3) which encompass the main lakeshore of Rosen Lake, were ranked as Low value habitat (Appendix B and D).

**Table 2: Aquatic Habitat Index rankings for Rosen Lake**

Ranking	Shoreline Length	% of Shoreline
Very High	120	2.2
High	0	0.0
Moderate	0	0.0
Low	5,320	97.8
Very Low	0	0.0
<i>Total</i>	<i>5,440</i>	<i>100.0</i>

#### **4.10.1 Potential Aquatic Habitat Value (PAHV)**

The PAHV calculated for Rosen Lake segments were similar to the current AHI rankings. The PAHV calculated for Segments 2 and 3 were slightly higher than current AHI values, with increases of 20% and 10%, respectively, from current values (Appendix D). The increased PAHV changes the Low ranking classification to Moderate for Segments 2 and 3. The PAHV of Segment 1 remained the same as the current AHI, since modifications do not occur along the shoreline of this small island (Appendix D).

## 5.0 STATE OF THE FORESHORE

The Rosen Lake foreshore has been heavily impacted by development along the main lakeshore area. Urban developments, mainly seasonal homes, occur along almost the entire length of the Rosen Lake foreshore. Shoreline modifications associated with these developments were mainly retaining walls and docks. Development along the Rosen Lake foreshore has resulted in disturbed and modified substrates along over 70% of the shoreline length, which is substantially higher compared to other East Kootenay lakes. For example, substrate modifications in Tie and Moyie lakes were 27% and 36% of the shoreline, respectively (AMEC in prep; Schleppe 2009). Additional substrate modifications observed during fish and wildlife surveys included the removal of native vegetation and planting grass right to the water's edge, infilling to create beach areas, and the installation of retaining walls. The resulting level of disturbance was high, with only small natural areas remaining. Therefore, the overall habitat available along the main shore of Rosen Lake was rated as low, but some areas may still provide important, high value fish habitat including:

- Small pocket wetlands in the northeast end of the lake may provide juvenile fish refuge and rearing areas; And,
- Outlet areas, such as Little Sand Creek, may provide spawning habitat to fish species such as kokanee which were observed spawning at this location in 2002 (Oliver 2003).

Rosen Lake's fish community included native cyprinids. This further highlights the importance of diverting development away from high value habitats such as wetlands. Further fish inventories of Rosen Lake using a variety of methods (snorkel surveys, minnow traps, seine nets, electrofishing, etc.) in different seasons could provide more insight into important fish populations and habitat which could then be used to update the AHL. The small size of the lake, low flush rate and warm water temperatures can result in degraded water quality impacting fish both in the lake and spawning downstream of outlet areas.

The small island at the northern end of Rosen Lake and pocket wetlands were the only areas with high value aquatic habitat. The small, shrub dominated island contained loon nesting habitat and a wide littoral zone with abundant aquatic vegetation. Signs on the island notify water users of the use of the island by loons. Boating too close to the island or other zones of sensitivity in Rosen Lake can result in the disturbance of bird and turtle nesting and refuge areas as well as the erosion of sensitive shorelines as a result of wake. Boater awareness and restrictions need to be encouraged to prevent wave action from altering shoreline habitats, both along the island shore, and the main lakeshore.

Though the majority of the aquatic habitat in Rosen Lake is rated as being of low value, potential for restoration of these habitats exists as demonstrated by the PAHV analysis. The removal or unnecessary modifications or re-establishment of native riparian vegetation could improve the quality of aquatic habitat. Restoration and re-development activities could not only restore degraded habitats throughout the lakeshore but also re-establish a connection between shoreline and riparian areas along developed shoreline areas.

As with other shoreline management guidelines for East Kootenay lakes, the information used to highlight current zones of vulnerability in Rosen Lake was a snapshot in time of a dynamic biological system. Additional information collected in different seasons can be incorporated into the AHL to create a more robust and reliable evaluation of aquatic habitat resources in Rosen Lake. The addition of new information is encouraged as it becomes available.

## **5.1 Bylaws, Land Use Zoning, and Implications for the Rosen Lakeshore**

Rosen Lake is found in an area of southeastern B.C. that has been experiencing a steady increase in development pressure. The close proximity of East Kootenay lakes to urban centers has made the area an attractive location to vacation or have a holiday property. The RDEK recognizes both the inherent natural beauty of the region and the need to encourage economic growth and opportunities for residents. This is exemplified by the vision statement included in the Regional Growth Strategy adopted by the RDEK in 2004 which states (RDEK 2004):

“The RDEK is a region of distinct communities separated by open spaces within a dramatic natural setting of mountains, lakes and wetland areas. Growth will be encouraged where it is socially, environmentally, and economically sustainable and respects the character of each of its subregions.”

The RDEK has established the Jaffray, Tie Lake, Rosen Lake Land Use and Floodplain Management Bylaw No. 1414, 1999 (RDEK 2009). Important points related to lakeshoreline development in the RDEK document are provided below (RDEK 2009).

- The Regional District will not support an application for a private commercial marina on either lake (Section 4.02:5e).
- Should residents and property owners wish to initiate discussion on boating restrictions following adoption of this plan, the Regional District will work with the community to examine whether some form of boating restrictions should be requested on Rosen Lake (Section 4.02:5f).
- Buildings and structures used for livestock shelter and agriculture or for the storage and handling of manure must be sited not less than: 30 meters from a domestic well, spring, ordinary high water mark of a lake or watercourse (Section 5.09(2)(a)).
- Floodplain setbacks are 7.5 meters from the ordinary high water mark of a lake, marsh, or pond (Section 5.17(2)(b)(iii)).

The setback for rural dwellings from the high water mark is 7.5 m. This is less than the minimum setback of 15 to 30 m suggested in land development guidelines produced by DFO and MOE (Chilibeck 1992). The current minimum setback requirements and lack of permitting applications for foreshore modifications may have been what has lead to the heavily modified shorelines seen in the majority of Rosen Lake. Shoreline management guidelines, like those produced for Moyie, Windermere and now Rosen Lake, can provide lakeshore residents with a relatively simple means of determining the vulnerability of aquatic habitats along their shoreline, determining what level of environmental assessment and

permitting is required prior to development and what restoration opportunities may exist (Appendix B).

Partnerships formed between the multiple stakeholders related to social, economic, and environmental concerns, such as EKILMP, have become a key planning option for regional districts. By accepting and integrating the various pressures facing lakeshore environments, a developed and realistic lake management plan can be created.

## **6.0 RECOMMENDATIONS**

1. *Incorporate the Rosen Lakes Shoreline Management Guidelines into future community planning initiatives and the review of development projects by regulatory agencies.*
2. *Conduct more intensive fish inventory studies in multiple seasons. Additional methods such as snorkel surveys, minnow traps and electrofishing may provide a better indication of the relative populations of native and invasive fish species in Rosen Lake.*
3. *Continue to update the AHI with additional fish and fish habitat use information, including ZOS, as it becomes available.*
4. *Conduct habitat restoration activities along appropriate areas of the Rosen Lake shoreline. As outlined in the calculation of the PAHV, restoration by the removal of unnecessary shoreline modifications could improve the value of shoreline habitats. Restoration and re-development activities could restore degraded habitats and re-establish a connection between shoreline and riparian areas along this heavily developed shoreline.*
5. *Monitor water quality throughout the year in Rosen Lake. This can be accomplished by re-establishing collaborative efforts between the residents association and the BCLSS.*
6. *Conduct more detailed inventories of bird and turtle nesting sites. Spatially recording this information allows an accurate determination of the location of ZOS that can be included on shoreline segment maps and included in Shoreline Management Guidelines.*
7. *Update the shoreline segment maps used in the Shoreline Management Guidelines with updated orthophoto imagery when available. More detailed maps would allow further refinement of ZOS such as wetlands, wildlife nesting areas, outlet streams and creek mouths in Rosen Lake.*
8. *Further refine the segment breaks used in future FIM surveys. In some instances, more practical breaks would separate remaining high value aquatic features such as wetlands.*
9. *Expand existing boating restrictions that limit the speed, wake and distance from shore boats are allowed to travel at on Rosen Lake. This is especially important on a small lake with very few remaining natural areas.*
10. *Address the development of shoreline modifications and infilling activities. Limiting the number of modifications in a given shoreline area could reduce the overall density of modifications.*

## **7.0 SHORELINE MANAGEMENT GUIDELINES**

In anticipation of reproducing the shoreline management guidelines separately from this document, they have been included as a supplemental appendix to this report. Please refer to Appendix B for the Rosen Lake Shoreline Management Guidelines in their entirety.

## 8.0 REFERENCES

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Schleppe, J., 2009. Moyie Lake Foreshore Inventory and Mapping. Prepared by Ecoscape Environmental Consultants Ltd. Prepared for East Kootenay Integrated Lake Management Partnership. 54 p + 7 app.

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**Photo and Video Documentation**

Refer to CD with Photos and Video

Video available at <http://www.cmnbc.ca/>



## Photo Documentation Key

### Rosen Lake Baseline Photos and Video (taken 6 June 2008)

Segment	Representative Photo	Beginning of Segment	Video of Segment
1	img_0831.jpg	img_0830.jpg	RosenSeg1_sm.wmv
2	img_0836.jpg	img_0832.jpg	RosenSeg2_sm.wmv
3	img_0837.jpg	img_0837.jpg	RosenSeg3_sm.wmv
Other photos (loon): 0833, 0834, 0835			
Additional photos taken during 21 July 2009 Fish and Wildlife surveys are provided on the CD. Photos are separated by segment, but a key for each photo is not available.			

## **APPENDIX A**

### **Segment Descriptions**

Rosen Lake Segment Number 1



General Segment Classification

Segment Length (km)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
0.12	Vegetated Shore	None	Bench	N/A	None	No	0%	100%	Small island at north end of lake

Shore Type

Cliff/Bluff	Gravel Beach	Low Rocky Shore	Sand Beach	Stream Mouth	Wetland	Vegetated	Other
0%	0%	0%	0%	0%	0%	100%	0%

Land Use

Urban Residential	Commercial	Institutional	Rural	Conservation	Agriculture	Park	Industrial	Reserve
0%	0%	0%	0%	0%	0%	0%	0%	0%

Substrates

Mud	Fines	Gravel	Fine Gravel	Coarse Gravel	Cobble	Fine Cobble	Coarse Cobble	Boulder	Bedrock	Embeddedness	Shape
100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	Unknown	Smooth

Vegetation Band 1

Class	Stage	Shore Cover	Bandwidth (m)	Overhanging Vegetation
Natural wetland	tall shrubs 2-10m	Sparse (<10%)	20	70%

Vegetation Band 2

Class	Stage	Cover	Bandwidth (m)
N/A	N/A	N/A	0

Riparian Habitat

Veteran Trees	Snages	Flora Comments	Fauna Comments
No	No	N/A	loon nesting habitat

Aquatic Vegetation

Aquatic Vegetation	Submergent	Emergent	Floating
80%	0%	100%	0%

Littoral Zone

Littoral Zone	Spawning Habitat	Large Woody Debris	Littoral Width
Wide (>50m)	Unknown	No	0

Modifications

Retaining Walls	% Ret. Wall	Ret. Wall Material	Ret. Wall Type	Docks	Docks per km	Groynes	Groynes per km	Boat Launches	% Rail Modifier	% Road Modifier	Marine Railways	Marinas	Substrate Modification	% Substrate Modi.
0	0%	N/A	N/A	0	0	0	0	0	0%	0%	0	0	No	0%

N/A = Not available



Rosen Lake Segment Number 2



General Segment Classification

Segment Length (km)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
3.42	Vegetated Shore	None	Low (0-5)	Urban Development	High (>40%)	No	98%	2%	Cottages along west side of lake

Shore Type

Cliff/Bluff	Gravel Beach	Low Rocky Shore	Sand Beach	Stream Mouth	Wetland	Vegetated	Other
0%	0%	0%	0%	0%	5%	95%	0%

Land Use

Urban Residential	Commercial	Institutional	Rural	Conservation	Agriculture	Park	Industrial	Reserve
100%	0%	0%	0%	0%	0%	0%	0%	0%

Substrates

Mud	Fines	Gravel	Fine Gravel	Coarse Gravel	Cobble	Fine Cobble	Coarse Cobble	Boulder	Bedrock	Embeddedness	Shape
50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	Unknown	Smooth

Vegetation Band 1

Class	Stage	Shore Cover	Bandwidth (m)	Overhanging Vegetation
Landscaped	tall shrubs 2-10m	Moderate (10--50%)	25	25%

Vegetation Band 2

Class	Stage	Cover	Bandwidth (m)
Coniferous forest	mature forest	Abundant (>50%)	25

Riparian Habitat

Veteran Trees	Snages	Flora Comments	Fauna Comments
>=5	>=5	N/A	loon nesting habitat

Aquatic Vegetation

Aquatic Vegetation	Submergent	Emergent	Floating
20%	0%	100%	0%

Littoral Zone

Littoral Zone	Spawning Habitat	Large Woody Debris	Littoral Width
Moderate (10-50m)	Unknown	<5	0

Modifications

Retaining Walls	% Ret. Wall	Ret. Wall Material	Ret. Wall Type	Docks	Docks per km	Groynes	Groynes per km	Boat Launches	% Rail Modifier	% Road Modifier	Marine Railways	Marinas	Substrate Modification	% Substrate Modi.
33	45%	Stonework	Discontinuous	46	13	0	0	0	0%	0%	0	0	Yes	75%

N/A = Not available



Rosen Lake Segment Number 3



General Segment Classification

Segment Length (km)	Shore Type	Shore Type Modification	Slope	Land Use	Level of Impact	Livestock Access	Disturbed	Natural	Class Comment
1.90	Vegetated Shore	None	Low (0-5)	Urban Development	High (>40%)	No	90%	10%	Cottages along east side of lake

Shore Type

Cliff/Bluff	Gravel Beach	Low Rocky Shore	Sand Beach	Stream Mouth	Wetland	Vegetated	Other
0%	0%	0%	0%	0%	3%	97%	0%

Land Use

Urban Residential	Commercial	Institutional	Rural	Conservation	Agriculture	Park	Industrial	Reserve
100%	0%	0%	0%	0%	0%	0%	0%	0%

Substrates

Mud	Fines	Gravel	Fine Gravel	Coarse Gravel	Cobble	Fine Cobble	Coarse Cobble	Boulder	Bedrock	Embeddedness	Shape
50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	Unknown	Smooth

Vegetation Band 1

Class	Stage	Shore Cover	Bandwidth (m)	Overhanging Vegetation
Landscaped	tall shrubs 2-10m	Moderate (10--50%)	15	40%

Aquatic Vegetation

Aquatic Vegetation	Submergent	Emergent	Floating
15%	0%	100%	0%

Littoral Zone

Littoral Zone	Spawning Habitat	Large Woody Debris	Littoral Width
Moderate (10-50m)	Unknown	<5	0

Vegetation Band 2

Class	Stage	Cover	Bandwidth (m)
Coniferous forest	mature forest	Abundant (>50%)	35

Riparian Habitat

Veteran Trees	Snages	Flora Comments	Fauna Comments
<5	>=5	N/A	loon nesting habitat

Modifications

Retaining Walls	% Ret. Wall	Ret. Wall Material	Ret. Wall Type	Docks	Docks per km	Groynes	Groynes per km	Boat Launches	% Rail Modifier	% Road Modifier	Marine Railways	Marinas	Substrate Modification	% Substrate Modi.
21	3%	Mixed	Discontinuous	26	14	0	0	0	0%	0%	0	0	Yes	70%

N/A = Not available

**APPENDIX B**  
**Rosen Lake Shoreline Management Guidelines**  
(Including maps)

# Rosen Lake Shoreline Management Guidelines



Submitted to:  
**East Kootenay Integrated Lake Management Partnership**

Submitted by:  
**AMEC Earth & Environmental  
Nelson, BC**

25 November 2010

**amec.com**  
**VE51966-2010-004**



## **Rosen Lake Shoreline Management Guidelines**

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Submitted by:

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a division of AMEC Americas Limited**

Suite 203, 601 Front St.  
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## PREFACE

This report has been prepared to provide Shoreline Management Guidelines for Rosen Lake. The intention of these guidelines is to provide a visual description of the location of important habitats for fish and wildlife in Rosen Lake, and a protocol for lakeshore residents, developers, and regional governments to follow when considering alterations to shoreline areas. The development of shoreline guidance documents for lakes in the East Kootenay region have been commissioned by the East Kootenay Integrated Lake Management Partnership (EKILMP), a collaborative effort between community groups, First Nations, homeowner associations, conservation groups and various levels of government. The Guidelines are focused around the protection, conservation and restoration of important fish and wildlife values. EKILMP believes the Guidelines will help focus where new development could be located on the lake, while sustaining priceless natural public assets and maintaining the economic viability of the area.

Increased pressure for recreational and urban development along the foreshore of lakes, such as Rosen, in the East Kootenay has created concern for the state of natural resources and habitats in the area. In order to balance the functioning of a healthy, natural ecosystem with other social, economic and cultural values, an understanding of the aquatic and riparian resource values is required. Thus, by collecting detailed, spatially accurate information of existing shoreline habitats and their condition, more informed land use planning decisions can be made that better balance the different pressures that exist.

The Guidelines included herein have been prepared following this general process:

1. Foreshore Inventory and Mapping (FIM) surveys were integrated with information collected during additional fish and wildlife surveys to identify the state of the Rosen Lake foreshore and identify sensitive habitat features<sup>1</sup>.
2. An Aquatic Habitat Index (AHI) was generated using the FIM data to determine the relative habitat value of the shoreline. This index follows that developed for Moyie and Monroe Lakes and is similar to that used for Okanagan and Windermere Lakes.
3. Shoreline Management Guidelines have been prepared for the shorelines surveyed to facilitate making informed land use decisions for our watersheds. The Guidelines are intended to provide background information to stakeholders, proponents, and governmental agencies when land use changes or activities are proposed that could alter the shoreline thereby affecting fish and wildlife habitat.

This approach provides a science-based assessment of areas of highest natural value requiring the highest level of on-going protection. There are four colour zones from red, which calls for the highest level of shoreline protection and are identified as conservation areas, to grey zones, where there is already significant impact from development and

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<sup>1</sup> Lawrence, C. and L. Porto. 2010. Rosen Lake Foreshore Inventory and Mapping. Prepared by AMEC Earth and Environmental, Nelson, BC. Prepared for East Kootenay Lake Management Partnership.

potential for redevelopment and restoration. The risks of selected development activities have been determined for each colour zone, identifying activities, which require additional review and consideration. A flow chart has been developed based on activity risk, which outlines the review process at a broad scale.

This report only provides direction relating to fish and wildlife habitat values, and as such, does not consider other development factors (such as erosion hazards, drinking water quality or navigation considerations). Although some mention is made to potential permits required, the guidelines do not fully outline the regulatory agency permit planning process.

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## **1.0 INTRODUCTION**

Shoreline Management Guidelines for Rosen Lake (herein referred to as Guidelines) are intended to streamline land use decision making processes between different agencies and stakeholders. Guidelines were initially prepared by the East Kootenay Integrated Lake Management Partnership (EKILMP) for Windermere Lake. Guidelines have since been developed for Moyie and Monroe lakes, and are currently being produced for Tie, Columbia and Wasa lakes, using the Windermere Lake<sup>2</sup> template. The Moyie Lake<sup>3</sup> template, developed from the Windermere Lake Guidelines, was used to complete the Guidelines for Rosen Lake to maintain consistency throughout the East Kootenay. These guideline documents will not be further referenced throughout the duration of this document to promote readability. However, similarities may exist between the present document and those cited above as the templates developed for Windermere and Moyie lakes were used to complete Guidelines for Rosen Lake.

### **1.1 Zones of Sensitivity**

Following fieldwork, literature review and professional consultation, several habitat types and locations were identified as being highly important to fish and wildlife, and sensitive to development. These locations were classified as zones of sensitivity (ZOS) and included: wetlands, aquatic macrophyte beds, tributaries, outlets, as well as valuable fish and wildlife areas including turtle habitat and loon nesting locations. The ZOS are depicted in the Rosen Lake shoreline map in Appendix A. The ZOS were not factored into the Shoreline Vulnerability Color Zones and should be treated as vulnerable habitats. Appropriate approvals must be obtained from regulatory agencies prior to development in these areas (see Section 2.3).

## **2.0 MANAGEMENT GUIDELINES OVERVIEW**

The Guidelines utilize a risk based approach to shoreline management. This approach determines the risk of a proposed activity in each of the identified Vulnerability Zones. Vulnerability Zones relate to the environmental sensitivity of the shoreline, as determined by the Aquatic Habitat Index (AHI). Vulnerability Zones have been color coded to help more easily understand the risk matrix.

The following is a “How To” Guide to Development Planning along the Rosen Lake Shoreline:

1. Determine the Shoreline Vulnerability Color Zone your application is situated in using maps in Appendix A. See Section 2.1 below.

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<sup>2</sup> EKILMP. 2009. Windermere Lake Shoreline Management Guidelines for Fish and Wildlife Habitats. Prepared by Interior Reforestation Co. Ltd. Prepared for East Kootenay Integrated Lake Management Partnership. 11 p + 3 app.

<sup>3</sup> Ecoscape Environmental Consultants Ltd. 2009. Shoreline Management Guidelines: Moyie and Monroe Lakes. Prepared for East Kootenay Integrated Lake Management Partnership. 10 p + 3 app.

2. Determine what the Risk is of your proposed activity using the risk matrix (see Section 2.2 below.) If the proposed activity has not been identified within the table, please assume the activity is High Risk and contact FrontCounter BC or the Regional District of East Kootenay for further advice and information. If your identified activity is considered High Risk, determine if you can move your activity to a different colour zone or select a lower risk activity.
  - a. If a Species at Risk is present or identified by a Qualified Environmental Professional (QEP), the risk of proposed activities is greater. If identified, the Modified Column for Species at Risk should be used.
3. Use the flow chart contained in this document to determine your application review needs based upon the risk of your proposed activity.

## 2.1 Step 1- Shoreline Vulnerability Color Zones

The Shoreline Vulnerability Color Zones are best viewed graphically, as they relate to specific shoreline areas. The Shoreline Vulnerability Color zones are based upon fisheries and wildlife information collected during field surveys and the AHI that was prepared for the shorelines. Appendix A contains the Shoreline Vulnerability Zones.

The following provides a brief summary of the different Vulnerability Color Zones.

Red Shoreline
<p><b>Defined by:</b> Very High by the Aquatic Habitat Index.</p> <p><b>Background:</b> These areas have been identified as essential for the long term maintenance of fish and/or wildlife values through the AHI analysis process. This zone includes most creek mouths, wetland areas, and zones essential for fish and/or wildlife populations around the lake. Red Zones are considered very high habitat value because of their biophysical characteristics which create habitats of high diversity. These areas are considered integral to the maintenance of a healthy ecosystem. Wetlands, stream confluences, and other important identified habitats (e.g., spawning features) are all identified as Red Zones. Red Zones account for 2.2% of the Rosen Lake Shoreline.</p> <p>EKILMP recommends that these areas be designated for conservation use, and that no development that can impact these sensitive communities occur within them. Low impact water access recreation and traditional First Nation uses are permissible in these areas, but permanent structures or alteration of existing habitats is not considered to be acceptable. Habitat restoration may be appropriate in these areas where warranted. Invasive aquatic plant removal is acceptable, provided there is an approved aquatic plant removal program including trained persons. Please contact a plant specialist if uncertain of a plant species.</p>

### Orange Shoreline

**Defined by:** High Value Habitats identified by the Aquatic Habitat Index.

**Background:**

These shoreline segments have been identified as High Value Habitat Areas for fish and/or wildlife. These are made up of areas that are relatively natural; possibly have high value spawning habitats and/or other features that could be impacted by proposed land uses or activities. These areas are sensitive to development, continue to provide important habitat functions, but may be at risk from adjacent development pressures. Activity Risks in this zone will trigger the requirements to have an environmental assessment conducted by a QEP. Restoration opportunities potentially exist in these areas. Proponents should consider moving high risk activities to other areas if possible, or pursuing activities that have lower risks associated with them. Orange shorelines account for 0% of Rosen Lake.

### Yellow Shoreline

**Defined by:** Moderate Value Habitats identified by the Aquatic Habitat Index

**Background:**

These areas have generally experienced more intensive development disturbance and pressures. Generally, these areas do not contain critical habitat features required by fish and wildlife to maintain viable populations. However, these areas still maintain important general living habitats that are important to fish and wildlife that and they should be considered when changes to land uses are proposed. Yellow shorelines account for 0% of Rosen Lake.

Development is more appropriate on these shorelines, and should incorporate protection of habitat features that remain. Intensive development below the high water mark and/or within riparian areas could have unacceptable environmental impacts without proper planning. Restoration may be an option in some areas that have experienced some developments. Development may proceed for low risk activities provided a Best Management Practices (BMP) or Regional Operating Statement (ROS) is followed. High risk activities without a BMP or ROS will require a report from a QEP.

### **Grey Shoreline**

**Defined by:** Low and Very Low Habitats identified by the Aquatic Habitat Index

**Background:**

These are shorelines identified by the AHI analysis that have a lower ecological value. However, they still may contain valuable habitats requiring some protection, such as in-lake wetlands, or gravel/cobble substrate areas. Grey shorelines account for 97.8% of Rosen Lake.

Residential development has been concentrated in these areas and has resulted in disturbances to the natural fish and wildlife habitat. In keeping with the objective of concentrating development in areas that are already disturbed or of low value, new developments may be considered in these areas. Redevelopment will also be considered. New developments or redevelopment proposals shall incorporate fish and wildlife habitat restoration or improvement features where feasible and practicable. For example, a retaining wall redevelopment may be moved back from the high water mark and/or incorporate re-vegetation, bioengineering or other fish and wildlife features in the design.

## **2.2 Step 2- Activity Risk Matrix and Analysis**

Different shoreline activities have been assigned risk ratings based on the potential level of risk that they may have on fish and wildlife habitat values. Risks have been determined based upon the different habitat values present and typical requirement to complete the proposed activity. The table below provides the risks of different activities in each of the different shoreline Vulnerability Zones identified. Risks have been determined as Not Acceptable (NA), High (H) or Low (L). To account for the limited survey information, a species at risk modifier column has also been provided and should be used in cases where a species at risk has been identified in the project area.



**Table 1: Activity risk table for each shoreline vulnerability colour (NA = Not Acceptable, High = H, Low = L).**

Activity	Shore Zone Colour and Activity Risk				Modifier
	Red	Orange	Yellow	Grey	Zone has Species at Risk
Over water piled structure (i.e. building, house, etc.) <sup>1</sup>	NA	NA	NA	NA	NA
Boat house (below HWM) <sup>1</sup>	NA	NA	NA	NA	NA
Dredging (new proposals)	NA	NA	NA	NA	NA
Beach creation above HWM	NA	NA	H	H	H
Beach creation below HWM	NA	NA	H	H	H
Aquatic vegetation removal	NA	NA	H	H	H
Upland vegetation removal	NA	NA	H	H	H
Marina <sup>2</sup>	NA	H	H	H	H
Breakwater	NA	H	H	H	H
Boat launch upgrade	NA	H	H	H	H
New boat launch	NA	H	H	H	H
Infill	NA	H	H	H	H
Groynes	NA	H	H	H	H
Fuel facility <sup>3</sup>	NA	H	H	H	H
Boat house (above HWM with vegetation removal) <sup>1</sup>	NA	H	H	H	H
Waterline trenched	NA	H	H	L	H
Erosion protection hard-joint planted	NA	H	H	L	H
Erosion protection vertical wall or retaining wall <sup>4</sup>	NA	H	H	L	H
Invasive weed removal	H	H	H	L	H
Boat house (above HWM without vegetation removal) <sup>1</sup>	NA	H	L	L	H
Permanent rail launch system	NA	H	L	L	H
Removable rail launch system	NA	H	L	L	H
Dock <sup>1</sup>	NA	H	L	L	H
Erosion protection (soft-bioengineered)	NA	H	L	L	H
Elevated boardwalk below HWM	NA	H	L	L	H
Mooring buoy	NA	H	L	L	H
Maintenance dredging (previously approved)	NA	H	L	L	H
Boat lift – temporary	NA	H	L	L	H
Geothermal loops – open <sup>5</sup>	NA	H	L	L	L
Geothermal loops – closed	NA	H	L	L	L
Habitat restoration <sup>6</sup>	H	H	L	L	H
Public beach maintenance	NA	L	L	L	H
Waterline drilled	NA	L	L	L	L

1. These Guidelines are to be used in the initial development planning stage and do not cover all legislative requirements. Docks and boathouses are an example of an activity that could require additional approval process through Transportation Canada or Ministry of Agriculture and Lands.

2. Marinas or marina expansions in orange zones may not be acceptable.

3. Fuel facilities are inherently high risk, and if approved will be subject to all other regulations.

4. Retaining wall redevelopment should be designed to restore fish and wildlife values where feasible and practical.

5. Geothermal loops open (water) versus closed (glycol) and associated risk must also be assessed and ranked for physical habitat and water quality aspects.

6. Habitat restoration proposals are listed as high risk in red and orange zones because individual objectives and proposals must be reviewed.

In cases where multiple activities with differing risk are proposed, the combined risk may increase. In these cases, proponents should default to the highest risk identified and retain a QEP to help determine if the overall risk has increased. If your activity is not listed, contact FrontCounter BC for advice. The Activity Risk Table also distinguishes between activities above the high water mark (HWM) and below the HWM. The HWM as opposed to the 'natural lake boundary' is the standard practice used by Fisheries and Oceans Canada (DFO) when considering impacts to fish and wildlife values because the natural lake boundary often contains very important emergent vegetation communities that are important to fish and wildlife.

The following provides background, descriptions and examples of the Activity Risk Ratings. The risk ratings identify the potential risk activities pose to fish and wildlife. Activities identified as Not Acceptable (NA) or High (H) have the greatest potential, whereas activities identified as Low (L) risk have a reduced potential to impact fish and wildlife populations. This process recognizes that there is a greater possibility that High Risk activities may not be approved by regulators due to the potential impacts of the activity. The process also identifies that important habitats do exist in degraded and developed areas and that minimal standards are required to protect fish and wildlife habitat in the grey zone areas.

### **Not Acceptable Activities**

Several activities have been rated as Not Acceptable and they generally occur in Red or Orange zones or are activities that have a high potential to impact fish or wildlife populations even in lower value habitat areas. These activities listed have potential to negatively impact fish and wildlife habitats and it is extremely difficult or impossible to mitigate or compensate for the activities. Applications for these types of development in the zones identified will not be considered.

### **High Risk Activities**

Proposals within the High Risk category are known to have significant challenges related to providing adequate mitigation or compensation to address the loss of fish and/or wildlife habitat values. Acceptable mitigation measures would likely be very costly to implement. In addition, there is a high likelihood that a request for a Harmful Alteration, Disruption or Disturbance of Fish Habitat (HADD) authorization under the *Fisheries Act* would be triggered. Applicants are thus encouraged to avoid activities with a High Risk, consider activities that are a lower risk, or relocate the activity to an area where the environmental sensitivity is less. If the applicant wishes to proceed with a High Risk activity, a QEP should be retained to determine if there is a HADD &/or other environmental impacts which can be mitigated through design and relocation. The application will be reviewed by the applicable agencies. As identified in the Activity Risk Table, certain activities are rated High Risk for all shore colour zones and should be avoided if at all possible.

### **Low Risk Activities**

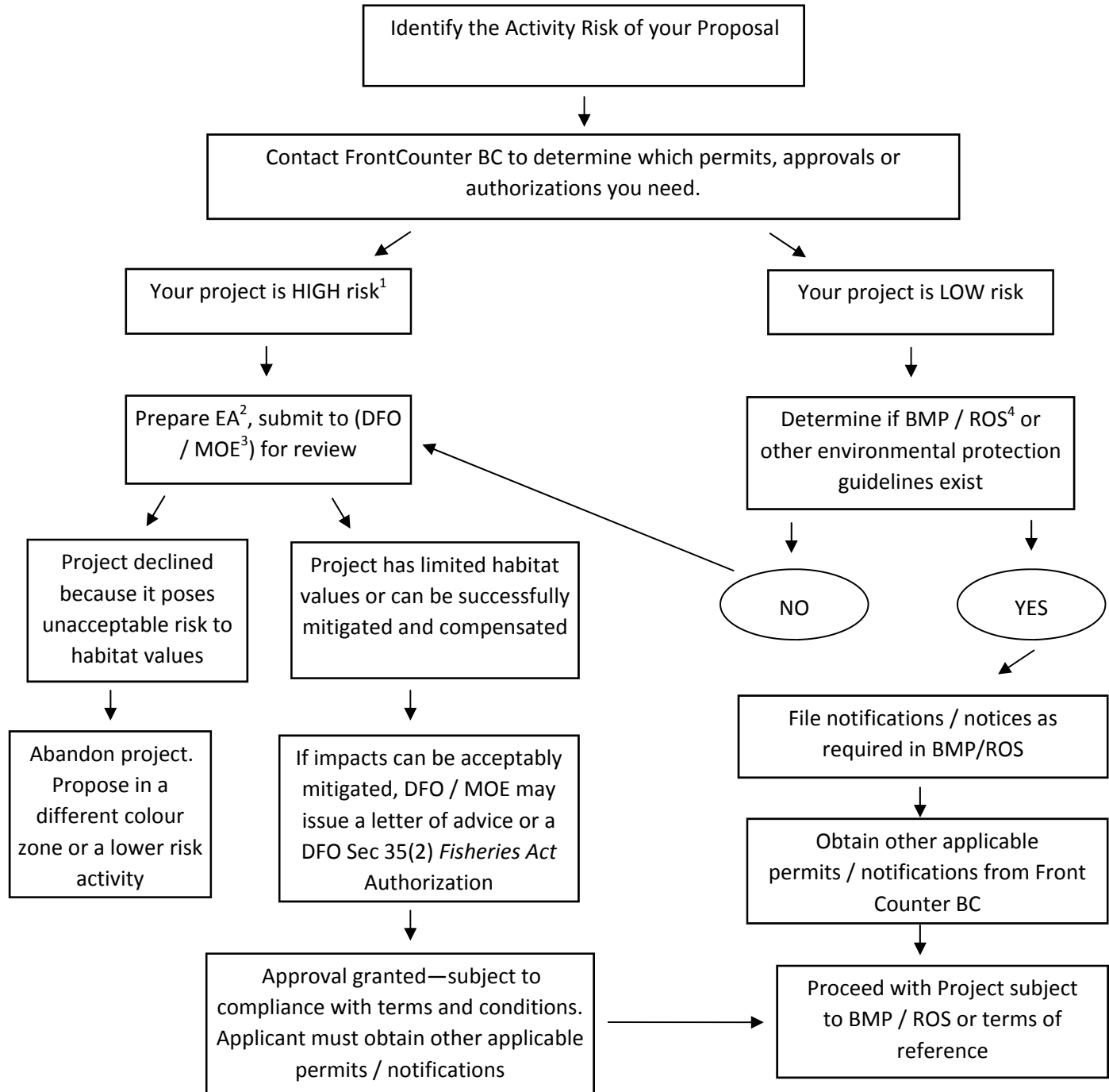
With appropriate design and planning, Low Risk activities could be incorporated along the foreshore with minimal impacts on fish and wildlife habitat values. These activities are to follow BMP and/or ROS, where available. Where BMP/ROS are not available, or a

deviation to the BMP/ROS is proposed, a QEP is to be hired to determine if there is a HADD and design the project to minimize environmental impacts. The application will be reviewed by the applicable agencies. Examples of activities which have Low Risk along most/all of the shoreline are: maintenance dredging (previously approved) and erosion protection (soft-bioengineered).

### **2.3 Step 3- Decision Process Flow Chart**

The flow chart below provides an outline for the decision-making process for the High and Low Risk activities. The chart is a tool to help depict the Guideline requirements outlined in the previous sections. Note that this process provides Guidelines on only the initial planning stages of development. There are other legal requirements that are not covered through this process (such as approvals/notifications through Transport Canada, BC *Water Act*, BC *Lands Act*), which are the responsibility of the applicant. Additional potential legal requirement listings are provided in Appendix E. If these Guidelines are followed, the intent is that the subsequent permitting process(es) should be more streamlined for the applicant.

### Flow Chart: Decision-making process for High and Low Risk Activities for Fish and/or Wildlife Habitat authorizations



<sup>1</sup> Activities within the High Risk category raise significant concerns. These activities have significant challenges related to providing adequate mitigation or compensation to address the loss of fish and/or wildlife habitat values and could be costly to implement acceptable mitigation measures. With High Risk activities, there is a high likelihood that a request for a Harmful Alteration Disruption or Destruction of fish habitat (HADD) authorization under Sec 35(2) of the *Fisheries Act* would be triggered. Proponents are encouraged to avoid activities with a High risk, revise activities to a lower risk option, or relocate the activity to a less sensitive colour zone. <sup>2</sup> Environmental Assessment; <sup>3</sup> DFO- Fisheries and Oceans Canada; MOE- Ministry of Environment; <sup>4</sup>BMP – Best Management Practice; ROS – Fisheries and Oceans Canada Regional Operating Statement.

### **3.0 MITIGATION AND COMPENSATION CONSIDERATIONS**

In order to assess impacts of a proposed project, it may be necessary to retain a QEP who could assess habitat values and sensitivities in the area. Information contained in this report will help with this task; however, further studies will likely be necessary to address site specific issues and because of the limitations of information currently available. The DFO principle of “no net loss” within the Policy for the Management of Fish Habitat 1986 applies to all proposals where there is the potential for a HADD under Section 35(2) of the federal *Fisheries Act*. This involves following a sequence of mitigation alternatives. Mitigation is a process for achieving conservation through the application of a hierarchical progression of alternatives, which include: (1) avoidance of impacts; (2) minimization of unavoidable impacts; and (3) compensation for residual impacts that cannot be minimized. These alternatives are described in the following sections.

#### **3.1 Avoidance of Impacts**

The first step, avoidance, involves the prevention of impacts, either by choosing an alternate project, alternate design or alternate site for development. It is the first and best choice of mitigation alternatives. Because it involves prevention, the decision to avoid a high value area or to redesign a project so that it does not affect a high value area must be taken very early in the planning process. It may be the most efficient, cost effective way of conserving important habitats because it does not involve minimization, compensation or monitoring costs. Avoidance may include a decision of not to proceed with the project.

#### **3.2 Minimization of Unavoidable Impacts**

Minimization should only be considered once the decision has been made that a project must proceed, that there are no reasonable alternatives to the project, and that there are no reasonable alternatives to locating the project within key/high value habitat. Minimization involves the reduction of adverse effects of development on the functions and values of the habitat at all project stages (including planning, design, implementation and monitoring), to the smallest practicable degree. Considering any planning efforts, DFO must deem a HADD to be acceptable before work can commence.

#### **3.3 Compensation**

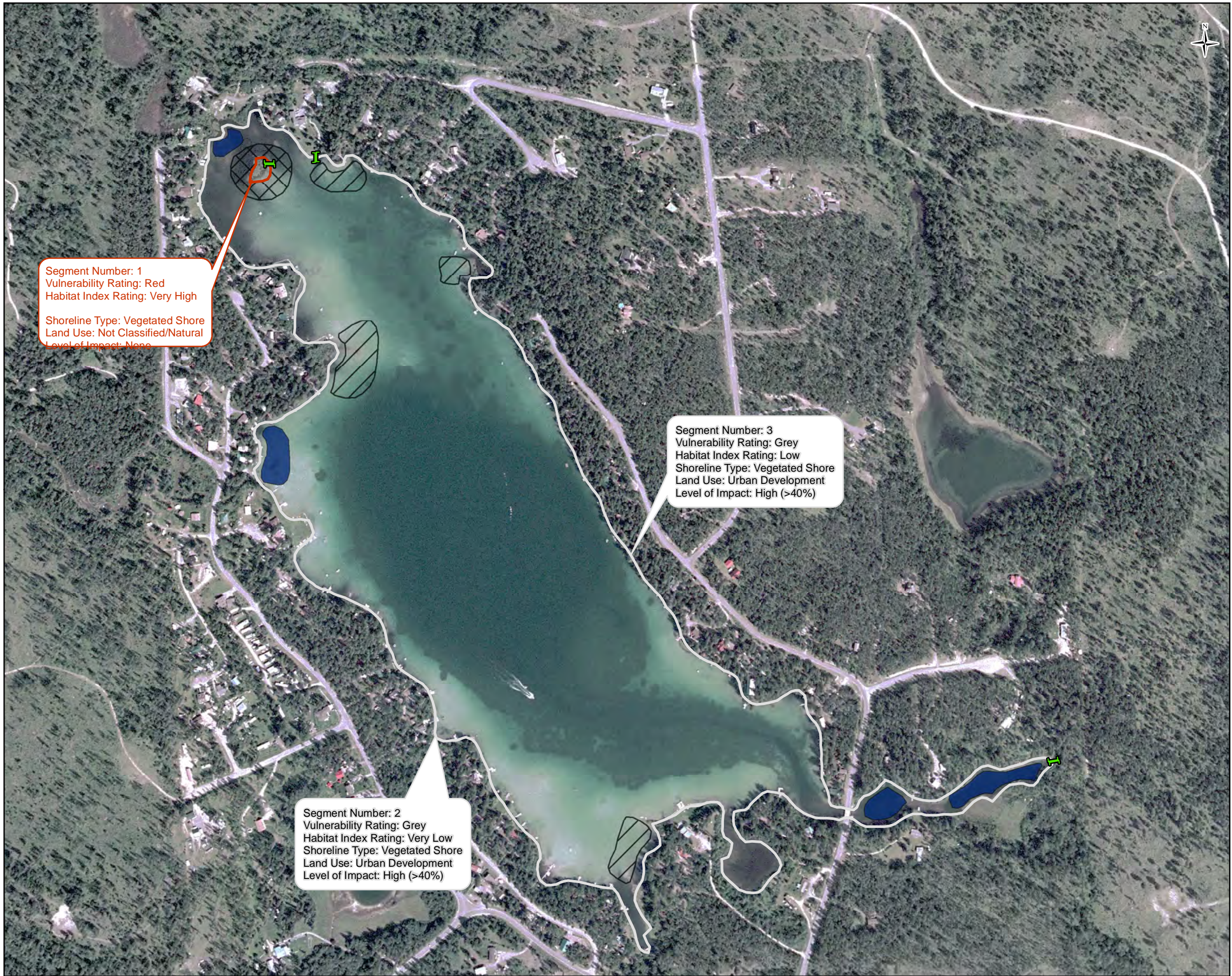
Compensation is the last resort in the mitigation process, an indication of failure in the two earlier steps. It should only be considered for residual effects that were impossible to minimize. Compensation refers to a variety of alternatives that attempt to “make up for” the unavoidable loss of or damage to habitat functions and values. Habitat compensation may be an option for achieving “no net loss” when residual impacts of projects on habitat productive capacity are deemed harmful after relocation, redesign or mitigation options have been implemented. After reviewing the project proposal and the potential impacts to fish habitat, DFO may determine that the impacts are not acceptable if the habitat to be affected is critical habitat or compensation is not feasible. In addition, compensation for deposit of a deleterious substance into water frequented by fish is not acceptable. Habitat compensation involves replacing the loss of fish habitat with newly

created habitat or improving the productive capacity of some other natural habitat. Depending on the nature and scope of the compensatory works, habitat compensation may require, but not be limited to, several years of post-construction monitoring and evaluation. In the event that functional objectives of the compensation are not achieved (i.e., due to failure or inadequate maintenance), additional remediation or redevelopment of the compensation works may be required to achieve the compensation objectives. There is no guarantee that projects in high value fish habitats that result in HADD will be authorized under Section 35(2) if application is submitted.

**APPENDIX A**  
**Rosen Lake Mapsheet**



Y:\GIS\Projects\VE\VE51966\_T16\_Rosen\_Lake\_FIM\Mapping\XDDrafts\rosen\_lake\_vuln\_v2.mxd



## Legend


 Segment Break

Shoreline Vulnerability Rating:

 Red

 Orange

 Yellow

 Grey

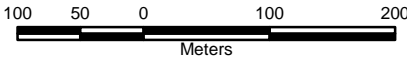
Zones of Sensitivity:

 Loon Nesting

 Wetland/Aquatic Vegetation

 Creek Mouth or Outlet

Scale: 1:6,000



### Note

Location of zones of sensitivity are approximate

### Reference

Rosen Lake Inventory- EKILMP

CLIENT:

EKILMP

PROJECT:

Rosen Lake Shoreline Management Guidelines

## Rosen Lake Foreshore Inventory and Mapping, 2008

DATE:  
April 8, 2010

ANALYST:  
EO

Mapsheet 1

JOB No:  
VE51966

QA/QC:  
CL

PDF FILE:  
rosen\_lake\_vuln.pdf

GIS FILE:  
rosen\_lake\_vuln.mxd

PROJECTION:  
UTM Zone 11

DATUM:  
NAD83





**APPENDIX B**  
**Additional Legal Requirements**

*This Appendix was reproduced from the Windermere Lake Shoreline Management Guidelines. All credit should be given to the original authors of that document.*

Laws and regulations provide the regulatory ‘teeth’ to uphold environmental protection and management. Applicable legislative requirements must be met for a project to be in compliance with the law. Legal requirements have been presented here in the following categories: Federal, Provincial, and Regional District. The reader is cautioned that other legislation (not listed) may apply to their development, and they are encouraged to consult with the appropriate agency prior to proceeding with any proposed works.

## **1. Federal Legislation**

All federal legislation is administered by the parliament of Canada (federal government).

### ***Canada Migratory Birds Convention Act***

This Act implements an internationally recognized Convention between Canada and the United States to protect various species of migratory game birds, migratory insectivorous birds and migratory non-game birds including herons. The taking of nests or eggs of these birds is prohibited, except for permitted scientific or propagating purposes.

### ***Fisheries Act***

The *Fisheries Act* is administered by the federal Department of Fisheries and Oceans and is one of the most important pieces of legislation for managing aquatic resources in Canada. The fish habitat provisions of this Act enable the federal government to protect marine and freshwater habitats supporting those species that sustain fisheries, namely fish, shellfish, crustaceans and marine mammals.

### ***Navigable Waters Protection Act***

This act is administered by Transport Canada and is primarily applicable to protecting, maintaining, and developing opportunities for the public to access and use waterbodies for navigation and recreation. Any activities that may affect movement of people or goods, near or on water are affected (i.e. dock/marina construction, dredging, shoreline development).

### ***Pesticides Act***

The Pesticides Act is intended to 1) prevent and mitigate harmful effects to the environment and human health, and 2) rationalize and reduce the use of pesticides. The Act promotes the analysis, assessment and control of the effects of the use of pesticides through specific activities intended to widen knowledge about these products (environmental monitoring, for example).

### ***Species at Risk Act***

This act prevents Canadian indigenous species, subspecies and distinct populations from becoming extirpated or extinct, provides for the recovery of endangered or threatened species and encourages the management of other species to prevent them from becoming at risk.

### ***Canadian Environmental Assessment Act (CEAA)***

The CEAA requires federal departments to conduct environmental assessments (EA) for prescribed projects and activities before providing federal approval or financial support.

The EA is a planning tool used to identify potential effects of projects or activities on the environment. This includes the air, water, land and living organisms, including humans.

### ***Indian Act***

The *Indian Act* provides legislation relating to Indians and Lands Reserved for Indians. The *Indian Act* is administered by the Minister of Indian Affairs and Northern Development.

## **2. Provincial Legislation**

All provincial government legislation within B.C. is administered by the legislative assembly of British Columbia (provincial government).

### ***Land Act***

The *Land Act* is the main legislation governing the disposition of provincial Crown (i.e. public) land in British Columbia. Crown land is any land owned by the Province, including land that is covered by water, such as the foreshore and the beds of lakes, rivers and streams. The *Land Act* is administered by the Ministry of Sustainable Resource Management.

### ***Wildlife Act***

The provincial Ministry of Environment administers the *Wildlife Act*, which includes legislation relating to the conservation and management of wildlife populations and habitat, issuing licenses and permits for fishing, game hunting, and trapping. A provision of the *Wildlife Act*, which may be pertinent to shoreline development is the prohibition, to take, injure, molest, or destroy a) a bird or its egg; b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl; c) or the nest of any other bird species when the nest is occupied by a bird or its egg.

### ***Water Act***

The *Water Act* is the primary provincial statute regulating water resources. Under the *Water Act*, a stream is defined as “a natural watercourse or source of water supply, whether usually containing water or not, and a lake, river, creek, spring, ravine, swamp and gulch.” Section 9 of the *Water Act* requires that a person may only make “changes in and about a stream” under an Approval or Notification where required; or under a Water License or Order.

### ***Weed Control Act***

The B.C. *Weed Control Act* imposes a duty on all land occupiers to control designated noxious plants. The purpose of the Act is to protect our natural resources and industry from the negative impacts of foreign weeds.

### ***Public Health Act***

The *Public Health Act* contains Sewerage System Regulations which require homeowners installing new sewage systems to retain the services of an authorized person who may be a professional engineer or a registered onsite wastewater practitioner. The authorized person assesses both the owner's needs and the lot's capability for sewage treatment and dispersal, then plans or designs a septic system that meets those needs. The plan is filed with the health authority and an authorized person installs the system according to the plan.

### ***3. Regional District of East Kootenay***

The Regional District of East Kootenay (RDEK) provides local government services to rural areas outside municipal boundaries. The RDEK functions as a partnership of the municipalities and electoral areas (unincorporated areas) within its boundaries. These local governments work together through the RDEK to provide and coordinate services in both urban and rural areas. Regional districts are governed by the *Local Government Act* and other provincial legislation. Three bylaws regulate private land development around Rosen Lake: Jaffray, Tie Lake, Rosen Lake Land Use and Floodplain Management Bylaw No. 1414 (1999); Subdivision Servicing Bylaw No.1954 (2008); and Building Regulation Bylaw No. 1735 (2004).

**APPENDIX C**  
**Best Management Practices and Regional Operating Statements**

*This Appendix was reproduced from the Windermere Lake Shoreline Management Guidelines. All credit should be given to the original authors of that document.*



Many provincial and federal agencies have developed Best Management Practices (BMP) in order to provide consistent direction to the public on acceptable development methods. The BMPs provide information to help ensure that proposed development activities are planned and carried out in compliance with the various applicable legislation, regulations, and policies. The range of activities that associate BMPs is broad.

The province of BC has, over a period of many years, developed a series of BMPs. These have evolved into “Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia.” The Develop with Care Guidelines have links to several provincial BMPs related to shoreline development activities. Examples are as follows:

- ◆ Standards and Best Management Practices for Instream Works;
- ◆ Best Management Practices for Small Boat moorage on Lakes;
- ◆ Timing and Terms and Conditions for Changes In and About a Stream Specified by MOE Habitat Officers, Kootenay Region;
- ◆ Small Boat Moorage;
- ◆ Boat Launch Construction and Maintenance on Lakes;
- ◆ Lakeshore Stabilization;
- ◆ Installation and Maintenance of Water Line Intakes;
- ◆ Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia;
- ◆ Best Management Practices for Amphibians and Reptiles in Urban and rural Environments in BC; and
- ◆ Best Management Practices for Recreational Activities on Grasslands in the Thompson and Okanagan Basins.

The Regional Operating Statements (ROS) developed by DFO, provide information regarding several low risk activities associated with shoreline development, including but not limited to:

- ◆ Aquatic Vegetation Removal in Lakes;
- ◆ Bridge & Culvert Maintenance;
- ◆ Dock and Boathouse Construction in Freshwater Systems;
- ◆ Routine Maintenance Dredging for Navigation;
- ◆ Public Beach Maintenance;
- ◆ Clear Span Bridges;
- ◆ Culvert Maintenance;
- ◆ Directional Drilling;
- ◆ Small Moorings;
- ◆ Underwater Cables in Freshwater Systems;
- ◆ Overhead Line Construction;
- ◆ Maintenance of Riparian Vegetation in Existing Rights of Ways;
- ◆ Dry Open Cut Stream Crossing; and
- ◆ Isolated Ponds.

## **APPENDIX D**

### **Restoration Techniques**

*This Appendix was reproduced from the Windermere Lake Shoreline Management Guidelines. All credit should be given to the original authors of that document.*

A variety of techniques have been developed to restore productive habitat (aquatic and terrestrial) and maintain/enhance productivity and biodiversity. There are a variety of groups' currently leading/undertaking restoration activities within the East Kootenay, using proven restoration techniques and concepts. For information contact local environmental groups, local government, or provincial government offices.

**Even small restoration efforts will help improve our ecosystems.**

## **APPENDIX C**

### **Fish and Wildlife Observations**

Table C1: Summary of fish observations in Rosen Lake on 21 July 2009

Segment	Date	Start Time	End Time	Crew <sup>1</sup>	Weather	Air Temp (°C)	Water Temp (°C)	Channel Distance (m)	Method <sup>2</sup>	Species <sup>3</sup>	Life Stage <sup>4</sup>	Number	Aquatic Vegetation	Substrate Type	Segment Comments
1	21-Jul-09	10:00	10:20	BM/PH	Sunny	22	19	1 x 200	BO	RSS	Adult	10+	Scattered floating pondweed	100% silt and organics	Intact shrub community; alder/willow
										SU	Adult	10+			
										Cyprinid	Juv	-			
2	21-Jul-09	9:00	9:30	BM/PH	Sunny	22	19	1 x 200	BO	RSS	Adult	100+	None. Rushes on edge	95% silt and organics; 5% gravel along shore	Shoreline moderately to heavily modified throughout; some retaining walls; grass to edge of water; docks, floats, boathouses; some mixture of mature pine/fir with healthy understory; scattered sections of intact forest/foreshore (50 m) including a couple of small bays and outlet area.
										SU	Adult	50+			
										Cyprinid	Juv	100+			
3	21-Jul-09	9:30	10:00	BM/PH	Sunny	22	19	1 x 200	BO	RSS	Adult	50+	Sparse beds of floating pondweed	90% silt; 10% gravel/ cobble/ boulder along shore	Steep hillside on east; scattered old submerged LOD along foreshore; shoreline moderately to heavily impacted; many retaining walls, boathouses, docks, floats and some infill areas; mixture of intact foreshore forest, fir/pine/shrub and grass to water edge; some pocket wetland areas on north edge of segment 3.
										SU	Adult	50+			
										Cyprinid	Juv	50+			

<sup>1</sup> BM= Bruce MacDonald (DFO); PH= Peter Holmes (MOE)

<sup>2</sup> BO= Boat observation; BS= Beach seine

<sup>3</sup> RSS= reidside shiner; SU= sucker sp.; PMB= pumpkinseed sunfish; LMB= largemouth bass; P= perch

<sup>4</sup> Juv= juvenile



**Table C2: Wildlife and riparian observations in Rosen Lake on 21 July 2009**

Habitat Type	#1	#2	#3
Forest Canopy <sup>1</sup> - Age/Canopy - Species		Mature, closed Fd, Lw	Mature, closed Fd, Lw and Py
Wildlife Trees		Few	Few
CWD/LOD <sup>2</sup>		Some LOD	Some LOD, very large
Shrub Cover – Amount - Species	Abundant Willow, red osier dogwood	Abundant Willow, red osier dogwood, alder	Less abundant than site 2, willow, red osier dogwood, alder
Grasslands			
Clay Banks			
Adjacent Wetlands		Yes, wetland at south end and at undeveloped property near north	Little one at north end
Littoral Zone			
Shallow Lake Edges			
Emergent/Submergent		No/very little	
Wildlife	Kingfisher, loon nesting site, osprey	Loon	Merganser family, sandpiper,
Notes	Island	Pockets of natural along most properties, very little bank protection measures	Natural areas by island and by undeveloped lot

<sup>1</sup>Tree Species Codes: Fd= Douglas Fir (*Pseudotsuga menziesii*); Lw= Western Larch (*Larix occidentalis*); At= Trembling Aspen (*Populus tremuloides*); Pl= Lodgepole Pine (*Pinus contorta*); Py= Ponderosa Pine (*Pinus ponderosa*); Sp= Spruce (*Picea sp.*); Ct= Black Cottonwood (*Populus balsamifera ssp. trichocarpa*)

<sup>2</sup> CWD= coarse woody debris; LOD= large organic debris

## **APPENDIX D**

### **Aquatic Habitat Index Calculations**

Appendix Table D1: Rosen Lake aquatic habitat index (AHI) and potential habitat value calculations

Segment Number	Shore Type	Biophysical				Riparian		Fisheries Juvenile Rearing	Modifications	Current AHI Score	Current AHI Ranking	Potential AHI Value	Potential AHI Ranking
		Substrate	% Natural	Aquatic Vegetation	Overhanging Vegetation	Riparian Band 1	Riparian Band 2		Modifications				
1	10	6	15	6.4	4.2	8	0	10	0	60	Very High	60	Very High
2	10.5	5	0.3	1.6	1.5	3	4.8	5	-6.85	24.85	Low	31.7	Moderate
3	10.3	5	1.5	1.2	2.4	1.8	4.8	5	-2.75	29.25	Low	32	Moderate

Ranking Categories (AHI score must be greater than this number).			
Very High	54	Moderate	30
High	42	Low	18

Appendix Table D2: Summary of Rosen Lake maximum and minimum scores

	Shore Type	Substrate	% Natural	Aquatic Vegetation	Overhanging Vegetation	Riparian Band 1	Riparian Band 2	Juvenile Rearing	Modifications
Max Score Possible	20	10	15	8	6	10	6	10	-12.75
Max Score Observed	10.5	6	15	6.4	4.2	8	4.8	10	-6.85
Min Score Observed	10	5	0.3	1.2	1.5	1.8	0	5	0